

Science and Mathematics Education Centre

**A Study of the Perceptions of Interpersonal Behaviour of
Mathematics Teachers in Singapore**

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Declaration

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

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Abstract

This study focused on the teacher interpersonal behaviour in the teaching of Mathematics, compared to English. It investigated: differences between student perceptions of their Mathematics and English teachers' interaction styles using the actual and ideal QTI; investigate associations between students' attitudes to Mathematics and English and their perceptions of the teachers' interpersonal behaviour; investigate whether any factors exist that contribute to students' perceptions of teachers' interpersonal behaviour, determine what the typical Mathematics and English teacher in Singapore is like; and what makes an effective teacher from students' and teachers' viewpoints. The QTI, together with the Attitude to Mathematics and Attitude to English, was administered to 913 students and 37 mathematics and English teachers from an independent school in Singapore. Student and teacher interviews were conducted to further substantiate the quantitative results. Both QTI and attitudinal scales were found to be valid and reliable instruments with alpha coefficients ranging from 0.69 to 0.92. In terms of leadership, helping/friendly, understanding and student responsibility, teacher behaviour as perceived by students, fell short of the ideal. Positive associations were found between students' attitudes to Mathematics and English and their perceptions of the teachers' interpersonal behaviour. Teacher experience and students' grade level were factors that contributed to students' perceptions of teachers' interpersonal behaviour. The typical Singaporean Mathematics teacher is that of the directive and authoritative type and the English teacher is the tolerant-authoritative type. Finally, an effective teacher is one who, besides having the positive qualities of good leadership, helping/friendly, understanding, has a good sense of humour and a passion to make a difference.

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Chapter 1

Introduction and Overview

1.1 INTRODUCTION

In the Third International Mathematics and Science Study (TIMSS), which was the largest and most ambitious study undertaken by the International Association for Evaluation of Educational Achievement (IEA), Singapore schools ranked first at the 4th and 8th grade level (TIMSS, 2003). The good standing of Asian students portrayed in the outcomes of these international studies and testing has led to much research work being centred on the mathematics curricula of these countries in an attempt to explore factors which contribute to the excellent academic achievement. Many researchers have examined the factors that affect mathematics learning, such as the curriculum, textbooks, mother tongue, societal expectation, parental involvement, social beliefs, cultural values, the learners' time spent on studying and their learning attitudes (Cai, Lo, & Watanabe, 2002; Zhu, 2003). However, educators often pay too much attention to students' achievement and more could be given to learning environments.

In this study, the focus is on the quality of interpersonal relationships of mathematics teachers as mathematics has been traditionally associated with scientific thinking and is often referred to as a 'hard' subject, not in reference to the difficulties some students encounter in its study, but to differentiate it from 'soft' subjects such as language and visual arts (Giles, 2007). Questions often asked are: Do mathematics teachers have a certain way of relating to their students compared with teachers teaching English? Are there certain qualities or characteristics or profiles of

mathematics teachers in Singapore that help contribute to the overall good performance of Singapore in international tests like TIMSS? Research has always focussed on the many other factors contributing to the good standard of mathematics in Singapore. For example, in a recent paper, Foong (2007) did a review on mathematics education research of Singapore teachers from 1991 to 2005. It was found that the majority of this research centred on teaching strategies, problem-solving skills, gender differences, attitudinal studies of students, etc., there was little research that focussed on the learning environments until in the last decade or so.

The curriculum of schools should focus, not only, on content and outcomes, but also to look into the nature of classrooms where the real business of learning takes place. While innovative teaching strategies are important, what is of primary importance is the classroom learning environment, in particular, the basic and crucial teacher-student interpersonal relationship. Palmer (1997, 1998) is one educator who has offered a critique that calls for a closer look at our relational practices in education. Palmer (1998) goes further to suggest that teachers teach out of who they are, a matter pertaining to the heart. Clearly, there is a need for further research in the Singapore context to explore this area of study. Therefore, this study focussed on the teacher-student interpersonal behaviour in the teaching of Mathematics as compared with another subject, namely, English.

Rutter (1979) estimated that by the end of secondary school, students would have spent at least fifteen thousand hours in school. Therefore, students' perceptions of their educational experiences and learning environments are important. Many studies have been conducted based on the effects of learning environments on academic achievement and attitudes of students. Since students and teachers spend

such a considerable amount of time in a formal school setting, the teacher's behaviour, when interacting with students, has been found to have a considerable impact on the nature of the learning environment that is created. The classroom learning environment has been increasingly recognised as an important factor in education. Recent international research has focussed on the conceptualisation, assessment and investigation of perceptions of aspects of the classroom environment. (Fraser, 1998; Fraser & Walberg, 1991).

Also, teaching is about effective communication and the nature of communication affects the environment (Wubbels & Levy, 1993). Since teachers communicate in different ways, they naturally develop different types of relationships with students. One of the keys of effective teaching lies in interpersonal behaviour of the teacher (Wubbels & Levy, 1993). Research has also shown that students' perceptions of this relationship are strongly related to their educational outcomes, such as subject-related attitudes and cognitive achievement (Brekelmans, Wubbels, & den Brok, 2002; den Brok, Brekelmans, & Wubbels, 2004; Fraser, 1998; Henderson, Fisher, & Fraser, 2000; Wubbels & Levy, 1993).

Most teachers would believe that good relationships with their students are important in the learning process. For many teachers, it has been common sense to say that what matters most in students' learning occurs within classrooms. It is generally accepted that the best teachers are those who can translate their knowledge, wisdom and experience into a kind of communication that can sustain the interest of their students. It is the human dimension that gives all teachers in the classroom their power to influence the students under their charge. Teaching is about relationships and whether learning takes place depends on the character of the relationship between

the two key players in the classroom - the teacher and the students (Wubbels & Levy, 1993).

Educational research has finally caught up with teachers in recognising the importance of good teacher-student relationships in ensuring high quality teaching and learning. However, are the students' perceptions of teacher-student interpersonal behaviour the same as their teachers? Is there a difference in teachers' perceptions of their actual teacher-student interpersonal behaviour and what they perceive to be ideal? Fisher and Fraser (1983) reported differences between student perceptions between the actual environment and that preferred or considered ideal by students. It was found that students preferred a more positive classroom environment than was actually present for all five environment dimensions. Similarly, in terms of teacher interpersonal behaviour, it was found that students often considered their best teachers to be stronger leaders, more friendly and understanding than teachers on average (Levy, Créton, & Wubbels, 1993).

Various learning instruments have been devised to measure students' and teachers' perceptions which can provide meaningful insights into the nature of the interpersonal relationship. If teachers can compare their own views with those of their students or their own preferences, differences between each of these views can provide interesting clues for change in behaviour (Fisher, Fraser, & Cresswell, 1995; Fisher & Rickards, 2000). Teacher reflection on their own and their students' perceptions of teaching could be further enhanced if information containing these perceptions is presented in various ways (Wubbels, 1992). *Images or profiles* are one of these alternative ways of presenting such information, next to written information on item, scale or (higher order) dimension scores. Images and profiles are powerful

tools for reflection because they can be used to conceptualise complex and interrelated information (as is the case with the teacher-student relationship), because they can summarise information into (smaller) chunks that are easier to comprehend, and because they can stimulate associations and links within the teachers' own knowledge if they are accompanied with powerful labels (e.g., Copeland, Birmingham, de la Cruz, & Lewin, 1993; Weber & Mitchell, 1996; Wubbels, 1992).

1.2 BACKGROUND OF THE STUDY

In Singapore, there has always been great interest by the government to make policy changes to the educational system to meet the changing needs of society. However, policy changes at the 'top-level' do not necessarily bring about the intended change in the classroom. Indeed, studies have shown that most 'top-down' reform efforts rarely change fundamentally what happens inside the classroom (Cuban, 1993; Griffin, 1995). It is the author's conviction that enhancing a more positive teacher-student interpersonal relationship may be one of the best ways to effect changes. Our country's then Prime Minister Goh Chok Tong (2001) reiterated, "Indeed, the best educational policies and programmes can only come alive in the hands of a good teacher". Our current Education Minister Ng Eng Hen stated, "The top-performing systems demonstrate that the quality of an education system depends ultimately on the quality of its teachers." (The Straits Times, 29 May 2008). At the heart of educational reform is the axiom that good teachers make good learners. Failure to recognise the centrality of teachers' abilities, dispositions, and working relationships in professional development efforts has been tied to the "predictable failure of school reform" (Fullan, 1993; Sarason, 1990). As Fullan (2003, p. 117) asserts "educational change

depends on what teachers do and think – it's as simple and as complex as that.” If teachers can realise the significance in terms of working toward a positive and appropriate relationship with their students, this can enhance the learning environment and contribute to the overall quality of a successful and nurturing educational system.

Past learning environment studies have shown the importance of teacher-student interpersonal behaviour in determining student learning outcomes. Wubbels, Brekelmans, and Hermans, (1987) and Getzel and Thelen (1960) suggested that teacher-student interaction is a powerful force that can play a major role in influencing the cognitive and affective development of students. Wubbels and Levy (1993) highlighted the role and significance of teacher behaviour in classrooms and in particular how it can influence students' motivation leading to improved achievement. As teachers communicate in various ways, they naturally develop different types of relationships with students. Some other factors that may influence teacher behaviour are the nature of the school environment, its geographic location, the socio-economic status of the school and its students, and the subject taught. Some teachers are more business-like than others; some are more strict than lenient; some are more distant than friendly. To describe these characteristics more clearly, the communication model of Leary (1957) was adopted. Leary stated that communication could be described by two dimensions- a *Dominance/Submission* dimension, and a *Cooperation/Opposition* dimension. Thus, the communication of both (or all) parties in an interaction can be described in terms of how cooperative they are (*Proximity*), who is controlling the interaction and to what degree (*Influence*). Researchers subsequently applied the model to teaching (Wubbels & Levy, 1993) and designed the *Questionnaire on Teacher Interaction* (QTI) which has been one of the most used instruments for measuring interpersonal teacher behaviour in the classroom. There has

been research to develop and use instruments to assess the qualities of the classroom learning environment from both the perspectives of teachers and students. In this study, the QTI was administered to both students and teachers to measure perceptions of teacher-student interaction.

1.3 RATIONALE OF THE STUDY

This study is conducted with several aims in mind. First, to provide validation data for the QTI in Singapore. Secondly, to investigate differences between students' perceptions of their mathematics and English teachers' interaction styles using the actual and ideal QTI. Thirdly, to investigate associations between students' attitudes to mathematics and English and their perceptions of the teachers' interpersonal behaviour. The fourth aim is to investigate whether any factors exist that would contribute to students' perceptions of teachers' interpersonal behaviour. The final aim is to determine what the typical type of mathematics and English teachers in secondary schools in Singapore is like and from the viewpoints of students and teachers, what makes an effective teacher?

Apart from a typology by Fraser (1986) and the typology of interpersonal teaching styles described below, little research has been reported on typifying learning environments. Research examining the cross-cultural validity of such styles or profiles is not so common. However, the existence of typologies of interpersonal teaching styles validated for teachers in The Netherlands, the USA, and Australia, allows comparison to be made with the average secondary mathematics and English teacher in Singapore. The earlier work with the QTI in The Netherlands has revealed eight different interpersonal styles (Brekelmans, 1989; Creton & Wubbels, 1994).

These eight styles were later confirmed in an American sample of secondary school teachers (Levy, Wubbels, & Brekelmans, 1992). A study of science teachers in Australia revealed slightly different profiles (Fisher & Rickards, 2000). This study seeks to match the profiles of the mathematics and English teacher in Singapore with those found in earlier studies. Such information could be useful when the QTI is used in Singapore for teacher professional development and teacher education.

1.4 RESEARCH QUESTIONS

To achieve the aims of the study, the following research questions were derived:

1. Is the Questionnaire on Teacher Interaction (QTI) a valid and reliable instrument for use in Singapore?
2. Are the Attitude to mathematics and Attitude to English scales valid and reliable instruments for use in Singapore?
3. Are there any differences between students' perception of their actual and ideal mathematics teachers' interpersonal behaviour?
4. Are there any differences between students' perception of their actual and ideal English teachers' interpersonal behaviour?
5. Are there any differences between students' perception of their actual mathematics and English teachers' interpersonal behaviour?

6. Are there any differences between students' perception of their ideal mathematics and English teachers' interpersonal behaviour?
7. Are there any differences in students' attitudes toward mathematics and English?
8. What associations are there between students' perception of their teachers' interpersonal behaviour in mathematics and their attitudes toward mathematics?
9. What associations are there between students' perception of their teachers' interpersonal behaviour in English and their attitudes toward English?
10. Are there any factors affecting the students' perception of their teachers' interpersonal behaviour and attitudes toward subject such as gender of teachers, number of years of experience and grade-level of students?
11. What is the average interpersonal profile of the sample of secondary school mathematics and English teachers in Singapore and how do they compare to the types of profiles found in previous research studies?
12. From the viewpoints of students and teachers, what makes an effective mathematics teacher?

1.5 OVERVIEW OF METHODOLOGY

Data about the perceptions of students on their teachers' interpersonal behaviour were gathered by means of the *Questionnaire on Teacher Interaction (QTI)*. The QTI is an unusual learning environment instrument in that it is based on a two-dimensional

circumplex model for interpersonal behaviour. The circumplex nature of the model means that the interscale correlations are highest between adjacent scales, and lowest and negatively correlated with scales that are opposite. Thus, the scales opposite each other in the model describe opposite types of teacher behaviour. The Australian version of the QTI was distributed to the students and teachers. This version consisted of 48 items which are answered on a five-point Likert scale. These items are divided into eight scales which conform to the eight sectors of the model. From a generalisability study by Wubbels and Levy (1993), the QTI should be administered to at least ten students in a class for the data to be reliable. The QTI does not need to be administered more than once per year, since interpersonal style remains relatively unchanged. The QTI can be used to obtain both students' and teachers' perceptions of interpersonal behaviour. When it is administered to both teachers and students, information is provided about the perceptions of teachers and the perceptions of their students of the interpersonal behaviour of that teacher. The information obtained by means of the questionnaire includes perceptions of the teacher toward the students as a class, and it reflects the stable patterns of behaviour over a considerable period of time. At the same time, teachers can be asked for their own perceptions of behaviour or the behaviour they consider to be ideal. By using these separate forms of the QTI, data on students' perceptions of actual and ideal teacher-student interpersonal behaviour, and teachers' perceptions of their actual teacher- student interpersonal behaviour are collected.

In the study, 25 mathematics teachers and 12 English teachers from an independent school in Singapore, with a six-year Integrated Programme, and students from 13 years to 18 years (Year 1 to Year 6) were selected to be the sample. Each teacher would then select one of his or her classes to participate in the study. The

study involved a total of 913 students and 37 teachers. Student attitudes were assessed with a 10-item Attitude to this Class scale, which was based on the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981).

The researcher sought permission from the principal of the independent school and enlisted the help of teachers in the mathematics and English departments and their respective students to carry out the study. Besides quantitative data, this study also collected qualitative data through interviews and observations of both teacher and student participants, in order to better understand the learning environment. The researcher also sat in real classroom situations to make further observations to better understand the profiles found in our context in Singapore.

1.6 SIGNIFICANCE OF THE STUDY

The outcome of this study is important for both researchers and teachers. The first area of significance is in the use of the QTI in Singapore. Though the QTI has been used in Singapore, this is the first time the QTI has been used to study the teacher-student interpersonal behaviour of mathematics teachers, using English teachers as a comparison. Differences in students' perceptions toward mathematics teachers, in comparison to English teachers are analysed. The other significant contribution made by the study is in the determining of associations between students' perceptions of their teacher's interpersonal behaviour and students' attitudes to the specific subject. Finally, this study is significant in that it presents a picture of the types of typical mathematics and English teachers in Singapore in the form of profiles. For teachers, the profiles can be used as a feedback tool and a personal means of comparison between peers and between earlier self-administration of the QTI to explore changes

over time and perhaps the way mathematics is taught. For professional development, teachers not only can compare their own perceptions with their ideals or the perceptions of their students (e.g., den Brok, Brekelmans, Levy, & Wubbels, 2002), but they can also compare their own perceptions or that of their students with the average profile of a mathematics or English teacher in Singapore. How do they compare with the average teacher? This makes the results of this study practically significant and supportive of teacher self-reflection. Previous research has shown that high scores or low scores on particular scales of the QTI are associated with high cognitive and affective student outcomes (Fraser, 1994). By adopting such teaching styles, teachers can be more effective in their approaches and seek to develop themselves professionally and improve the achievement of their students. Teacher educators can also understand the needs and abilities of teachers at different points in their careers and help customise pre- or in-service programmes to help in the professional development of teachers contributing to a general improvement in learning environment. Furthermore, appropriate teacher-student relationships is an important means for preventing discipline problems and fostering professional development (Rosenholtz, Bassler, & Hoover-Dempsey, 1986).

1.7 LIMITATIONS OF THE STUDY

Since one of the aims of the study was to determine how the interpersonal communication styles developed in the Netherlands, the USA (Brekelmans, Levy, & Rodriguez, 1993) and Australia (Fisher & Rickards, 2000) applied to a sample of secondary school mathematics teachers in Singapore, it is likely that there would be differences found, due in no small part, to cultural differences. Also another likely

difference in the outcomes of this study and other international studies might lie in the sampling procedure. Due to sampling constraints, this study only used a sample of mathematics and English teachers from two departments of an independent school with an integrated programme in Singapore.

1.8 CHAPTER SUMMARY

This chapter provides an overview of the research study. The aims of the study have arisen out of the review of the related literature on teacher-student interpersonal behaviour. Chapter 2 provides a review of this literature and provides a historical perspective of classroom environment research, focusing on the QTI and showing the ways in which it has been used. Chapter 3 outlines the methodology used in this study. It discusses the selection of 913 students and 37 mathematics and English teachers which constituted the sample of the research, together with the ways in which data were collected and analysed. Both quantitative and qualitative data were collected using the QTI and through group and individual interviews which provided a more in-depth study. How the students' attitudinal outcomes were measured is also explained.

Chapter 4 uses descriptive statistics to show that the QTI was reliable and valid and went on to detail the analysis of the results of the study. It determines associations between students' perceptions of the actual and ideal QTI in mathematics and English teachers and their attitudinal outcomes. It also uses the findings to profile the typical mathematics and English teacher in Singapore.

Chapter 5 expands on the qualitative data from student focus group interviews as further support for the construct validity of the QTI as well as individual student and teacher interviews to provide a more in-depth study on teacher interpersonal behaviour from the viewpoints of both students and teachers. The teacher interviews were presented as case-studies. The final chapter, Chapter 6 draws together the strands of the entire study and summarises the findings for each of the research questions and any implications which follows. It also delineates the limitations of this study and makes recommendations for areas of further research.

Chapter 2

LITERATURE REVIEW

2.1 INTRODUCTION

Research has shown that the learning environment is a variable that can directly influence cognitive and affective outcomes (Fraser, 1998a; Wang, Haertel, & Walberg, 1993; Waxman & Huang, 1998). While there are many other variables which affect learning outcomes, nonetheless the learning environment is a crucial one. Recent international research has focused on the conceptualisation, assessment and investigation of perceptions of aspects of the classroom environment. (Fraser, 1998a; Fraser & Walberg, 1991). It has been shown that these student perceptions and attitudes can influence learning outcomes. Research on learning environments has been evolving over the last thirty years or more. Fraser (1994) reviewed 40 past studies of the effects of classroom environment on student outcomes involving various cognitive and affective outcome measures, various classroom environment instruments and various samples (ranging across numerous countries and grade levels). Learning environments were found to be consistently and strongly associated with achievement and affective outcomes. Studies investigating associations between interpersonal relationships and student outcomes have shown that particular teacher-student relationships are more effective for student achievement and attitudes than others. This review outlines the historical perspectives of research in this field and how these have evolved moving on specifically to the development of the QTI in classroom learning environments and past uses of the QTI. The chapter begins with an

overview of the education system in Singapore and then reviews research literature in mathematics education with particular reference to Singapore to provide a clearer background to the research.

2.2 OVERVIEW OF EDUCATION SYSTEM IN SINGAPORE

The educational landscape in Singapore has changed substantially, especially over the last decade. The official strategy of *Thinking Schools, Learning Nation* (TLLN), emerged from a strategic review of education to prepare our children so that they could be continually prepared for the future (Tan & Ng, 2005). Our then Prime Minister, Goh (1997) said:

Singapore's vision for meeting the challenge for the future is encapsulated in four words: Thinking Schools, Learning Nation. It is a vision for a total learning environment, including students, teachers, parents, workers, companies, community organisations and the government.

Thinking Schools aims to develop creative thinking skills, lifelong learning passion and nationalistic commitment in the young while *Learning Nation* aims to make learning a national culture, encouraging creativity and innovation at every level of society, which goes beyond schools and educational institutions (Tan & Ng, 2005). Keeping Singapore's economic edge in the global market is also one of the *raison d'être* for the radical changes on the educational front. It is generally recognised that Singapore's education system, in terms of efficiency and academic success, has achieved some standing. For example, as mentioned earlier in the introduction, Singapore students came out top in a 49-nation comparative study in 4th and 8th grade

mathematics and Science by the International Association for Evaluation of Educational Achievement (TIMSS, 2003).

The education system in Singapore has traditionally been structured in three main parts following a 6:4:2 model: six years of primary, four years of secondary and two years of pre-university or junior college education. Formal education begins at six years of age. The English language is the medium of instruction and mother tongue languages (Chinese, Malay and Tamil) are taught as a second language. After six years of primary school, students sit for a national examination, the Primary School Leaving Examination, known as the PSLE, in English, mathematics, science and mother tongue languages. Based on performance in the PSLE, students are placed into one of the three secondary streams, the Special, Express and Normal (Academic or Technical). The fundamental principle underlying this placement examination is that students are placed into a stream that suits their learning ability and aptitude.

The secondary curriculum for Special and Express streams are four-year courses, after which they sit for the Singapore-Cambridge General Certificate of Education Ordinary Level examinations (GCE O-Level), whereas that of the Normal stream is a five-year course. There is also the Gifted Education programme which makes provision for the brightest students at selected primary and secondary schools.

However, since 2002, there have been significant changes in secondary schools. One of which is the implementation of the Integrated Programme (IP) in selected secondary schools. This is “part of continuing efforts to ensure that education in Singapore remains relevant to the shifting demands of the knowledge age and that our students are well-prepared for future challenges” (Ministry of Education, 2002, p. 19). The most distinguishing feature of the IP is that the students in the selected

schools need no longer sit for the GCE O-Level before taking the General Certificate of Education Advanced Level examinations (GCE A-Level). Instead, they are on a six-year “through-train” programme; thereafter, they either sit for the GCE A-Level or the International Baccalaureate Diploma Programme (IBDP) examinations.

This study was carried out at in an independent school which has a 6-year Integrated Programme and students who participated in the study were from different streams: the Gifted Programme, Express and Integrated Programme.

2.3 OVERVIEW OF MATHEMATICS EDUCATION IN SINGAPORE

The emphasis of mathematics education in Singapore has always been in the area of problem-solving at all levels from primary up to pre-university studies (Lim, 2002, CPDD, 2005, SEAB, 2006). It involves both the understanding and the application of mathematical concepts, procedures and processes to a range of situations that include non-routine, open-ended and real-world problems. The development of mathematical problem-solving also involves the affective aspects of learning that include appreciation, interest, confidence and perseverance as well as the metacognitive dimension of being aware of and the ability to control one’s own thinking and learning in the problem-solving process (Koh & Koh, 2006). Teachers are encouraged to move away from the more conventional manner of monopolising the entire instructional process by telling and showing students how to execute particular procedures or solve problems through the practice of repetition, drill and more practice. There is a constant awareness to help teachers to imbibe the constructivist view of teaching as a process of guiding and facilitating learners in their attempts to

construct knowledge and of helping learners learn how to construct knowledge plausibly and sensibly (Cohen, 1988).

As part of the TLLN initiative, the Information Technology (IT) Masterplan in 1997 set the stage for computer revolution in the classrooms (Ministry of Education, 1997). Vast resources were spent on equipping schools with computers, on developing courseware for teaching and on educating and training teachers on the relevance and benefits of the use of IT in education (Ang, 1999; Cheong, 2001; Ong-Chee, 2000). The use of technology in the mathematics curriculum started with showing work on Powerpoint and putting notes on the Internet to the more recent use of graphing or geometry software and computer algebra systems (Leong, 2001; Ong, 2002; Yeo, 2004). The first IT Master Plan 1 was followed up with another IT Masterplan 2 that was launched in 2002 (Ministry of Education, 2002) so that more teachers may be encouraged to make greater use of computers “by taking into account new teaching methods that are made possible by technology” (Tharman, 2002, p. 5). The IT initiatives have a significant impact on the teaching and learning of mathematics in Singapore schools. In keeping with the important role that technology plays in our schools today, a small section of this literature review is focused on computer-related and online learning environment instruments.

2.4 HISTORICAL PERSPECTIVE OF CLASSROOM LEARNING ENVIRONMENTS

This section contains a review of the literature on the study of classroom learning environments. Fisher, Dorman, and Waldrip (2005) stated that, in educational settings the concept of environment refers to the atmosphere, ambience, tone, or climate that

pervades the particular setting. The field of learning environments has undergone remarkable growth, diversification and internationalisation during the last 30 years (Fraser, 1998a). One striking feature of this field of learning environments is the availability of a variety of economical, valid and widely-applicable questionnaires that have been developed and used for assessing students' perceptions of classroom environment (Fraser, 1998b). While historically, research on classroom environments has focused mainly on its psychosocial dimensions – those aspects of the environment that focus on human behaviour in origin or outcome (Boy & Pine, 1988), reviews of classroom environment research by Fraser (1998a), Dorman (2002), Goh and Khine (2002) and Khine and Fisher (2003) have delineated at least ten areas of classroom environment research. However, one of the strongest traditions of classroom environment research has been in the study of associations between classroom environment and student cognitive and affective outcomes.

Results of studies conducted over the past 30 years have provided convincing evidence that the quality of the classroom environment in schools is a significant determinant of student learning (Fraser, 1994, 1998a). While studies have mainly been conducted in the USA, the Netherlands and Australia, it has become more international with research papers from Canada (e.g., Nair & Fisher (2001); Raaflaub & Fraser, 2002; Zandvliet, 2003), Fiji (Baba & Fraser, 1983) and South Africa (e.g., Idiris & Fraser, 1997; Ntuli, 2001). Moreover, Asian researchers have also made many major and distinctive contributions in the last decade or so. Many of these questionnaires have been adapted, translated and cross-validated for use in several Asian countries. Studies conducted in Indonesia by Margianti, Fraser, and Aldridge (2002), Singapore (Fraser & Chionh, 2000; Goh & Fraser, 1998) and Brunei (Riah &

Fraser, 1998) are amongst some of the many research findings, which are further elaborated in another section of this chapter.

As early as the thirties, Murray (1938) developed the theory to describe the concept of the personal needs of an individual (including goals and drives) as distinct from the environment press (including stimulus, treatment and process variables). Murray's needs-press theory led to the development of various measures of personality which were elucidated by Pace and Stern (1958). According to Murray, the environmental forces which impact on individuals can be perceived by observers outside the environment or individuals within the environment - he defined them by using the concept of alpha and beta press respectively. The alpha press is that of an outside observer describing the environment, "the subject's own interpretation of the phenomena that is perceived" (p.122). In the classroom, the beta press is the student's views of the conditions, forces or external stimuli as the student perceives them acting on him or herself. Lewin (1936) postulated that behaviour is a function of personal and environmental characteristics; i.e. $B = f(P,E)$. The Lewinian formula hypothesizes that human behaviour (B) is a function of the personal characteristics of an individual (P) and his or her environment (E) (cited in Fraser, 1998). This formula has since generated considerable interest and formed the basis for further research in various situations where human behaviour is demonstrated. Since an individual is always interacting with his or her environment, observed behaviour is a result of the combined effect of the interaction between variables P and E.

The foundation for this flourishing field of learning environments was initially laid by two psychologists, Walberg (1976) and Moos (1974) who were working

independently of each other. Their work led to the development of a variety of learning environment instruments.

By the late sixties and early seventies, studies recognised that people perceive stimuli in different ways and that these perceptions are important in the learning process. Walberg (1976) proposed two teaching models, the 'Behavioural Model' and the 'Structured Model'. Walberg termed the teaching model which grew out of this psychological perspective the 'Perceptual Model'. He believed that:

The perceptual model allows for behavioural and structural mechanisms but holds that the student's conscious perception of external and internal stimuli and his choices are the proximate, mediating determinants of learning (Walberg, 1976 p. 142).

Subsequently, psychological studies arrived at a point where behaviour was seen to be influenced by the individual's perceptions of stimuli rather than merely the stimuli themselves or the individual's stage of cognitive development. Walberg (1976, 1981, 1982) also recognised the importance of the environment as he built on the formula established by Lewin. In any educational setting, one is constantly interacting with an array of variables, such as teachers, peers, physical settings, subject materials and a cluster of factors unique to different learners. As such, there was a need to develop suitable learning environment instruments that had the capability of quantitatively measuring the impact of the learning environment on a learner in different settings.

Thus by the seventies, psychological studies in classrooms had moved beyond the Behavioural Model and Structural Model to recognise the impact of students' perceptions of the environment on their learning. This was evident by the changes in

the ways studies were carried out to investigate what happened in classrooms. Today, classroom research methodologies have evolved from the systematic observation of classroom and naturalistic, ethnographic research, to the use of perceptions of students and teachers within the learning environments. Thus, Moos (1974) and Walberg (1976) independently pioneered a new approach which:

conceptualised (the) environment as a dynamic social system which includes not only teacher behaviour and teacher-student interaction but student-student interaction as well (Trickett & Moos, 1973 p. 94).

This work of both Moos (1974) and Walberg (1976) used the concept of Murray's beta press and involved the subjective perceptions of teachers and students within the classroom environment rather than the perceptions of external, objective researchers. Each focused his research on the identification and measurement of classroom environment characteristics.

Moos (1979) found that three general categories can be used in characterising diverse learning environments. The three dimensions 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 (1968) ultimately developed and refined what is now known as the *Classroom Environment Scale* (CES), (Moos & Trickett, 1974; Trickett & Moos, 1973).

At about the same time, Walberg developed the *Learning Environment Inventory* (LEI), (Anderson & Walberg, 1968) as part of the Harvard Project Physics. Walberg's theory of educational productivity (Walberg, 1984) states that there are nine factors which contribute to variance in students' cognitive and affective outcomes. These factors are: student ability, age and motivation; the quality and quantity of instruction; and the psychosocial climate of the home, the classroom social group, the peer group outside the classroom, and the mass media. Walberg's model was tested and national studies confirmed its validity in showing that student achievement and attitudes are influenced by a range of factors rather than just one dominant factor (Walberg, 1968; Walberg, Fraser, & Welch, 1986). Classroom and school environment factors were shown to be particularly important influences on students' outcomes.

These two instruments have been in use and the basis for the development of other similar instruments. Other examples of classroom environment instruments include: the *My Class Inventory* (MCI) (Fraser, Anderson & Walberg, 1982); the *College and University Classroom Environment Inventory* (CUCEI) (Fraser, Treagust, & Dennis, 1986); the *Individualised Classroom Environment Questionnaire* (ICEQ) (Fraser, 1990); the *Science Laboratory Environment Inventory* (SLEI) (McRobbie & Fraser, 1993); and the *Constructivist Learning Environment Survey* (CLES) (Taylor, Fraser, & Fisher, 1997).

2.5 INSTRUMENTS FOR ASSESSING CLASSROOM ENVIRONMENT

Since few fields of educational research can boast of the existence of such a rich array of validated and robust instruments, this section describes some of the more

historically-important questionnaires like the CES, LEI, MCI, CUCEI, ICEQ, and the more contemporary instruments that have been used: the SLEI, CLES and the *What is Happening In This Class?* (WIHC) questionnaires. They all share a common conceptualisation of the classroom environment as a dynamic social system (Getzels & Thelen, 1960) but each focuses on aspects of the environment that were perceived by the developers as important in their research. Each of the instruments has been extensively and statistically analysed and shown to be reliable and valid. In addition, since technology plays such an important role in schools today, computer-related and online learning environment instruments, such as the *Technology-Rich Outcomes-Focused Learning Environment Inventory* (TROFLEI) and *Web-based Learning Environment Inventory* (WEBLEI) are also briefly discussed.

Historically-Important Questionnaires

Moos (1968) developed the CES as a questionnaire consisting of nine scales, each represented by 10 items. Students responded to a True/False format. The LEI, reflected a similar conceptualisation of the classroom environment to that of the CES. The final version of the LEI consists of 15 scales, each represented by seven items to which students and teachers respond by using a four-point Likert type scale with the response categories of 'Strongly Disagree, Disagree, Agree, Strongly Agree'. Both the CES and LEI underwent trials and statistical analysis to ensure reliability and discriminant validity. These descriptive statistical details are reported extensively in Fraser, Anderson, and Walberg (1982). In India, the LEI was used in the Hindi language in a large study involving approximately 3,000 10th grade students in 83 science and 67 social studies classes (Walberg, Singh, & Rasher, 1977). Student perceptions on the LEI accounted for a significant increment in achievement variance

beyond that attributable to general ability. In Indonesia, Paige (1979) used the CES and three scales selected from the LEI to reveal that individual modernity was enhanced in classrooms perceived as having greater task orientation, competition and difficulty and less order and organisation, while achievement was enhanced in classes higher in speed and lower in order and organisation. Hirata and Sako (1998) used an instrument in the Japanese language that incorporated scales from the CES. Factor analysis of the responses of 635 students suggested four factors of structure for this questionnaire, namely: Teacher Control, Sense of Isolation, Order and Discipline, and Affiliation.

The MCI is a simplified form of the LEI for use among children aged 8-12 years (Fisher & Fraser, 1981). In Singapore, Goh, Young, and Fraser (1995) changed the MCI's original Yes-No response format to a three-point response format (Seldom, Sometimes and Most of the Time) in a modified version which included a Task Orientation scale. Goh et al. found the modified MCI to be valid and useful in research applications with 1,512 primary mathematics students in 39 classes. In Brunei Darussalam, Majeed, Fraser, and Aldridge (2001) used the MCI with 1,565 mathematics students in 81 classes in 15 government secondary schools. He found strong support for a three-factor structure for the MCI consisting of Cohesiveness, Difficulty and Competitiveness.

The ICEQ was the first learning environment instrument to focus on dimensions which distinguish individualised classrooms from conventional ones (Fraser, 1990) whereas the LEI, CES and MCI were designed for teacher-centered classrooms. It included scales of Personalisation, Participation, Investigation and

Differentiation which are considered important variables in an individualised curriculum. The ICEQ appears not to have been used very often in the Asian context.

The CUCEI, like the MCI, was developed for a particular age cohort of students, those in university and college classes of up to 30 tertiary students (Fraser & Treagust, 1986). It contains dimensions adapted from previous instruments, including the ICEQ which reflect the greater degree of individualised work expected in tertiary classrooms.

Science Laboratory Environment Inventory (SLEI)

Laboratory settings are different from classroom settings, and teachers expect different relationships between students who are usually engaged in tasks which differ from those in regular classrooms. The SLEI was specifically designed to assess the environment of science laboratory classes at the senior high school or higher education levels because of the importance of laboratory settings in science education (Fraser, Giddings, & McRobbie, 1995; Fraser & McRobbie, 1995). The SLEI has five seven-item scales (Student Cohesiveness, Open-Endedness, Integration, Rule Clarity and Material Environment). The SLEI was field-tested and validated simultaneously with a sample of 5,447 students in 269 classes in six different countries (the USA, Canada, England, Israel, Australia and Nigeria), and cross-validated with Australian students (Fisher, Henderson, & Fraser, 1997; Fraser & McRobbie, 1995).

The validity of the English version of the SLEI has been established in Singapore by Wong and Fraser's (1996, 1997) study of 1,592 Grade 10 chemistry students in 56 classes in 28 schools, and by Quek, Fraser, and Wong's (2001) study of 497 gifted and non-gifted chemistry students. In Brunei Darussalem, Riah and Fraser (1998) cross-validated the English version of the SLEI with 644 Grade 10 chemistry

students. In Korea, it was translated into the Korean language by Kim and Kim (1995) and built upon by Lee and Fraser (2002) who reported strong factorial validity and replicated several patterns from previous research in Western countries which included low open-ended scores and significant associations with students' attitudes.

School Level Environment Questionnaire (SLEQ)

The SLEQ was designed by Fisher and Fraser (1990) to correspond with Moos' (1991) three psychosocial dimensions of relationship, personal development, and system maintenance/system change by using eight subscales. Two scales, namely Student Support and Affiliation measure relationship, one scale which is Professional Interest, measures personal development, and five scales, namely Staff Freedom, Participatory Decision Making, Innovation, Resource Adequacy, and Work Pressure, measure system maintenance/system change. The 56 items on each form (actual and preferred) have a five-point response format. Reliability and validity have been established with three samples from Australian schools (Fisher & Fraser, 1990). Besides being used at the college level, it was also translated into the Indonesian language for use in Indonesian junior secondary schools (Wahyudi & Fisher, 2006).

Constructivist Learning Environment Survey (CLES)

The Constructivist Learning Environment Survey (CLES) was developed to assist researchers and teachers to assess the degree to which a particular classroom's environment is consistent with a constructivist epistemology, and to assist teachers to reflect on and reshape their teaching practices. In the constructivist mind, meaningful learning is a cognitive process in which individuals make sense of the world in relation to the knowledge that they already have constructed. This constructive process involves active negotiation and consensus building. The original version of

the CLES was introduced in 1991 (Taylor & Fraser, 1991) and was consistent with von Glasersfeld's (1981, 1988) perspective of radical constructivism. It was designed to measure students' perceptions of the extent to which the classroom learning environment enabled them to reflect on their prior knowledge, develop as autonomous learners, and negotiate their understandings with other students. This version was subsequently revised based more on critical constructivism (Taylor & Campbell-Williams, 1993). This version of the CLES was designed to measure five key dimensions of a critical constructivist learning environment from the students' perception, namely, the degree of relevance between school and world outside school, degree of empowerment they get to express their concern about teaching and learning; the degree to which they can share control of the design, management, and evaluation of their learning; the degree of their engagement and interaction with each other to improve their understanding; and the extent to which science is viewed as ever changing (Taylor, Dawson, & Fraser, 1995; Taylor, Fraser, & Fisher, 1997). The new version of the CLES is available in Actual and Preferred Forms and consists of 30 items, with five response alternatives ranging from Almost Never to Almost Always, which assess Personal Relevance, Uncertainty, Critical Voice, Shared Control, and Student Negotiation.

The CLES has been used in studies of high school science and mathematics classrooms (Dryden & Fraser, 1998; Taylor, Dawson, & Fraser, 1995) and validated and used in various studies in different countries (Churach & Fisher, 1999; Stolarchuk & Fisher, 2001). It has also been translated and modified to suit specific situations in both English and non-English speaking countries.

Wilks (2000) expanded and modified the CLES for use among students studying English (called General Paper) in junior colleges in Singapore. The revised GPCLES which contained two new scales named Political Awareness and Ethic of Care, was administered to 1,046 students in 48 classes in junior colleges. It was found to display good factorial validity and internal consistency reliability, and each scale differentiated significantly between the perceptions of students in different classrooms.

In Korea, Kim, Fisher, and Fraser (1999) translated the CLES into the Korean language and administered it to 1,083 science students in 24 classes in 12 schools to investigate the extent to which a new general science curriculum, reflecting a constructivist view, has influenced the classroom learning environment in grade 10 science. The Korean-language version of the CLES was found to be valid and reliable and grade 10 students did perceive a more constructivist learning environment than grade 11 students who had not been exposed to the new curriculum. This suggested that efforts of curriculum reform can produce some positive effects. Typically, students tended to prefer a more positive environment than that was perceived to be present and statistically significant relationships were found between classroom environment and student attitudes. These suggested that favourable student attitudes could be promoted in classes where students perceive more personal relevance, share control with their teacher and negotiate their learning. Furthermore, Lee and Fraser (2001a) replicated the Korean version of the CLES among 440 Grade 10 and 11 science students in 13 classes and established similar findings.

The CLES was also translated into Chinese for use in Taiwan (Aldridge, Fraser, Taylor, & Chen, 2000). In this cross-national study, the original English

version was administered to 1,081 science students in 50 classes in Australia, while the Chinese version was administered to 1,879 science students in 50 classes in Taiwan. The same five-factor structure emerged for the CLES in the two countries and scale reliabilities were similar.

In Thailand, Wanpen and Fisher (2006) translated the CLES into the Thai language and administered it to 366 students undertaking computer courses in Thailand. It was found to be reliable and the main study followed the fundamental steps of assessment, feedback, reflection and discussion, intervention and reassessment (Fisher, 1992, 1993, 1994). The use of the CLES was able to improve the learning environment.

What is Happening In This Class? (WIHIC) Questionnaire

The WIHIC, one of the more recent questionnaires is composed of modified versions of scales from a wide range of existing questionnaires with additional scales that cover contemporary educational concerns (e.g., equity and cooperation). The original 90-item nine-scale version was modified after a statistical analysis of data from 355 junior high school science students and extensive interviewing of students (Fraser, Fisher, & McRobbie, 1996). Aldridge and Fraser (2000) constructed the final version of the WIHIC from an Australian sample of 1,081 students in 50 classes. This final form contains seven eight-item scales namely: Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity.

The WIHIC has been translated into several Asian Languages and cross-validated in Brunei Darussalam, Indonesia, Singapore, Taiwan and Korea. In Brunei, Riah and Fraser (1998) administered it to 644 Grade 10 chemistry students and Khine and Fisher (2001) replicated the study among 1,188 Form 5 science students. Fraser

and Chionh (2000) reported strong validity and reliability for both an Actual and a Preferred Form of the WIHIC for a sample of 2,310 mathematics and geography students in 75 classes in junior colleges in Singapore. Similarly, Khoo and Fraser (1998) used the WIHIC with a sample of 250 adults attending computer courses in 23 classes in four Computing schools in Singapore. In Taiwan, a Chinese version of the WIHIC was developed for use and it was cross-validated with a sample of 1879 junior high school students in 50 classes (Aldridge & Fraser, 2000; Aldridge, Fraser, & Huang, 1999). Furthermore, Chua, Wong, and Chen (2001) developed a bilingual instrument of the WIHIC, with every item presented in both English and Chinese and cross-validated it with a sample of 1,460 students in 50 classes. In Korea, Kim et al. (2000) validated the Korean version with a sample of 543 Grade 8 students in 12 schools. The WIHIC was also translated into the Indonesian language and its validity and reliability established with 2,498 university students in 50 computing-related courses (Margianti, Fraser, & Aldridge, 2001a, 2001b) and 422 students in 12 research methods classes (Soerjaningsih, Fraser, & Aldridge, 2001a).

Computer-related Learning Environment Instruments

With the implementation of information and communication technology in schools, classroom environment instruments have also been effectively used in the evaluation of educational innovation. For example, a classroom environment inventory used to assess a computerised database showed that students became more inquiry orientated (Maor & Fraser, 1996). In Singapore, classroom environment measures were used in evaluations of computer-assisted learning (Teh & Fraser, 1994, 1995b) and computer application courses for adults (Khoo & Fraser, 1997). As more technology finds its way into classrooms, there is a continued and growing interest in how technology is

being used and its relationship to pedagogy (Zandvliet, 2003). The Technology-Rich Outcomes-Focused learning Environment Inventory (TROFLEI) is one such example of a learning environment instrument designed to meet the growing interest and need. This new instrument includes all seven of the original WIHIC scales, with three newly developed scales, namely, Differentiation, Computer Usage and Young Adult Ethos scales. The initial version of TROFLEI contained 80 items with 8 items in each of the scales. Extensive field-testing and instruments validation procedures led to a refined version of 77 items in the same 10 scales (Aldridge & Fraser, 2003). To examine whether the TROFLEI could be used to monitor the evolution of technology-rich, outcomes-focused learning environments, it was administered to 441 students in 2001 and 596 students at the end of 2002. The TROFLEI was found to be valid and reliable at the senior high school level across a number of different subjects and learning areas.

As online learning became more popular, the Web-based Learning Environment Instrument (WEBLEI) was developed for use in university settings (Chang & Fisher, 2003). This instrument was designed with four scales to capture students' perceptions of web-based learning environments. The first three scales of emancipator activities, co-participating activities, and qualia are adapted from Tobin's (1998) work and the final scale focuses on information structure and the design aspect of the web-based material.

It is only in the last decade that educational research in the field of learning environments in Singapore has made much headway (Goh, 2002). The first study on learning environment in Singapore was conducted in 1993 with secondary four (or year ten) students from different types of schools (Good, Average, and Below

Average), streams (Gifted, Special, Express and Normal), subject specialisations (Arts, Science, Technical/Commerce) and varied socio-economic backgrounds (high, middle and Low) (Lim, 1993, 1995). The ICEQ was administered to a stratified random sample of secondary 4 students from nine secondary schools to assess their perceptions of their actual and preferred classroom environments. It was found that the school type, the stream, the subject specialisation and the socio-economic background of the students had an effect on the students' perceptions of all the dimensions of the preferred environment and some of the dimensions of the actual environment. Furthermore, it was also established that students preferred a more positive classroom environment than was actually present. In addition, students in the good schools, gifted and special streams and science students viewed their environment more positively than the others. At about the same time, Teh and Fraser (1994) developed a new questionnaire, the Geography Classroom Environment Inventory based on the original SLEI to study the computer-assisted learning environment in secondary geography classrooms.

Subsequently, several studies were also conducted at the primary, secondary, junior college, tertiary, adult education classroom environments and cross-national collaboration across varied subject areas like mathematics, chemistry, science, social studies, general paper, Chinese language and geography subjects using different learning environment instruments (Goh, 2002). The first major study done at the primary level used both the Questionnaire on Teacher Interaction (QTI) (see section 2.6) and the MCI to investigate teacher interpersonal behaviour and classroom climate in mathematics classrooms in 13 government-co-educational schools (Goh & Fraser, 1998, 2000). Findings revealed that student-teacher relationships and classroom climate were significantly related to students' achievement and attitude toward

learning. There were also other similar studies on learning environments in primary schools (Chin, 2001; Pang, 1999; Teng, 2000).

There were also studies conducted in secondary chemistry laboratories in secondary 4 express, normal and gifted classes (Wong & Fraser, 1997; Quek et al., 2001). One important finding of this study was the strong associations between students' enjoyment of their chemistry classes and their perceptions of teacher interpersonal behaviour. Fraser and Chionh (2000) used the WIHIC questionnaire in mathematics and geography classrooms and found that for both subjects, better examination scores were found in classrooms with more student cohesiveness, whereas self-esteem and attitudes correlated positively with more teacher support, task orientation and equity. However, while students perceived both subject classrooms positively, they found their mathematics classrooms to be more positive than their geography classrooms.

At the tertiary level, Khine and Goh (2001) used the CUCEI for the first time in Singapore to measure teacher trainees' perceptions of their university learning environment. The findings provided evidence of the cross-cultural validity and reliability of the CUCEI when used in Singapore and significant environment-attitude relationships were also established.

In 1997, a cross-national study involving Australia and Singapore was carried out to study the learning environment of lower secondary science classrooms in both countries (Fisher et al., 1997). The study showed that all the eight dimensions of teacher interpersonal behaviour in the QTI and the attitude scores were significantly correlated for both Singapore and Australian students. In particular, students' attitudinal scores were higher in classrooms in which they perceived greater

leadership and helping/friendly behaviours among the teachers. It also found that Australian teachers were perceived as being more lenient toward their students, as well as giving them more responsibility and freedom than teachers in Singapore. Other studies (Chua, Wong & Chen, 2001; Khoo & Fraser, 1997; Teh & Fraser, 1999; Wilks, 2000) also showed findings which attest to the importance of a conducive learning environment.

The independent contributions of Moos and Walberg in the development of the CES and LEI respectively have pioneered much of the quantitative research into classroom learning environments. Moos and Trickett (1974) concluded that student satisfaction with the class and with the teacher is more evident in classes with strong teacher-student relationships, high student involvement, innovative teaching efforts and high clarity of rules governing classroom behaviour. These four dimensions from Moos' study support the underlying hypotheses of this research study that good teacher-student interpersonal relationships is one of the key factors in ensuring that students have positive attitudes toward learning. It is in this area that this study was focused on. This approach and the development of the Questionnaire on Teacher Interaction (QTI) are discussed in the following section (Wubbels & Levy, 1991).

2.6 DEVELOPMENT OF THE QTI TO ASSESS TEACHER

INTERPERSONAL BEHAVIOUR

Together with other psychologists, Leary (1957) argued that the most important forces driving human behaviour are the reduction of fear and the corresponding upholding of self-esteem. Therefore, when communication takes place, there is a conscious or unconscious choosing of behaviour that will avoid anxiety and allow people to feel

good about themselves. This may be different for each person depending on their communicating styles. One may have an authoritarian style, whereas another prefers dependency to achieve the same end. Based on this theoretical approach, Leary proposed a two-dimensional model with two axes – a *Dominance/Submission* dimension and a *Cooperation/Opposition* dimension. Thus the communication of both or all parties in an interaction can be described in terms of how cooperative they are (*Proximity*) and who is controlling the interaction and to what degree (*Influence*). Researchers built a paradigm which divided Leary's original two dimensions into eight different sectors which will be discussed in greater detail subsequently. Leary's original ideas were applied during the 1970s as a result of a Dutch 'Education for Teachers' research programme at the University of Utrecht (Wubbels & Levy, 1993). The first attempt at a model to map teacher interpersonal behaviour involved the use of an instrument, named the Interpersonal Adjective Checklist (ICL). While the ICL was deemed unsuitable, the ideas behind it were embraced.

Wubbels, Creton, Levy, and Hooymayers (1993) continued their research and adapted a theory of communication processes developed by Watzwick, Beavin, and Jackson (1967) to investigate teachers' behaviour in the classroom from a systems perspective. Within the systems perspective on communication, it is assumed that the behaviours of participants influence each other mutually and communication is circular, consisting of, and determining behaviour. When applied in the classroom the communication between teachers and students is found in the behaviour of teachers and students, as well as determining the behaviour of teachers and students. Students perceive both what the teacher is saying and the manner in which it is communicated. Creton, Wubbels, & Hooymayers (1993) stated the following with regard to teachers' communication, "The way it is received actually depends upon the history of the

relationship, or the accumulation of all teacher and student molecular behaviours” (p. 6).

Thus, with the systems approach, classroom groups are conceived as ongoing systems with a certain stability. After some interaction, tentative ideas about the teacher will have stabilised and students’ perceptions of the teacher are formed and also the teachers’ perceptions of the students. Thereafter, the behaviour of the teacher will be influenced by the behaviour of the students and in turn influences student behaviour.

To measure this behaviour, the researchers in the Netherlands used the framework based on Leary’s (1957) model of interpersonal behaviour. Wubbels, Creton, Levy, and Hooymayers (1993) argued that all interpersonal behaviour can be conceptualised into positions somewhere on the two dimensions proposed by Leary and they believed that these two dimensions are both necessary and sufficient to describe the interpersonal behaviour.

The conceptualisation of interpersonal behaviour has been expressed diagrammatically as shown in Figure 2.1.

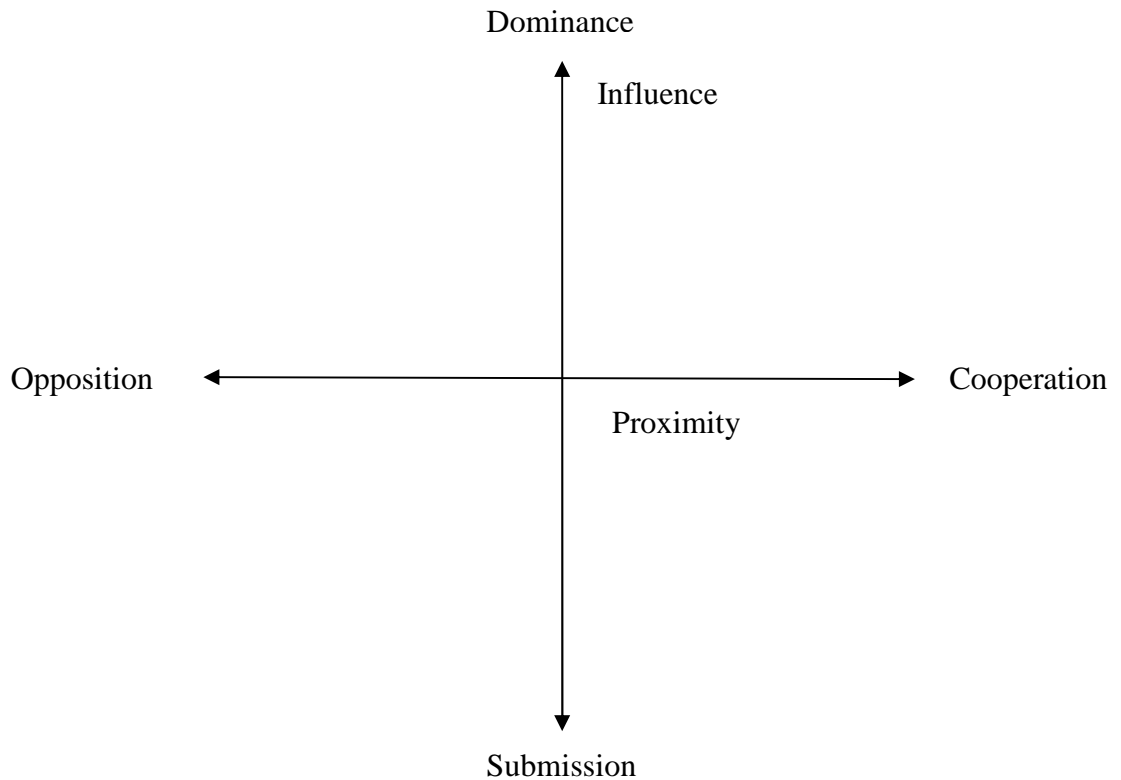


Figure 2.1. Leary's Model (Hooymayers, Wubbels, Creton, & Holvast, 1981).

In this diagram the vertical axis represents the Influence dimension. A point at the top of the axis represents dominance in the interpersonal behaviour while the bottom of this axis is indicative of submission. Similarly in the horizontal axis, which represents the Proximity dimension, a point to the right indicates a high degree of cooperation while a point on the left indicates oppositional behaviour (Hooymayers, Wubbels, Creton, & Holvast, 1981).

The Leary model was modified to suit the educational context and was named the Model for Interpersonal Teacher Behaviour to describe the perceptions of students of the behaviour of their teachers. Wubbels, Créton, and Hooymayers (1985) believed that all teacher interpersonal behaviours could be plotted in this system of coordinates. The quadrants resulting from these axes were subdivided on to equal-sized octants as shown in Figure 2.2.

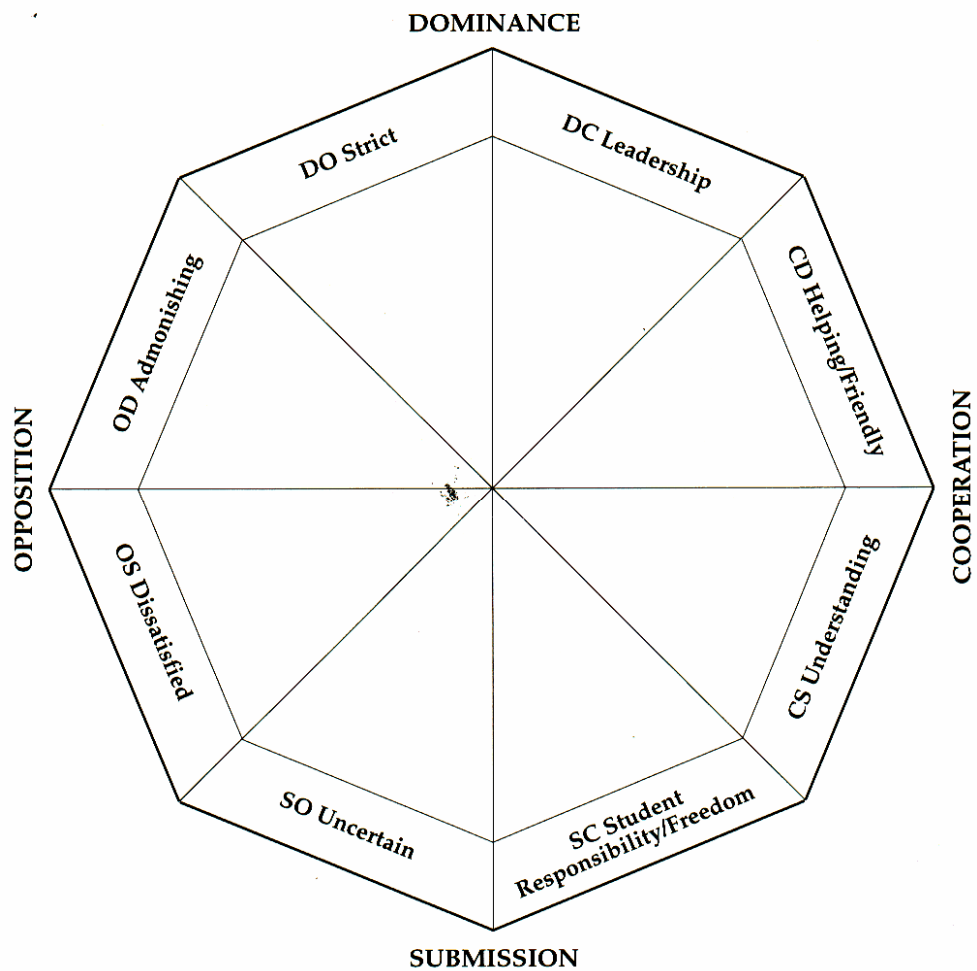


Figure 2.2. The Model for Interpersonal Teacher Behaviour.

(Source: Wubbels & Levy, 1993).

The sectors are labelled DC, CD, etc according to their position in the coordinate system. The first of these is labelled DC. This is the Dominant-Cooperative sector but with the teacher being perceived by students to be more dominant than cooperative. Strong leadership characterises interpersonal behaviour in this sector. Thus, a teacher displaying Leadership (DC) might be explaining something to the class, organising groups, and the like. The adjacent or second sector is labeled CD as the cooperative aspect is perceived as more pronounced than the dominant aspect. This sector is characterised by helping and friendly behaviour by the teacher. The Helping/Friendly (CD) sector includes behaviours of a more cooperative and less dominant character, and the teacher might be seen assisting students, acting in a friendly manner or being considerate toward their students.

The boundaries between sectors are not strict, as there is an overlap between neighbouring categories as well as an association between scales. The closer the sectors are to each other, the more closely they resemble each other and the more they represent similar teacher behaviours whereas opposite sectors reflect opposite behaviours (Student Responsibility versus Strict, for example). Consequently it is called a circumplex model. The circumplex property is typically confirmed when inter-scale correlations are examined (den Brok, 2001; Wubbels & Levy, 1991, 1993).

Therefore, the QTI was developed to assess student perceptions of these eight aspects of behaviour namely, Leadership (DC), Helping/Friendly (CD), Understanding (CS), Student Responsibility/Freedom (SC), Uncertain (SO), Dissatisfaction (OS), Admonishing (OD) and Strict (DO) behaviour. The QTI was first constructed in the Netherlands between 1978 and 1984 (Wubbels, Creton & Hooymayers, 1985). The original version of the QTI in Dutch language consisted of

77 items and it was designed to measure secondary students' and teachers' perceptions of teacher interpersonal behaviour. Its development involved four rounds of testing using different sets of items and adjusting this set of items (Wubbels & Levy, 1991). There were interviews with teachers, students, teacher educators and researchers to judge the face validity of items. The QTI consisted of eight scales symmetrically arrayed around orthogonal axes representing the two dimensions. (See Figure 2.2).

Each item has a five-point response scale ranging from 'Never/Not at all'(0) to 'Always/Very'(4). The scores for each item within the same sector are added to obtain a total scale score. The higher the scores the more the teacher shows behaviours from that sector. Scale scores are obtained for individual students or combined to obtain the mean of all students in a class. The instrument was designed to be used either as a teacher self-report measure or as a measure of student perceptions (using the class as a unit of analysis) of teacher interpersonal behaviour. After extensive analysis, the 77-item Dutch version was reduced to a 64-item version. This version was translated, validated and administered in the USA (Wubbels & Levy, 1991; 1993). The Australian version of the QTI containing 48 items was developed and validated at a later time (Wubbels, 1993). This version has been used extensively in Australia and Asia. Table 2.1 shows the nature of the QTI by providing a scale description and a sample item for each of the eight scales.

Table 2.1

Description and Example of 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 toward 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 unexpectedly.
Strict [DO]	Extent to which the teacher is strict with demands of the students.	We are afraid of this teacher.

A distinctive feature of the QTI is that, in addition to a form that measures the students' perceptions of their teacher's actual interpersonal behaviour, there is another form that measures the students' preferred or ideal teacher's interpersonal behaviour. Although the wording of items is similar for the actual and ideal forms, different instructions for answering each are used. For example, 'This teacher helps us with our work' in the Actual Form is changed to 'This teacher would help students with their work' in the Ideal Form.

2.7 PAST USES OF THE QTI

The reliability and validity of the QTI have been established in several studies including international samples (Dutch samples: for example, Brekelmans, Wubbels, & Creton, 1990; den Brok, 2001; Wubbels, Creton, & Hooymayers, 1985; American samples: Wubbels & Levy, 1991; Australian samples: Fisher, Fraser & Wubbels, 1993). In a more recent research, den Brok, Fisher, Brekelmans, Rickards, Wubbels & Levy (2003) in a study of teacher interpersonal behaviour in six countries, namely The Netherlands, USA, Australia, Slovakia, Singapore and Brunei established the validity of the QTI in all six countries.

Feedback information based on student or teacher perceptions can be employed as a basis for reflection upon, discussion of, and systematic attempts to improve learning environments (Fraser & Fisher, 1986). Previous research has indicated differences in students' perceptions of their actual environment and their ideal or preferred environment (Fraser, 1991; Levy, Creton, & Wubbels, 1993; Wong & Fraser, 1994). Wubbels (1993) used the QTI with a sample of 792 students and 46 teachers in Western Australia and Tasmania. The results of this study were similar to

previous Dutch and American research in that, generally, teachers did not reach their ideal and differed from the best teachers as perceived by students. It is noteworthy that the best teachers, according to students, are stronger leaders, more friendly and understanding, and less uncertain, dissatisfied and admonishing than teachers on average. Therefore, in keeping with this line of research, differences between students' actual and ideal teacher interpersonal behaviour were explored in this study.

Another use of the QTI in The Netherlands involved investigation of relationships between perceptions on the QTI scales and student outcomes (Wubbels, Brekelmans, & Hooymayers, 1991). Regarding students' cognitive outcomes, the more that teachers demonstrated strict, leadership and helping/friendly behaviours, then the higher were cognitive outcomes scores. Conversely, student responsibility and freedom, uncertain and dissatisfied behaviours were related negatively to achievement.

Variations in the students' appreciation of the subject and the lessons have been characterised on the basis of the proximity dimension: the more cooperative the behaviour displayed, the higher the affective outcome scores (Wubbels, Brekelmans, & Hoomayers, 1991). That is, student responsibility and freedom, understanding, helping/friendly and leadership behaviours were related positively to student attitudes. Uncertain, dissatisfied, admonishing and strict behaviours were related negatively to students' attitudes (Wubbels & Levy, 1993). Overall, previous studies have indicated that interpersonal teacher behaviour is an important aspect of the learning environment and that it is related strongly to student outcomes.

Levy, Creton, and Wubbels (1993) analysed data from studies in The Netherlands, the USA and Australia involving students being asked to use the QTI to

rate their best and worst teachers. The best teachers, according to students, are stronger leaders, more friendly and understanding, and less uncertain, dissatisfied and admonishing than teachers on average. Best teachers also provide students with a little more responsibility and freedom. For worst teachers, a complementary picture emerges: they are perceived by students as being more oppositional and less cooperative than average teachers; often they are more admonishing and dissatisfied. The study also found that the ideal teacher as seen by teachers, differs in the same way from the average teacher: they want to behave in a more cooperative and less oppositional manner. As might be expected, teachers' vision of ideal behaviours is more extreme than students' perceptions of their best teachers.

In further analysis of the differences between the profiles of the best and worst teachers, Creton and Wubbels (1984) showed that quality of instruction in students' eyes is more closely related to the proximity (CO) than the influence (DS) dimension of the Leary Model. While good teachers clearly achieve high scores on both dimensions, students respond more to friendly and understanding behaviour than to leadership and strictness.

In a further investigation into the characteristics of teachers, Wubbels and Levy (1991) compared Dutch and American teachers and found very few differences, although American teachers were perceived as stricter and Dutch teachers as giving their students more responsibility and freedom.

The QTI also has been used to develop typologies of teacher interpersonal behaviour in The Netherlands (Wubbels, Brekelmans, Creton, & Hoomayers, 1990). Using cluster analysis, eight types were distinguished. The behavioural patterns on the eight teacher types were characterised as directive, authoritative,

tolerant/authoritative, tolerant, uncertain/tolerant, uncertain/aggressive, repressive, and drudging. Teacher types associated with the greatest student cognitive and affective gains were directive (characterised by a well structured task oriented learning environments) and tolerant/authoritative (characterised by a pleasant well structures environment in which the 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.

In on of the first uses of QTI in Australia (Fisher, Fraser, & Wubbels, 1993), associations were investigated between teachers' perceptions of their work environment, using the School Level Environment Questionnaire (SLEQ), and students' and teachers' perceptions of their classroom interactions (Fisher & Fraser, 1990). Results from this study indicated that relationships between SLEQ and QTI scores generally were weak, thus suggesting that teachers believed that they had considerable freedom to shape their own classrooms regardless of their school environment.

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. Conversely, students' attitude scores were lower in classrooms in which students perceived greater uncertainty, dissatisfaction, admonishing, and strictness in their teachers' interpersonal behaviours. It was concluded that, if biology teachers want to promote favourable student attitudes in their class and laboratory work, they should ensure the presence of these interpersonal behaviours (Henderson, Fisher, & Fraser, 2000).

Fisher, Rickards, and Fraser (1996) have described how science teachers can use the results obtained with the three versions of the QTI as a basis for reflecting on their own teaching and thus providing a basis for guiding systematic attempts to improve their teaching practice. They also reported that after having completed the questionnaire and having had time to read the QTI report supplied to them, science teachers stated that the results had stimulated them to reflect on their own teaching.

A primary school adaptation of the QTI was used in Singapore by Goh and Fraser (1996). This revised questionnaire was administered to 1,512 students in 39 fifth-grade classes in Singapore and each scale exhibited satisfactory internal consistency and predictive validity for two levels of analysis (the student and the class mean) and differentiated between classes. Furthermore, girls consistently rated the teacher behaviour more favourably than boys.

2.8 PAST RESEARCH IN ASIAN LEARNING ENVIRONMENTS

This section provides a review of previous learning environment studies that have been conducted in Asian countries.

Some early studies established the validity of classroom environment instruments that had been translated into the Indian (Walberg, Singh, & Rasher, 1977) and Indonesian (Schibeci, Rideng, & Fraser, 1987) languages. Associations between student outcomes and classroom environment perceptions were found.

In Hong Kong, Wong (1996) used qualitative methods involving open-ended questions to explore students' perception of the learning environment in Grade 9 classrooms. He found that many students identified the teacher as the most crucial

element in a positive learning environment. Teachers who could keep order and discipline while creating an atmosphere that was not boring and yet able to interact with students in ways that could be considered friendly and showed concern contributed to the positive learning environment. Cheung (1993) used multilevel analysis to determine the effects of the learning environment on students' learning. The findings of the study provided insights that could help to explain why Hong Kong was found to rank highly in physics, chemistry and biology in international comparisons (Keeves, 1992).

In Singapore, relationships have been established between a variety of student outcomes and students' classroom environment perceptions as assessed by different instruments. Wong and Fraser (1996) established links between students' attitudes and scores on SLEI scales for a sample of 1,592 Grade 10 chemistry students in 56 classes. In another study, Goh used both the MCI and QTI with 1,512 primary mathematics students in 39 classes to establish associations between the classroom environment and mathematics achievement and attitudes (Goh & Fraser, 1998, 2000). Fraser and Chionh's (2000) comprehensive study used Actual and Preferred Forms of the WIHIC to investigate associations between WIHIC scales and three student outcomes of examination results, attitudes and self-esteem among a sample of 2,310 mathematics and geography students in 75 classrooms in Singapore and Australia. It was found that better examination scores were achieved where students perceived the environment as more cohesive. Self-esteem and attitudes were more favourable in classrooms perceived as having more teacher support, task orientation and equity. Quek et al. (2001) found links with student attitudes, using the SLEI and QTI for a sample of 497 gifted and non-gifted secondary school chemistry students. Khoo and Fraser (1997) reported links between student satisfaction and dimensions of the

WIHIC for a sample of 250 adults attending 23 computing classes. Teh and Fraser (1995) established associations between classroom environment, achievement and attitudes among a sample of 671 high school geography students in 24 classes. Two studies compared the results from multiple regression analysis with those from an analysis involving the hierarchical linear model. In Wong, Young and Fraser's (1997) study involving 1,592 Grade 10 students in 56 chemistry classes in Singapore, associations were investigated between three student attitude measures and a modified version of the SLEI. In Goh's study with 1512 Grade 5 mathematics students in 39 classes, scores on the MCI and QTI were found to be related to student achievement and attitude (Goh & Fraser, 1998).

In Thailand, Fraser (1984) provided cross-cultural data about the predictive validity of students' perceptions. A Thai version of the LEI was used to predict three attitudinal outcomes with a sample of 989 grade 12 physics students in 31 classes in Bangkok and nearby provinces. Classes perceived as having more cohesiveness, less friction, less cliqueness, and more satisfaction seemed to have more favourable attitudes to the learning of physics. Greater enjoyment of physics was reported in classrooms characterised as having less speed, less disorganisation, and greater competitiveness. Also in Thailand, Santiboon (2006) modified the SLEI for use in physics upper secondary classes and found associations between students' perceptions of their learning environments and teachers' interpersonal behaviour with their attitudes to their physics classes.

In Indonesia, Margianti, Fraser, and Aldridge (2001) reported associations between the outcomes of achievement and attitudes and students' perceptions on an Indonesian-language version of the WIHIC for a sample of 2,498 university students

in 50 classes. Soerjaningsih, Fraser, and Aldridge (2001) used the Indonesian versions of the WIHIC and QTI to establish links with student outcomes, namely course achievement, leisure interest in computers and attitudes toward the internet, among 422 university students in 12 classes.

In Brunei Darussalam, Majeed, Fraser, and Aldridge (2001) established associations between scales of the MCI and satisfaction for a sample of 1,565 Form 2 mathematics students in 81 classes. Khine and Fisher (2001) used the WIHIC to study the classroom environment and teachers' cultural background in an Asian context. The study found that teachers from different cultural backgrounds created different types of learning environments. It also showed that the WIHIC is a useful instrument to measure the effect of cultural background differences and also, as a basis for the identification and development of desirable teacher behaviours. Khine and Fisher (2002) also found associations between science attitudes and scales of both the WIHIC and QTI for a sample of 1,188 Form 5 students in 54 science classrooms. Riah and Fraser (1998) reported associations between achievement and attitudes and scales of the WIHIC, QTI and SLEI for a sample of 644 chemistry students in 35 classes from 23 government secondary schools. Scott and Fisher (2001) translated the QTI into a Standard Malay version and found association between enjoyment of science lessons with the various scales when used with 3104 students in 136 classes in 23 private schools.

In Korea, the SLEI, CLES and QTI were also translated into a Korean-language version and Lee and Fraser (2001a) reported association between students' attitudes and the scales. Kim, Fisher, and Fraser (1999) reported associations between student attitudes and the CLES for a sample of 1,083 science students in 24 classes

and of the QTI and WIHIC for a sample of 543 students in 12 schools (Kim et al., 2000)

Lin and Crawley (1987) investigated learning differences in classroom environment and science-related attitudes with 1,269 Taiwanese junior high school science students using the LEI. It was found that urban science classes, when compared to students in rural science classes, were characterised by more speed, friction, favouritism, cliqueness, and competitiveness. No differences were found when students were grouped according to sex or ability. It was found that differences existed in students' attitudes to science and that those differences depended on the school's location, sex of students and student ability. The WIHIC and CLES were also translated into the Chinese-language version and associations were established for student satisfaction and the scales for a sample of 1,879 science students in 50 classes (Aldridge & Fraser, 2000; Aldridge, Fraser & Huang, 1999; Aldridge, Fraser, Taylor, & Chen, 2000). Aldridge and Fraser (2000) used English and Chinese versions of the WIHIC in Australia and Taiwan, respectively, to explore the potential of cross-cultural studies. Results of the study indicated that students in Australia consistently perceived their classroom environment more positively than students in Taiwan. Significant differences were detected on the WIHIC scales of Involvement, Investigation, Task Orientation, Cooperation and Equity. It seemed to show that students in Australia perceived they are given more opportunity to get involved in the experiments and investigate scientific phenomena. In this study, cultural differences were highlighted. Education in Taiwan is examination based and teaching styles are adopted to suit the particular situation. In Taiwan, having good content knowledge of the subject was the measure for being a good teacher, while in Australia having good interpersonal relationships between students and teachers was considered the most

important factor in education process. Taiwan classrooms seemed to be more teacher-directed with fewer opportunities for students to discuss issues.

The review of literature up to this point has included studies in various subject areas; however the focus of the study reported in this thesis is specifically teacher interpersonal behaviour in the mathematics classroom, using English as a comparison. The literature seems inconclusive as far as the extent that aspects of mathematics classroom environments are similar to, or different from, classrooms in other subject areas. Grouws (1980) cited research by Evertson, Anderson, Anderson, and Brophy (1980) to show that “behaviours highly correlated with teacher effectiveness in mathematics did not correlate with teacher effectiveness in English” (Grouws, 1980 p. 202). This is also seen in Hill, Rowe, and Holmes-Smith’s (1995) study which suggested that different sets of variables may be significant in explaining student progress in English as compared to mathematics. However, Costello (1988) in his study of mathematics and English classrooms found that “students in the higher ability tracks of mathematics and English view the classroom environment significantly more favourably than students in the middle and lower ability tracks” (p. 64).

Grouws (1980) cited research by Cooney (1980) who suggested that affective and cognitive variables may play different roles in classroom environments. For instance, Cooney suggested that affective variables such as warmth and enthusiasm may be more generalisable across subject boundaries, whereas the cognitive variables of clarity and variability may be more subject specific and with particular relevance to mathematics.

However, while it is not the purpose of the study to compare mathematics classrooms and other classrooms, nevertheless, one of the purposes is in the determining of associations between students' perceptions of their teacher's interpersonal behaviour and students' attitudes to the specific subject.

2.9 DIFFERENCES BETWEEN STUDENT PERCEPTIONS OF ACTUAL AND IDEAL ENVIRONMENT

An investigation of differences between student perceptions between the actual environment and that preferred by students was first reported by Fisher and Fraser (1983). This research revealed that, first, students preferred a more positive classroom environment than was actually present for all environment dimensions and second, teachers perceived a more positive actual classroom environment than did their students in the same classrooms. This interesting pattern of results has been found in the USA, Israel, and Australia (Fisher & Fraser, 1983). Fraser, Giddings, and McRobbie (1992) used both the Actual and Preferred Forms of the SLEI with 1875 senior high school students and 298 university students in Australia. Again, the students indicated that they preferred a more positive laboratory learning environment than that they perceived to be present.

In Singapore, Quek, Fraser, and Wong (2001) used the Chemistry Laboratory Environment Inventory (CLEI) and the QTI and established the reliability and validity of the actual and preferred versions of the questionnaires and also found significant differences between students' perceptions of their actual and preferred chemistry laboratory classrooms and their chemistry teachers' interpersonal behaviour.

In another study, Rickards and Fisher (1999) administered the QTI to a sample of 153 teachers and 3,515 students from 164 secondary school science classes in 35 schools. From the study, it was found that teachers generally perceived their interactions more positively than did their students. Henderson, Fisher, and Fraser (2000) found in their study that, relative to the actual environment present, students preferred teachers who showed strong leadership, who were more helping and understanding, and who gave their students more responsibility and freedom. Students also preferred teachers who were less uncertain, dissatisfied, and admonishing. Only in the degree of strict behaviour shown by their teacher did students' perceptions of their teacher closely resemble the behaviour of the preferred teacher. These results were also similar to those reported by Levy, Créton, and Wubbels (1993) for an Australian sample. The disparity between students' actual and ideal perceptions of the level of student responsibility and freedom was similar to that reported by Levy et al. for the Australian sample, but greater than that reported (in the same study) for Dutch and American students, suggesting that Australian secondary students seemed to prefer more independence than did their Dutch and American counterparts.

In Thailand, Santiboon (2006) modified the SLEI for use in physics upper secondary classes and found that though students showed relatively favourable perceptions of their physics laboratory classroom environments, the students' perceptions of their preferred classroom laboratory environment tended to be greater than what they actually perceived to be provided, that is, they preferred more student cohesiveness, open-endedness, integration, rule clarity and an enhanced material environment in their laboratories. Similarly, with the use of the Actual and Preferred Forms of the QTI, students indicated that they preferred more responsibility and

freedom, leadership, helping/friendly and understanding behaviours and less uncertain, dissatisfied, admonishing and strict behaviours in their teachers.

That students prefer a more positive classroom environment than the one perceived as being currently present has also been reported using the WIHIC and QTI among Singaporean junior college students (Fraser & Chionh, 2000; Wong & Fraser, 1996) and with the WIHIC among 2,498 university students in Indonesia (Margianti, Fraser, & Aldridge, 2002). Previous research had indicated that achieving a closer match between students' actual and ideal or preferred learning environments is likely to lead to more favourable student outcomes (Fraser & Fisher, 1983a, 1983b; Fraser, 1984). Overall, the findings suggested that actual-preferred congruence could be an important variable in predicting student cognitive and affective outcomes.

2.10 DEVELOPMENT OF TEACHER TYPOLOGIES

Research with the QTI has shown that teacher-student communication patterns remain relatively stable in classrooms (Wubbels, Creton & Hoymayers, 1985, 1987; Wubbels & Levy, 1993) and these patterns are distinct and take typical recognisable forms (e.g., Wubbels, Brekelmans, & Hermans, 1987; Wubbels & Levy, 1991).

The QTI has also been used to develop typologies of teacher interpersonal behaviour in the USA, the Netherlands (Wubbels, Brekelmans, Creton, & Hoymayers, 1990) and Australia (Rawnsley, 1997). The eight types of patterns of interpersonal relationships as found in the Dutch and American studies were Directive, Authoritative, Tolerant/Authoritative, Tolerant, Uncertain/Tolerant, Uncertain/Aggressive, Repressive and Drudging whereas there were seven types

found in the Australian study (Rickards, den Brok, & Fisher, 2005). Four of the profiles in both typologies were classified as similar, namely Tolerant/Authoritative (Australian type 1), Authoritative (Australian type 2), Directive (Australian type 4) and Uncertain/Aggressive (Australian type 7). It was found that 73.1% of the teachers in the Australian sample belonged to one of these four types. The patterns of the other three types of teachers deviated from the original Dutch/American typology. These eight profiles consistently appeared in both American and Dutch samples of teachers (e.g. Wubbels & Brekelmans, 1998). The eight types can be characterised by means of the two dimensions in the Model for Interpersonal Teacher Behaviour. The Authoritative, the Tolerant/Authoritative and the Tolerant type are profiles in which students perceive their teachers to be relatively high on the Proximity dimension whereas the Tolerant type has profiles lowest on the Influence dimension. The Directive type, the Uncertain/Tolerant and the Drudging type are less cooperative than the earlier types with the Uncertain/Tolerant type lowest on the Influence dimension. The least cooperative of the interpersonal relationships are the Repressive and Uncertain/ Aggressive type. Repressive teachers are the most dominant of all eight types.

The eight interpersonal types have also been linked to student outcomes (Brekelmans, Wubbels, & Levy, 1993). Repressive teachers, followed by Tolerant and Directive teachers, realised highest cognitive achievement. Lowest achievement was found in classes of Uncertain/Tolerant and Uncertain/Aggressive teachers. Highest motivation has been found in classes of Authoritative, Tolerant/Authoritative and Directive teachers, while lowest motivation occurred in classes of Drudging and Uncertain/Aggressive teachers. The pattern found for the Tolerant/Authoritative teachers approximates the image of the 'best' or 'ideal' teacher.

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 the 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.

In Figure 2.3, the types are characterised by means of graphic representations using the eight sections of the Model of Interpersonal Teacher Behaviour. The greater the shaded part in each section the more the pattern of interpersonal relationships is characterised by this sector.

The typology found was further validated by observations in classrooms showing qualitative differences between each of the eight types. A separate hand-sort of 'teaching profiles', for instance, visual representations of scale scores on the QTI conducted by the researchers involved (Brekelmans, Levy, & Rodriguez, 1993) also resulted in a set of types similar to the one found by statistical analyses.

In much earlier research of Dutch and American interpersonal teacher behaviour, results indicated that Dutch and American teachers displayed the same interpersonal behaviour toward their students in many aspects. However, it was found that American teachers wanted to be stricter than did their Dutch colleagues; and that Dutch teachers wanted to give students more responsibility and freedom (Wubbels & Levy, 1991). In another study, Rickards, den Brok, and Fisher (2005) found that compared with the USA and the Netherlands, interpersonal communication between teachers and students in the classroom in Australia might be characterised by a higher degree of respect and formality in some schools. However, Fisher, Henderson, and

Fraser (1997) in another cross-national study of teacher interpersonal behaviour in Singapore and Australia found that Australian teachers were perceived as giving more responsibility and freedom to their students while the teachers in Singapore were perceived as stricter.

In another study of cross-national comparisons of secondary teachers' interpersonal behaviour in Singapore, Brunei and Australia, it was found that teachers were rated highest on the Influence dimension in Brunei and lowest in Australia (den Brok, Fisher, Wubbels, Brekelmans, & Rickards, 2006). However, differences in influence ratings between Australia and Singapore were only minimal, with Brunei teachers being rated somewhat higher from teachers in the other two countries which was rather surprising given that cultural differences in pedagogy between Singapore and Brunei would be smaller than that compared to Australia. Teachers were rated highest on the proximity dimension in Singapore and lowest in Brunei, with Australian teachers rated somewhat in the middle.

Interestingly, in a Thai study by Santiboon (2006), comparison of the sector profiles of physics teachers in Thailand with an Australian QTI-based typology, showed that Thai teachers could be described as authoritative. Furthermore, it was found that Thai students preferred authoritative teachers.

In this study, one of the aims was to compare the profiles obtained from mathematics and English teachers in Singapore with the typologies that exist in Dutch, American and Australian studies.

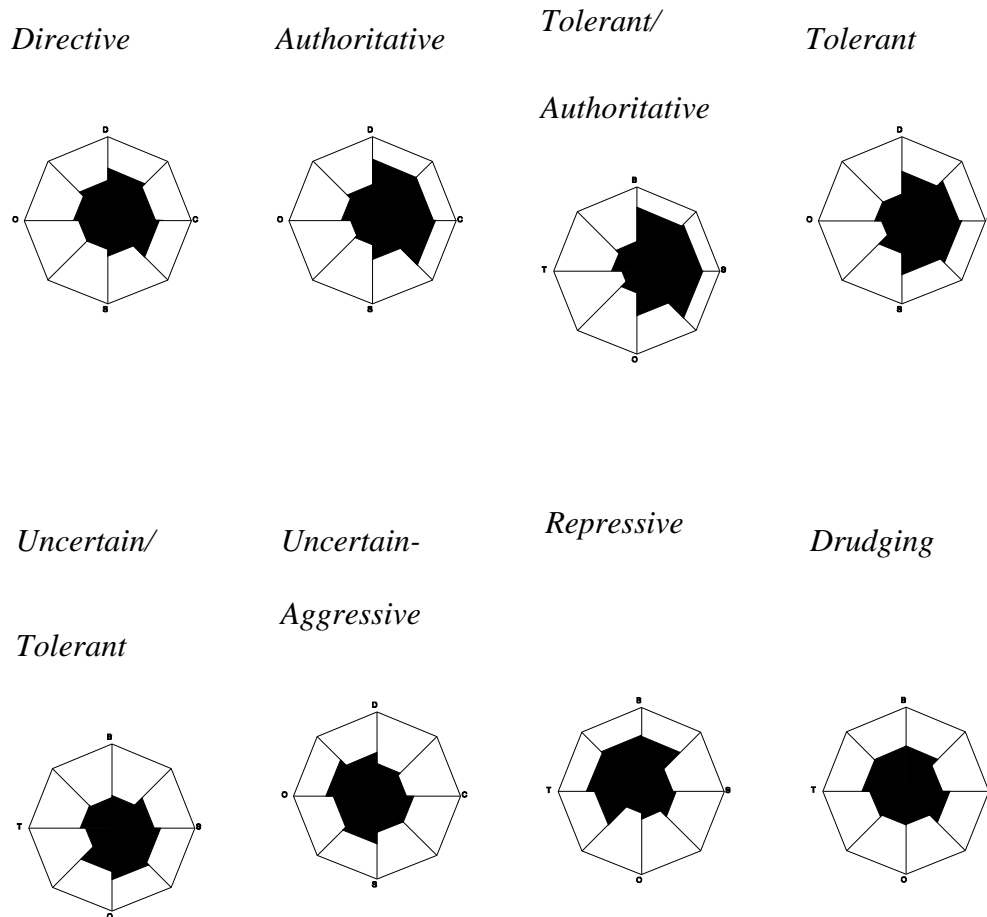
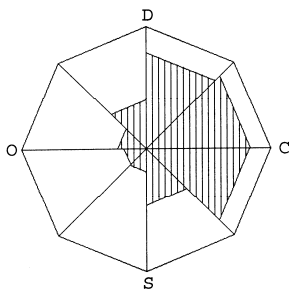
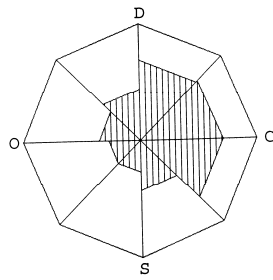


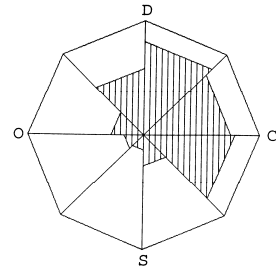
Figure 2.3. Graphic depiction of the sample cluster solution in terms of the eight QTI scales (Brekelmans, Levy, & Rodriguez, 1993).



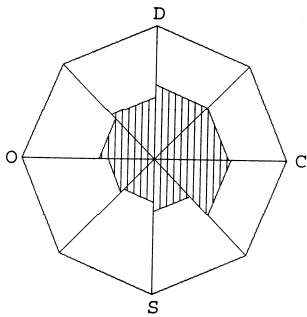
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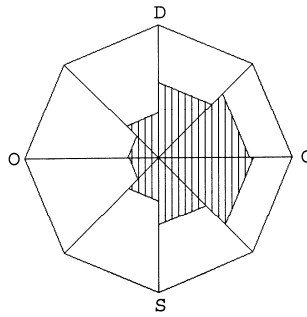
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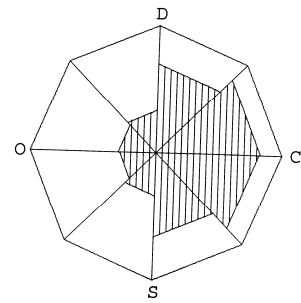
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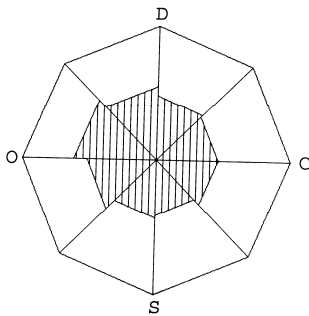
Type 4



Type 5



Type 6



Type 7

Figure 2.4. Graphical depiction of the sample cluster solution in terms of the eight QTI scales of Australian typology (Rickards, den Brok, & Fisher, 2003).

2.11 ASSOCIATION BETWEEN CLASSROOM ENVIRONMENT AND STUDENT OUTCOMES

Many classroom environment research studies have involved investigation of associations between students' cognitive and affective learning outcomes and their perceptions of classroom learning environment, as already mentioned elsewhere in the review. For example, studies by Fraser and McRobbie (1995), Fraser (1993), Teh and Fraser (1995), and Wong and Fraser (1996) revealed consistent associations between student outcomes and the nature of the classroom learning environment.

Research studies particularly investigating classroom learning environments and student attitudes are discussed in this section.

Koul and Fisher (2002) investigated associations between science students' perceptions of their teachers' interpersonal behaviour, cultural background and gender of the students, and their attitudinal and cognitive achievement scores in India. A sample of 1,021 students from 31 year nine and ten science classes in seven schools completed the QTI, an attitude scale, and the students' cognitive examination results were used. Generally, the dimensions of the QTI were found to be significantly associated with student attitude scores. In particular, leadership, helping/friendly and understanding behaviours were positively associated with student attitudinal outcomes. In contrast, the more oppositional behaviours such as dissatisfied, admonishing and uncertain behaviours were negatively associated with attitude outcomes. In terms of cognitive scores, there were positive associations with cooperative teacher behaviour and negative associations with oppositional behaviours.

In Zandvliet's (2003) study, analysis of the classroom environment using the WIHIC and a Computerised Classroom Environment Checklist revealed that student

autonomy/independence and task orientation were associated with satisfaction in learning. In a study, mentioned earlier, Lee and Fraser (2001) investigated Korean high school students' perceptions about laboratory classrooms using the SLEI and the TOSRA. When perceptions of students from three different ability streams were compared, students from the science-independent stream perceived their classroom environments more favourably than did students in the other two streams.

Rawnsley and Fisher (1997) reported on investigations in the perceptions of 490 grade 9 mathematics students in 23 classrooms in 14 schools in Australia using the QTI. The study identified associations between students' perceptions of their mathematics classroom learning environment, their perceptions of their teacher's interpersonal behaviour, and student outcomes. Associations between student perceptions of their mathematics classroom environment and attitudinal outcomes were stronger than the association with cognitive outcomes.

Rickards and Fisher (1996) used the QTI and an attitudinal scale based on TOSRA, with 405 students in grades 8, 9 and 10 mathematics classes with their 21 teachers. The dimensions of the QTI were found to be significantly associated with student attitude scores. In particular, students' attitudes scores were higher in classes which students perceived greater leadership and helping/friendly behaviours in their teachers.

2.12 TEACHER AND STUDENT CHARACTERISTICS AND TEACHER INTERPERSONAL BEHAVIOUR

Creton and Wubbels (1984) and Brekelmans (1989) examined relationships between teachers' and students' perceptions of teacher interpersonal style and selected teacher characteristics: sex, age, years of experience, grade level, subject taught, self-esteem, job satisfaction and opinions of the teacher about educational goals and the preferred student-teacher relationship. It was found that many of these characteristics influence perceptions of teacher interpersonal style. For example, it was found that students and to a lesser extent, the teachers themselves, perceived male teachers as less dominant than their female colleagues. No significant relationship was found for the proximity dimension.

Brekelmans (1989) also found significant, though small, differences in students' perceptions of classes thought by the teacher to be either his or her best or worst. It appeared that students in the best class saw the teacher as more cooperative and less oppositional than those in the worst class. In another study by Levy, Creton, and Wubbels (1993), it was found that students perceived that their best teachers are strong leaders, more friendly and understanding; less uncertain, dissatisfied and admonishing, and at the same time, they are able to provide students with more responsibility and freedom

When data from a cross-sectional and a longitudinal study was used to analyse differences between teachers in degree of dominant and cooperative behaviour in different stages of their professional career, Brekelmans, Wubbels, and den Brok (2002) found that while teachers' ideals of the teacher-student relationship were rather stable during the teaching career, they consistently strived for a high degree of

dominance and cooperation. The actual teacher-student relationship however changed during the career. First-year teachers seem to have difficulty in establishing and maintaining a consistent relationship with their students. This often resulted in students' perceptions of their interpersonal behaviour as uncertain. On average, there was a significant increase in dominant behaviour of teachers during the first decade of their career: a movement toward the ideal teacher-student relationship.

During the career, it may be that the cognitive component to training and staff development may be more important in order to support teachers to select appropriate skills in particular situations. Similar findings were presented in yet another study; Brekelmans, Wubbels, and van Tartwijk (2005) use unique and huge data sets to describe the amount of dominant and cooperative behaviour in different stages of the professional career of teachers; their cross-sectional QTI-data cover over 6,000 teachers and data from a longitudinal study of 100 teachers for 20 years. Results showed that, on average, teachers' ideal perceptions of influence and proximity were rather stable during the career.

There are further studies regarding student characteristics and teacher interpersonal behaviour. As previously mentioned, many studies have been undertaken with regard to sex, ethnic and cultural differences in students' perceptions toward teacher interpersonal behaviour and other variables. In another study by Brekelmans (1989), it was found that grade level in the USA was only related to the proximity dimension: teachers in the higher grades are perceived by their students as being more cooperative. This tends to make sense if one assumes that students in higher grades behave better and need less teacher discipline. In addition, Dutch teachers seem to allow students in the higher grades more responsibility and freedom

than those at lower levels. It appears, therefore, teachers adapt their behaviour to student age.

However, in Asia, in terms of grade differences, not many studies were carried out in learning environment research to determine if it is a factor affecting students' perceptions. Thus, in this study which was carried out in a mainly boys' school, gender differences in students would not be discussed but students' perceptions across grade levels would be examined.

In general, it would seem that classroom environment, in particular teacher interpersonal behaviour, can be a predictor of both achievement and attitudes in students, even when a comprehensive set of other factors are held constant.

2.13 CHAPTER SUMMARY

This chapter has reviewed research studies involving classroom environment, with a historical background of the development and use of the various instruments, with a specific focus on the QTI. The QTI is an internationally recognised and effective instrument for mapping the interpersonal behaviour of teachers in the classroom. Associations have been shown to exist between students' perceptions of particular types of teacher interpersonal behaviour, and cognitive and affective outcomes. The QTI has been used extensively in the Netherlands, the USA, Australia and many other countries like Korea, India, Brunei, Indonesia, and Singapore for various purposes. However, no comparative study has been reported whereby students' perceptions toward teacher interpersonal behaviour have been examined in terms of different subject areas. In this study, students' perceptions of mathematics teachers and their

attitudes were analysed, using English teachers as a comparison. Teacher characteristics such as gender and experience, and student characteristics such as grade level also were explored in the study.

Chapter 3

Research Methodology

3.1 INTRODUCTION

In terms of research in mathematics education, often students' perceptions of their mathematics classroom environments are overlooked. In this regard, this study is significant in that it addresses these perceptions and seeks to determine if there exist differences in students' perceptions of teachers' interpersonal behaviour in mathematics, but using English as a comparison. Profiles of typical mathematics and English teachers in Singapore are also established.

There are five aims in this study: to provide validation data for the QTI; to investigate differences between students' perceptions of their mathematics and English teachers' interaction styles using the actual and ideal QTI; to establish associations between students' attitudes to mathematics and English and their perceptions of the teachers' interpersonal behaviour; to determine factors contributing to students' perceptions of teachers' interpersonal behaviour; and to establish an interpersonal profile of the typical mathematics teacher in a secondary school, in comparison with an English teacher, in Singapore. Furthermore, from the viewpoints of students and teachers, what makes an effective teacher?

It is not possible for all variables in a study to be controlled. Neither classroom learning environments nor teacher-student interpersonal behaviour can be held constant, controlled or manipulated in the scientific sense for the duration of the

study. These variables exist and, it is hypothesized, link with the attitudes which students have toward mathematics. This research is *ex post facto*. Kerlinger (1973) defines such research as “systematic, empirical enquiry in which the scientist does not have direct control of independent variables because the manifestations have already occurred or because they are inherently not manipulatable” (p. 379).

Cohen, Manion, and Morrison (2000) delineate two types of *ex post facto* research; correlational study (or causal research) and criterion group study (or causal comparative research). This study is co-relational and seeks to determine associations between teacher-student interpersonal relationships and students’ attitudes toward the respective subjects of mathematics and English.

The methodology outlined in this chapter involves identification of the population and sample, description of the data gathering instruments and procedures, and an outline of the methods to be used for the description, analysis and interpretation of the findings.

3.2 SAMPLE

Purposive sampling (Merriam, 1988, p. 48) as a non-probabilistic sampling method was used in selecting the sample for the study. This is based on the assumption that the researcher seeks to discover, understand, and gain insight and that the researcher chooses the sample which will lead to the most understanding (Merriam, 1988). A total of 25 mathematics teachers and 12 English teachers from an independent school with a six-year Integrated Programme, and students from 13 years to 18 years (Year 1 to Year 6), in Singapore participated in this study. From Year 1 to Year 4, the students

are all males whereas in Year 5 and Year 6, there are female students as well. Each teacher provided one class to participate in the study. In total, the study involved 913 students and 37 teachers. All students completed the student version of the QTI to describe the teacher-student interpersonal behaviour occurring in their classrooms and also their perceptions of an ideal Mathematics or English teacher. Student attitudes were assessed with a 10-item Attitude to this Class scale, which was based on the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981).

3.3 ROLE OF PARTICIPANTS

The researcher sought permission from the principal of the independent school and enlisted the help of teachers in the mathematics and English departments and their respective students to carry out the study. Besides quantitative data, an attempt was also made to obtain qualitative data by carrying out interviews with both students and teachers to seek to better understand the learning environments. Individual interviews were carried as well as group interviews of students. As for teachers, individual interviews were conducted with five teachers. The teachers were selected based on number of years of experience. The researcher also sat in real classroom situations to make further observations.

3.4 DATA COLLECTION AND INSTRUMENTATION

Shavelson, Webb, and Burstein (1986) in a generalisability study, concluded that the QTI should be administered to at least ten students in a class for the data to be reliable. In this study, each class of about 30 completed the questionnaire for each teacher to achieve a reliable measure of overall style (Brekelmans, 1989). Classroom

research has evolved through different eras of systematic observation and ethnographic and case study research (Amidon & Hough, 1967; Merriam, 1998). Researchers now recognise the important contribution made by each and advocate the use of both types of data to provide complementary perspectives within the same study of classroom environments (Fraser & Fisher, 1994); Fraser & Tobin, 1991). This study included both quantitative and qualitative data, such as interviews and observations of both teacher and student participants.

Qualitative data are different in nature to quantitative data. They allow students to explore ideas, interpret, debate and amplify ideas about their classroom environment and mathematics. It enables the researcher to see new insights in the qualitative data and reinforces, or falsifies the data (Popper, 1963). Quite a few Asian studies have used qualitative methods, such as in interviews of a small group of students aimed at checking the suitability of a learning environment questionnaire and modifying it in a large-scale study (e.g., Margianti, Fraser, & Aldridge, 2001; Soerjaningsih, Fraser, & Aldridge, 2001; Khine, 2001). In Singapore, Khoo and Fraser (1998) randomly selected 46 students for interviews in order to cross-check students' questionnaire responses and to obtain richer insights into students' perceptions of their classroom environments. In this study, the construct validity of the QTI was confirmed through interviews with both students and teachers and these are reported in Chapter 5.

3.5 ATTITUDE TO MATHEMATICS AND ATTITUDE TO ENGLISH SCALES

To determine the attitudes of students toward the respective subjects, ten items were included as a scale and attached to the QTI (See items 49-59 in Appendix A). Students were asked to rate their agreement with such items as, 'I look forward to mathematics lessons', 'I enjoy mathematics lessons in this class' and 'I feel satisfied after a mathematics lesson'.

These items were adapted from the Test of Science Related Attitudes (Fraser, 1981). This seventy-item test of science related attitudes has been used extensively and has proven reliability. Ten items were selected from this test and adapted to read 'Mathematics' and 'English' instead of 'Science'. Three of these items were reversed to minimise the risk of students' response set bias. As a whole, these items gave each student a total score for his attitude toward Mathematics and English, respectively. From these data, class means were generated.

3.6 TEACHER INTERPERSONAL BEHAVIOUR USING QTI

The instrument used for the collection of data was the Questionnaire on Teacher Interaction (QTI) (Wubbels, Creton, & Hooymayers, 1985). This instrument has been reviewed in earlier chapters and its reliability is well-established in both the 64-item and the shorter 48-item format. The 48-item format was chosen because of time constraints in schools and also because its reliability has been well-established in various countries. The magnitude of the Cronbach alpha reliability coefficient gives an indication of how consistently students respond to each item within each scale. An alpha reliability of 0.60 or greater is considered to be acceptable (Nunnally, 1967). In

Fisher, Henderson, and Fraser's study (1995), the alpha reliability coefficients for the eight QTI scales ranged from 0.63 to 0.83 with the student as the unit of analysis, and from 0.74 to 0.95 with the class as the unit of analysis. This showed the instrument has acceptable levels of internal consistency. Wubbels and Levy (1993) also showed that the QTI has acceptable reliability and validity when used in grades 7 to 12. Furthermore, a recent review on the validity and reliability of over 20 studies that have used the QTI during the last 17 years (den Brok, 2001) showed that the reliability of the eight scales (sectors) is sufficient and consistent across classes. The internal consistencies at class level were generally above 0.80. Also, in other research, the agreement between the scores of students in a single class met the general requirements for agreement between observer scores (Brekelmans, 1989; Brekelmans, Wubbels, & den Brok, 2002).

As the internal consistency and reliability measurements for the instrument requires a large number of students in different classes, using the SPSS statistical package (Norusis, 1990a), single ANOVA (η^2 statistic) measurements are calculated to determine the extent to which the perceptions of students in different classrooms vary. The η^2 statistic gives an indication of the proportion or percentage of the variance in the dependent measure that is related to the independent variable of class membership (Tilley, 1999). If the values are statistically significant, it suggests that student perceptions within a class are similar but they differ from class to class indicating that the questionnaire can distinguish between classes.

3.7 QUALITATIVE DATA

Classroom research has moved through eras of systematic observation (Amidon & Hough, 1967) and ethnographic and case study research (Merriam, 1988). While in the past, discussions have focused on the merits of each of quantitative and qualitative data, researchers now recognise the important contribution made by each method of research and advocate the use of both types of data to provide complementary perspectives on the research problem. This has been elaborated earlier and is discussed extensively elsewhere (Fraser & Fisher, 1994; Fraser & Tobin, 1991). Data generated from a combination of qualitative methods present a better understanding of learning environments (Fraser, 1998a). Furthermore, with such a combination, the disadvantage of one method is offset by the strengths of the other which in turn enhances the quality of the research (Jayaratne & Stewart, 1995). Social scientists have come to abandon the spurious choice between qualitative and quantitative data, and are more concerned with the combination of both which makes use of the most valuable features of each. A 'focused group interview' (Merton, Fiske, & Kendall, 1990), which is a qualitative method in which researchers interactively question a group of participants in order to test theory-driven hypotheses, was used in this study. Through the explicit use of group interaction, group interviews would produce data and insights that are less accessible without the interaction found in such a group (Morgan, 1993).

Thus, both quantitative and qualitative data were collected in this study. The quantitative data were collected using the Questionnaire on Teacher Interaction and the qualitative data were gathered from interviews with students and teachers. Qualitative data allows students to explore ideas, interpret, debate and amplify ideas

about the teacher-student inter-relationships and their attitudes toward the respective subjects. It enables the researcher to see new insights in the quantitative data and reinforces, or falsifies, the data (Popper, 1963).

Student Interviews

In the student interviews, the researcher was interested in examining what were the students' perceptions of the scales that the items were examining: leadership, helping/friendly, understanding, student responsibility, uncertain, dissatisfied, admonishing and strict. What did they think the item meant? Did the concept of each scale appear to be important to them? How did they interpret each scale? What disconfirming evidence existed in students' perceptions of each scale? Were the students viewing the concepts behind each scale in a similar manner to the original developers?

An interpretative approach (Erickson, 1986) was adopted to answer these questions. Using a purposive sampling technique, students from classes where the QTI scores were high were selected for the group interview component of the study. These interviews were conducted in groups of three. There were ten group interviews. There were also individual interviews conducted. These were stratified random sampling of students across the six different grade levels. Two students per grade level were selected and there were twelve individual interviews. These were more in-depth interviews where the purpose was to establish what students consider to be the ideal teacher and how that can happen. Without students seeing their previous response to the questionnaire that had been administered to them some time beforehand, students were asked about how important they viewed the concept behind

each item or scale. They were asked to indicate how they would react to certain statements in both group and individual interviews.

In both group and individual interviews, students were interviewed for a maximum of 15 minutes in a fully visible position where student confidentiality could be assured, in a vacant classroom. After assuring them of the confidentiality of their responses, their approval for audio-recording was obtained. The interviews were semi-structured and students were asked for their perceptions about the nature of their classroom environment. Secondly, the interviews focused on the students' perceptions of the scales used. Thirdly, the focus was also on their responses to individual items. Finally, more detailed explanations were sought about students' perceptions about key concepts by focusing on consistency in their answers. Interview questions were generally scripted to follow a certain format for each interview session. However, at times when there were digressions, further clarifications were sought to ensure a more thorough understanding. General questions were asked about students' enjoyment of mathematics and their mathematics classes. This was then narrowed to address their perceptions of their teacher-student interpersonal relationships by focusing on the eight scales. The questions posed in the students' interviews are reflected in the Student Interview Questions (see Appendix B).

Teacher Interviews

Five teachers were selected for interviews, based on years of experience, from the list of teachers whose classes participated in the study. Each teacher represented each of the following age groups in the study: teachers with less than five years; between five and ten years; between ten and twenty years and more than twenty years of experience. In addition, the fifth teacher who was selected represented a teacher in his

second career; that is, he was an engineer for some number of years before embarking on a teaching career. Some 15 questions were asked on what makes an effective teacher and their general perceptions of teacher interpersonal behaviour. These questions are presented in the Teacher Interview Questions (see Appendix C).

3.8 DATA ANALYSIS

The data analysis focuses on the objectives of the study. The first objective was to check the reliability of the QTI and also to analyse its validity.

Validation of the QTI

The following areas of statistical validation were employed to establish the instrument's reliability, circumplex nature of the model, and the ability of the instrument to discriminate between classes.

The reliability, or internal consistency, of the instrument was established using the Cronbach alpha coefficient (Cronbach, 1951). An analysis of variance (ANOVA) test was used to determine the ability of the instrument to distinguish between classes. The ANOVA was performed on each scale of the instrument to show the proportion of variance on each of the scales which could be explained through class membership. Inter-scale correlations were used to show the circumplex nature of the model, rather than the use of mean correlation scores to show the discriminant validity of the scales. Adjacent scales in the model should correlate more highly whereas opposite scales should show strong negative correlations. These analyses were undertaken with the individual as the unit of analysis.

Analysis of differences between students' perceptions toward Mathematics and English teachers using Actual and Ideal QTI

Statistical analyses like t-tests and Tukey's post hoc tests were used to establish whether differences were statistically significant in the following: students' perceptions toward mathematics teachers using the actual and ideal QTI; students' perceptions toward English teachers using the actual and ideal QTI; students' perceptions toward mathematics and English teachers using the actual and ideal QTI; students' attitudes toward mathematics and English and certain factors that influenced students' perceptions were determined using analysis of variance (ANOVA).

Associations between students' perceptions using the QTI and students' attitudes to subjects

Associations between the scales of the QTI and the attitudinal scale were established by looking at the simple and multiple correlations between them. An 'attitude' score was calculated for each student based on the student's responses to the attitudinal scale. Simple correlations (r), standard regression coefficients (β) and multiple correlation scores (R) were calculated for the scales on the QTI with the attitude scores. The simple correlations were to determine the correlations between each scale and the attitude scores. The standard regression coefficient showed the relative weighting of each of the scales in the overall correlation whilst holding the effect of other scales constant. The multiple correlation was to determine the overall correlation of the scales when taken together.

3.9 CHAPTER SUMMARY

This chapter outlines the methodology used in this study which resulted in the construction of a database consisting of the responses to the QTI of 913 students from 37 classes of a big independent school in Singapore which provided validation data for the QTI. Data were analysed with SPSS to determine whether the QTI is a valid and reliable instrument for use in Singapore; to investigate differences between students' perceptions of their actual and ideal mathematics and English teachers; to investigate associations between students' attitudes to mathematics and English and their perceptions of the teachers' interpersonal teaching styles; to determine the factors that contribute to students' perceptions of teachers' interpersonal teaching styles and finally to determine if any of the eight profiles found in the Netherlands, USA and Australia were found in the data gathered in Singapore. It indicates how both quantitative and qualitative data gathering methods were used to answer the various research questions. The next chapter presents the results and discussions of findings.

Chapter 4

Results and Discussion

4.1 INTRODUCTION

The Australian 48-item version of the QTI was used for this study and it has been established that this version has acceptable reliability and validity when used in grades 7 to 12 (Rickards, 1998, Wubbels & Levy, 1993). Den Brok (2001) in a review on the validity and reliability of over 20 studies that have used the QTI in the last 17 years showed that the reliability of the eight scales or sectors is consistent across classes. The review also showed that the theoretical structure of the Model for Interpersonal Teacher Behaviour was represented in the items and scales of the instrument. However, the QTI which has been consistently shown to be an acceptable instrument for use in teacher research and professional development is already more than 20 years old. So it was considered imperative that the instrument be examined to ensure it still had acceptable reliability and validity, particularly with a Singapore sample.

The association between the scales of the QTI and students' attitudes was also investigated using simple and multiple correlation analyses. Earlier work with the QTI has shown that students' perceptions of their teachers are related to characteristics of themselves, for example, gender, age, report card grade, ethnic background, as well as characteristics of the teacher and class, for example class size, teacher gender, teacher experience, teacher ethnicity (den Brok, Levy, Rodriguez, & Wubbels, 2002; Levy, et al., 2003; Rickards, 1998). As this study was carried out in an independent school

with only boys from years 1 to years 4 with a minority of girls in year 5 and year 6, so gender was not explored as a factor. However, the grade level of the students was explored. Furthermore, in terms of teacher characteristics, teacher gender and teacher experience were also explored.

4.2 RELIABILITY OF THE QTI

The QTI, as already outlined in the literature review, has been extensively used in the Netherlands, the USA, Australia and many other Asian countries such as Brunei, Taiwan, Indonesia and also Singapore. In keeping with previous learning environment research, the reliability and validity of the QTI was established by examining the internal consistency (Cronbach alpha reliability coefficient) and discriminant validity (mean correlation with other scales) of each of the QTI scales. These are shown in Table 4.1 which indicates that for the sample of students the alpha coefficients ranged from an acceptable value of 0.79 for Strict (DO) to a strong value of 0.92 for Helping/Friendly (CD) for the Actual QTI. For the Ideal QTI, it ranged from 0.69 for Uncertain (SO) to 0.90 for Helping/Friendly (CD). This suggested that each QTI scale had acceptable reliability for application with this Singaporean sample. The range of reliability coefficients was similar to that reported in earlier studies carried out in the USA, the Netherlands, Australia, Brunei and also in Singapore.

Table 4.1

Reliability Coefficients and Eta² of QTI Scales

QTI Scale	Cronbach's Alpha		Eta ²
	Actual	Ideal	Actual
DC – Leadership	.87	.80	.21*
CD – Helping/ Friendly	.92	.90	.20*
CS – Understanding	.89	.87	.18*
SC- Student Responsibility	.81	.80	.12*
SO – Uncertain	.83	.69	.08*
OS – Dissatisfied	.88	.84	.10*
OD – Admonishing	.84	.74	.10*
DO – Strict	.79	.80	.05*

$p < 0.01^*$

Another desirable characteristic of the QTI is that it is capable of differentiating between perceptions of students in different classes. This characteristic was explored using one-way ANOVA, with class membership as the main effect and the individual as the unit of analysis. The results in Table 4.1 indicate that each scale differentiated significantly ($p < 0.01$) between classes. The eta^2 statistic represents the amount of variance in actual student-teacher interaction scores accounted for by class membership and in this study, it ranged from to 0.05 to 0.21. Fisher, Henderson, and Fraser (1995) reported eta^2 statistics ranging from 0.07 to 0.35. Kent, Fisher, and Fraser's eta^2 reported a range of 0.26 to 0.37 and Rickards, Fisher, and Fraser (1996) reported a range of 0.22 to 0.35. Therefore, in this study,

acceptable levels of reliability and the ability to differentiate between classes in the Singapore context has been confirmed.

4.3 VALIDITY OF THE QTI INTER-SCALE CORRELATIONS

Further analyses were also completed to explore the inter-scale correlations in the QTI. The Leary model predicts that correlations between two adjacent scales are expected to be highest, but the correlation gradually decreases as the scales move further apart until opposite scales are negatively correlated. That is, the scales of the QTI are arranged to form a circular pattern or circumplex model and are expected to be correlated. If a circumplex model applies to the data, correlations should be highly positive for neighbouring scales, decreasing as one moves around the model until the scales become strongly negative with scales on the opposite side of the interpersonal circle (Gurtman & Pincus, 2000). As shown in Table 4.2, the results of the inter-scale correlations from the study generally reflected the circumplex nature of the QTI and further confirmed the validity of the instrument. For example, the scale Leadership, DC, is correlated closely and positively with Helping/Friendly, CD (0.79) and Understanding, CS (0.81). This correlation decreases with other scales with the highest negative correlation of -0.65 occurring with the Admonishing scale, OD. The results from these analyses confirmed the circumplex nature of the QTI and taken with reliability and ability to differentiate between classes suggested that the QTI was a valid instrument for use in Singapore.

Table 4.2

Correlations Between QTI Scales

	DC	CD	CS	SC	SO	OS	OD	DO
DC	1							
CD	.79 *	1						
CS	.81 *	.84 *	1					
SC	.34	.49 *	.49 *	1				
SO	-.50 *	-.42 *	-.38 *	-.13 *	1			
OS	-.46 *	-.61 *	-.58 *	-.14	-.61 *	1		
OD	-.52 *	-.34 *	-.65 *	-.22	-.63 *	.76 *	1	
DO	-.16	-.42 *	-.34 *	-.38 *	-.26 *	.57 *	.56 *	1

* $p < 1.05.$, ($n = 913$)

4.4 RELIABILITY OF THE ATTITUDE TO MATHEMATICS AND ATTITUDE TO ENGLISH SCALE

The Attitude to Subject Questionnaire consisted of 10 items, which were amalgamated as a scale and included at the end of the classroom environment instrument. These items were taken from the Test of Science Related Attitudes (TOSRA) (Fraser, 1981) and adapted for use in this study.

George and Mallery (2006) believed that an alpha coefficient of 0.8 to 0.9 is good. Consequently, in this study, the internal consistency of items of this scale, Attitude to mathematics was good as the Cronbach alpha coefficient was found to be 0.87 and that of the Attitude to English scale was 0.91 which showed a high level of

correlation between the 10 items within the scale. The Attitude scales could therefore be used with confidence.

Table 4.3
Reliability of Attitude to Mathematics and Attitude to English Scale

Scale	Cronbach Alpha Coefficient
Attitude to mathematics	.87
Attitude to English	.91

4.5 DIFFERENCES BETWEEN STUDENTS' PERCEPTIONS OF MATHEMATICS TEACHERS' INTERPERSONAL BEHAVIOUR USING ACTUAL AND IDEAL QTI

Differences in the perceptions of students of the Actual and Ideal QTI were examined. Paired sample t-tests were performed to determine whether there were differences in the above. Table 4.4 shows that the scale item means, ideal and actual differences, standard deviations, and t-values for the mathematics teachers. The purpose of this analysis was to establish whether there were significant differences in students' perceptions of an ideal and their actual mathematics teachers' interpersonal behaviour as measured by the QTI. The item means ranged from 1.90 to 3.92 on the Actual QTI and from 1.77 to 4.50 on the Ideal QTI. Standard deviations ranged from 0.79 on the Student Responsibility scale to 0.91 on the Helping/Friendly scale on the actual QTI. For the ideal QTI, standard deviations ranged from 0.60 on the Leadership scale to 0.83 on the Student Responsibility and Strict scales. The mean differences between

the students' responses to the Actual QTI and Ideal QTI ranged from -0.37 (ideal-actual) on the Admonishing scale to 0.65 on the Understanding scale.

It was established that on all eight scales of the QTI, differences in the students' perceptions of the Ideal and Actual QTI were found to be statistically significantly different. It was found that in terms of Leadership, Helping/Friendly, Understanding and Student Responsibility, the actual behaviour often fell short of the ideal ($p < 0.001$). Teachers were perceived to show less leadership, were less friendly and understanding behaviour than what the students considered to be ideal.

In terms of student responsibility, students expected to be given more responsibility in ideal situations. Also, teachers were perceived to be more uncertain and strict in actual behaviour than what the students considered ideal. This was similar to previous Dutch, American and Australian research which found that, in general, teachers did not reach their ideal and differed from the best teachers as perceived by students. The ideal teachers have stronger leadership, are more friendly and understanding and less uncertain, dissatisfied and admonishing than teachers on average (Levy, Creton, & Wubbels, 1993).

Table 4.4

Item Mean and Standard Deviation for Ideal and Actual Differences in Students'

Perceptions of Mathematics Teachers.

Scales of QTI	QTI	Item Mean	Mean Diff (I-A)	SD	t-value
Leadership	Ideal	4.26	.42	.60	12.69***
	Actual	3.84		.81	
Helping/Friendly	Ideal	4.50	.58	.66	14.85***
	Actual	3.92		.91	
Understanding	Ideal	4.45	.65	.61	17.26***
	Actual	3.80		.86	
Student Responsibility	Ideal	3.30	.47	.83	11.87***
	Actual	2.83		.79	
Uncertain	Ideal	2.05	.15	.66	4.53***
	Actual	1.90		.80	
Dissatisfied	Ideal	1.77	-	.70	-8.30***
	Actual	2.07	.30	.88	
Admonishing	Ideal	1.81	-	.67	-9.94***
	Actual	2.18	.37	.88	
Strict	Ideal	2.52	-	.83	-8.00***
	Actual	2.83	.31	.83	

*** $p < 0.001$

4.6 DIFFERENCES BETWEEN STUDENTS' PERCEPTIONS OF THEIR ACTUAL AND IDEAL ENGLISH TEACHERS' INTERPERSONAL BEHAVIOUR

Differences in the perceptions of students of the Actual and Ideal QTI also were examined for English teachers. Table 4.5 shows the scale item means, Ideal and Actual differences, standard deviations, and t-values of English teachers. The purpose of this analysis was similar to that for mathematics teachers, that is, to establish whether there were significant differences in students' perceptions of an ideal and their actual English teachers' interpersonal behaviour as measured by the QTI. The item means ranged from 2.20 to 3.62 on the Actual QTI and from 1.94 to 4.25 on the ideal QTI. Standard deviations ranged from 0.76 on the Uncertain scale to 1.14 on the Helping/Friendly scale on the actual QTI. For the Ideal QTI, standard deviations ranged from 0.78 on the Uncertain scale to 0.92 on the Helping/Friendly scale. The mean differences between the students' responses to the Actual QTI and Ideal QTI ranged from -0.35 (ideal-actual) on the Dissatisfied scale to 0.73 on the Helping/Friendly scale.

In almost all eight scales of the QTI except for Uncertain, differences in the students' perceptions of the Ideal and Actual QTI were found to be statistically significantly different. It was found that in terms of Leadership, Helping/Friendly, Understanding and Student Responsibility, the actual behaviour often fell short of the behaviour considered by the students to be ideal ($p < 0.001$). Teachers were perceived to show less leadership, were less friendly and understanding by students.

In terms of student responsibility, students expected to be given more responsibility in ideal situations. Also, teachers are perceived to be stricter in their

actual behaviour than what the students hoped they would be. However, in the Uncertain scale, there was no significant difference. This meant that actual English teachers were perceived to be no less uncertain than what the students considered the ideal situation.

Table 4.5

Item Mean and Standard Deviation for Ideal and Actual Differences in Students' Perceptions of English Teachers.

Scales of QTI	QTI	Item Mean	Mean Diff (I-A)	SD	t-value
Leadership	Ideal	4.11	.51	.79	8.06***
	Actual	3.60		.92	
H/F	Ideal	4.31	.73	.92	9.57***
	Actual	3.58		1.14	
Understanding	Ideal	4.25	.73	.84	9.74***
	Actual	3.52		1.05	
Student Responsibility	Ideal	3.30	.36	.86	5.31***
	Actual	2.94		.99	
Uncertain	Ideal	2.21	.01	.78	0.23
	Actual	2.20		.76	
Dissatisfied	Ideal	1.98	-.30	.88	-5.38***
	Actual	2.33		.97	
Admonishing	Ideal	1.94	-.37	.79	-5.64***
	Actual	2.31		.96	
Strict	Ideal	2.55	-.21	.86	-3.28***
	Actual	2.76		.88	

***p< 0.001

4.7 DIFFERENCES BETWEEN STUDENTS' PERCEPTIONS OF THEIR MATHEMATICS AND ENGLISH TEACHERS USING ACTUAL QTI

Mixed results have been found for differences in subjects taught in other research studies. While in one study (Levy et al., 2003), students perceived physics, science and mathematics teachers as less understanding and displaying less leadership than teachers from other subjects, other studies found them to be more cooperative and dominant (den Brok, 2001; Wubbels & Levy, 1993). In an American study, Levy, Créton, and Wubbels (1993) found that mathematics teachers were perceived to be the most dominant teachers. However, this finding was not replicated here.

As shown in Table 4.6, it was found that there were many significant differences between mathematics and English teachers in terms of the various scales. In terms of Leadership, Helping/Friendly and Understanding, students perceived mathematics teachers more positively than English teachers. However, in terms of Student Responsibility, mathematics teachers tend to give less student responsibility than English teachers. In terms of Dissatisfied and Admonishing, students' perception of the English teachers tended to be higher.

Table 4.6

Item Mean and Standard Deviation in Students' Perceptions toward Mathematics and English Teachers Using the Actual QTI

QTI(Actual)	Math		English		Mean Diff	t-value
	Mean	SD	Mean	SD		
Leadership	3.84	0.81	3.60	0.92	.24	3.69***
Helping/Friendly	3.92	0.91	3.58	1.14	.34	4.48***
Understanding	3.80	0.86	3.52	1.05	.28	3.90***
Student Responsibility	2.83	0.79	2.94	0.99	-.11	-1.57
Uncertain	1.91	0.80	2.20	0.76	-.29	-5.28***
Dissatisfied	2.07	0.88	2.33	0.97	-.26	-3.86***
Admonishing	2.18	0.89	2.31	0.96	-.13	-1.92
Strict	2.83	0.83	2.76	0.88	.07	1.19

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

4.8 DIFFERENCES BETWEEN STUDENTS' PERCEPTIONS OF THEIR MATHEMATICS AND ENGLISH TEACHERS' INTERPERSONAL BEHAVIOUR USING IDEAL QTI

With the Ideal version of the QTI, it was found that there were significant differences in what students considered to be ideal teachers' interpersonal behaviour, between mathematics and English teachers in Leadership, Helping/Friendly and Understanding. The expectations of mathematics teachers somehow seemed higher than that of English teachers. This could be due to the nature of the subject whereby the development of concepts in mathematics is hierarchical and important and thus the

role of a teacher in ensuring conceptual development seemed more crucial. Students seemed to expect mathematics teachers to be less strict, admonishing and uncertain than English teachers. However on the scale of Student Responsibility and Freedom, there was no significant difference.

Table 4.7

Item Mean and Standard Deviation in Students' Perceptions toward Mathematics and English Teachers Using the Ideal QTI

QTI(Ideal)	Math		English		Mean	t-value
	Mean	SD	Mean	SD	Diff	
Leadership	4.26	0.60	4.11	.78	.15	2.98**
Helping/Friendly	4.50	0.66	4.31	.92	.19	3.13**
Understanding	4.45	0.61	4.25	.84	.19	3.46**
Student Responsibility	3.30	0.83	3.30	.86	-.00	0.98
Uncertain	2.05	0.66	2.21	.78	-.16	-3.03**
Dissatisfied	1.77	0.70	1.98	.88	-.21	-3.53***
Admonishing	1.81	0.68	1.94	.80	-.13	-2.50*
Strict	2.52	0.82	2.56	.86	-.04	-0.63

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

4.9 DIFFERENCES IN STUDENTS' ATTITUDES TOWARD MATHEMATICS AND ENGLISH

It was found that in terms of attitude toward the particular subject, there was a significant difference between the subjects of mathematics and English. Students indicated that they had significantly more positive attitudes toward mathematics than English as shown by the difference in means. This is not quite a surprising result since students in Singapore have done well mathematically, even by international standards as seen in the TIMSS results where Singapore schools ranked first at the 4th and 8th grade level (TIMSS, 2003).

Table 4.8

Item Mean and Standard Deviations of Attitude to Mathematics and Attitude to English Scales

Attitude to Subject				
Mathematics		English		F-value
Mean	SD	Mean	SD	
3.46	.70	3.17	.87	22.15 ***

*** $p < .001$

4.10 ASSOCIATION OF STUDENTS' PERCEPTIONS OF MATHEMATICS TEACHERS USING ACTUAL QTI AND ATTITUDE TOWARD MATHEMATICS

One of the aims of the study was to investigate whether there are any associations between students' perceptions of the actual teachers' interpersonal behaviour and their attitudes in both subject areas. This was explored using simple and multiple correlation analyses. An examination of the simple correlation coefficients indicated in Table 4.9 indicates that there were statistically significant relationships ($p < 0.001$) between students' perceptions of mathematics teachers using the Actual QTI and students' attitudes toward mathematics for all scales of the QTI, and that these associations were quite strong. Simple correlation coefficients were highest for the scales of Leadership, Helping/Friendly and Understanding. That is, students' attitude scores were more favourable in classes in which students perceived greater leadership, helping/friendly and understanding in their teachers' interpersonal behaviours. Conversely, students' attitude scores were lower in classes in which students perceived greater uncertainty, dissatisfaction, admonishing and strictness in their teachers' interpersonal behaviours.

Table 4.9

Associations between QTI Scales and Students' Attitudes to Mathematics in terms of Simple Correlations (r) and Standardised Regression Coefficients (β)

QTI Scale	Simple Correlation (r)	Standardised Regression Coefficient (β)
Leadership	0.39***	0.32***
Helping/Friendly	0.38***	0.16***
Understanding	0.35***	0.02
Student Responsibility	0.20***	0.03
Uncertain	-0.16***	0.07
Dissatisfied	-0.18***	0.12
Admonishing	-0.22***	-0.06
Strict	-0.08***	-0.03
Multiple Correlation $R = 0.44$ *** $R^2 = 0.19$		

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

The other analysis consisted of the more conservative standardised regression coefficient (β) which measures the association between students' perceptions on each scale of the QTI and their attitudes toward mathematics when the effect of relationships between the scales is controlled for. An examination of the beta weights revealed that perceptions on the Leadership and Helping/Friendly scales had the greatest effect on attitude. The multiple correlation, (R) was 0.44, which is statistically significant ($p < 0.001$). The R^2 value of 0.19 indicates that 19% of the variance in students' attitudes toward mathematics can be attributed to their perceptions of the teachers' interpersonal behaviour.

The findings are also in line with previous research which showed that variations in the students' appreciation of the subject and lessons have been characterised on the basis of the proximity dimension, that is, the more cooperative the behaviour displayed, the higher the affective outcomes scores (Wubbels, Brekelmans, & Hooymayers, 1991). In other words, student responsibility and freedom, understanding, helping/friendly and leadership behaviours were related positively with student attitudes. These results replicate previous research in Australia (Fisher, Henderson, & Fraser, 1997; Henderson, Fisher, & Fraser, 2000), Singapore (Goh & Fraser, 1998; Scott & Fisher, 2001), Korea (Kim, Fisher, & Fraser, 2000) and Brunei (Riah & Fraser, 1998; Scott & Fisher, 2001).

4.11 ASSOCIATION OF STUDENTS' PERCEPTIONS OF ENGLISH TEACHERS USING ACTUAL QTI AND ATTITUDE TOWARD ENGLISH

Similarly, associations between students' perceptions of the actual teachers' behaviour and attitude to English were investigated. The simple correlation coefficients indicated in Table 4.7 indicates that there were statistically significant relationships ($p < 0.001$) between students' perceptions and attitudes toward English for all scales of the QTI, except for the Uncertain and Strict scales, and that these associations were quite strong. Simple correlation coefficients were highest for the scales of Helping/Friendly, Leadership and Understanding. That is, students' attitude scores were higher in classes in which students perceived greater helping/friendly, leadership and understanding in their teachers' interpersonal behaviours. Conversely, students' attitude scores were lower in classes in which students perceived greater uncertainty, dissatisfaction, admonishing and strictness in their teachers' interpersonal

behaviours. As indicated previously, many past studies have also shown a similar association (e.g., Fisher, Henderson, & Fraser, 1995; Goh & Fraser, 1996).

The multiple correlation, (R) was 0.35, which is statistically significant ($p < 0.001$). An examination of the beta weights revealed that the scale Helping/Friendly had the greatest effect on attitude to English. The R^2 value of 0.13 indicates that 13% of the variance in students' attitudes toward English can be attributed to their perceptions of the teachers' interpersonal behaviour.

Table 4.10

Simple Correlations (r) and Standardised Regression Coefficients (β) between QTI and Students' Attitude to English

QTI Scale	Simple Correlation (r)	Standardised Regression Coefficient (β)
Leadership	0.31***	0.11
Helping/Friendly	0.34***	0.29**
Understanding	0.29***	-0.06
Student Responsibility	0.23***	0.04
Uncertain	-0.07	-0.01
Dissatisfied	-0.12*	0.09
Admonishing	-0.17**	-0.07
Strict	-0.05	0.05
Multiple Correlation $R = 0.35$ *** $R^2 = 0.13$		

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

4.12 DIFFERENCES BETWEEN STUDENTS' PERCEPTIONS AND ATTITUDES IN TERMS OF MALE AND FEMALE TEACHERS

As shown in Table 4.11, it was found that there were no significant differences on any of the eight scales of the QTI between students' perceptions of male and female teachers. Male teachers were not perceived to be more strict, as is generally the common perception, than female teachers. Nor are female teachers generally perceived to be more understanding than male teachers, as one would normally like to assume. In terms of attitudes toward the subject, be it mathematics or English, there was no significant difference between male and female teachers. Again, this result was not unexpected, as often it is the quality of the teacher's interpersonal behaviour that influences perceptions and attitudes and not the gender of a teacher per se. In fact, there is hardly any classroom environment research in teaching that measures gender differences in teachers. The results in this study seems to further explain why there is a dearth of research in this area, that put quite simply, perhaps it is because researchers already know instinctively that gender of teachers may not be a significant factor.

Table 4.11

Item Mean and Standard Deviation in Students' Perceptions and Attitudes in terms of Male and Female Teachers using Actual QTI

QTI(Actual)	Male		Female		t-value
	Mean	SD	Mean	SD	
Leadership	3.81	0.84	3.72	0.87	1.49
Helping/Friendly	3.85	0.96	3.78	1.00	1.17
Understanding	3.73	0.93	3.70	0.94	0.44
Student Responsibility	2.91	0.90	2.82	0.81	1.67
Uncertain	1.98	0.82	2.02	0.79	-0.74
Dissatisfied	2.16	0.90	2.14	0.94	0.45
Admonishing	2.25	0.90	2.19	0.92	1.02
Strict	2.81	0.86	2.81	0.84	0.01
Attitude to Subject	3.42	0.82	3.32	0.72	1.89

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

4.13 DIFFERENCES IN STUDENTS' PERCEPTIONS IN TERMS OF TEACHER EXPERIENCE

In previous studies, the more experience that a teacher had, the greater the perception of dominance, leadership and strictness (Levy, et al., 1992). While experience was found to positively relate to views on influence, those for proximity, including helpful/friendly or understanding behaviours, remained constant. In other words, students did not perceive any increase in cooperative behaviour according to teacher experience (Brekelmans, Holvast, & van Tartwijk, 1992; Brekelmans, et al., 2002;

Somers, Brekelmans, & Wubbels, 1997; Wubbels & Brekelmans, 1998; Wubbels & Levy, 1993).

In this study, it was found that significant differences did exist between the number of years of teaching experience on the following scales of the QTI: Leadership, Uncertain, Admonishing, Student Responsibility, and Strict. No significant difference was found on the Understanding, Helping/ Friendly and Dissatisfied scales. This seems to be in line with the findings of Brekelmans, Wubbels, and den Brok (2002) who found that on average, teachers do not become more friendly and understanding as experience grows.

Table 4.12

Item Mean and Standard Deviation in Students' Perceptions and Attitudes in Terms of Teacher Experience using Actual QTI

QTI(Actual) Years of Teacher Experience	Mean	SD	F-value	Post-hoc Test
Leadership				
1-5	3.61	0.91	4.27**	6-9 > 1-5 ($p < 0.05$)
6-9	3.90	0.77		
10-19	3.69	0.86		
20 & more	3.79	0.86		
Helping/Friendly				
1-5	3.70	0.96	1.40	
6-9	3.86	0.86		
10-19	3.77	1.01		
20 & more	3.87	1.09		
Understanding				
1-5	3.64	0.91	1.52	
6-9	3.76	0.83		
10-19	3.63	0.99		
20 & more	3.77	0.97		
Student Responsibility				
1-5	2.94	0.90	5.54***	1-5 > 6-9 ($p < 0.05$) 10-19 > 6-9 ($p < 0.05$) 20 & more > 6-9 ($p < 0.05$)
6-9	2.66	0.74		
10-19	2.97	0.92		
20 & more	2.90	0.85		
Uncertain				
1-5	2.17	0.83	6.45***	1-5 > 6-9 ($p < 0.001$) 1-5 > 20 & more ($p < 0.05$) 10-19 > 6-9 ($p < 0.05$)
6-9	1.85	0.81		
10-19	2.11	0.85		
20 & more	1.95	0.74		
Admonishing				
1-5	2.40	0.89	5.51***	1-5 > 20 & more ($p < 0.001$)
6-9	2.25	0.84		
10-19	2.28	0.97		
20 & more	2.08	0.91		
Strict				
1-5	2.74	0.83	7.33***	6-9 > 1-5 ($p < 0.05$) 6-9 > 20 & more ($p < 0.001$) 10-19 > 20 & more ($p < 0.05$)
6-9	3.00	0.79		
10-19	2.89	0.90		
20 & more	2.69	0.84		
Attitude to Subject				
1-5	3.35	0.71	3.30*	6-9 > 10-19 ($p < 0.05$) 6-9 > 20 & more ($p < 0.05$)
6-9	3.51	0.70		
10-19	3.30	0.85		
20 & more	3.33	0.80		

*** $p < .001$, ** $p < .05$, * $p < .01$

In terms of leadership, teachers with six to nine years of teaching experience seemed to show more leadership than those with less than five years of teaching experience. The following could provide an explanation for this. At the start of their careers, most teachers are in the early and mid-twenties and have not, as yet provided leadership to other people. From this point of view, the professional role does not coincide perfectly with their stage of personal development. Brekelmans, Wubbels, and den Brok (2002) believed that beginning teachers are often confronted with a lack of behavioural repertoire and inadequate cognitions in the area of providing leadership. This often results in students' perceptions of their interpersonal behaviour as uncertain.

In terms of uncertainty, teachers with less than five years of teaching experience seemed to be more uncertain than those with six to nine years of experience and teachers with more than twenty years of experience. However, it was found that teachers with six to nine years of experience seemed less uncertain than teachers with ten to nineteen years of experience.

In terms of admonishing, it was rather surprising that teachers with fewer years of experience, less than five years of experience were found to be more admonishing than teachers with more experience, teachers with more than twenty years. It could be hypothesized that this was so because teachers with more years of experience could be in more control of the classroom situation and so there was less need to be admonishing. At the same time, it could be postulated that newer teachers who may probably be more enthusiastic and want to be in control, tend to be more admonishing.

In terms of student responsibility, teachers with one to five years of experience seemed to give more student responsibility than teachers with six to nine years of experience. Also, teachers with six to nine years of experience seemed to give less student responsibility than teachers with more than ten years of experience.

In terms of strictness, teachers with one to five years of experience seemed less strict than teachers with six to nine years of experience. Research has shown that maintaining discipline continues to be one of the most problematic areas faced by trainee teachers in the classroom (Tulley & Lian, 1995) and thus could cause them to lack leadership and appear uncertain in class when they are new. Newer teachers often need time to acquire skills in classroom management and therefore, may come across as less strict. However, it was also found that teachers with more than twenty years of experience are less strict than those with both six to nine and ten to nineteen years of experience. Perhaps this was because experienced teachers are adept in the ways of classroom management and thus would not need to appear to be too strict.

These findings are in line with the recent findings of Brekelmans, Wubbels, & van Tartwijk (2005) who explore the significance of teacher experience for building and sustaining teacher-student relationship. It has been shown before that beginning teachers differ from more experienced colleagues in their relationship with students. Beginning teachers have relatively low scores on leadership and experienced older teachers may suffer from a lack of friendliness.

4.14 DIFFERENCES IN STUDENTS' ATTITUDES TOWARD MATHEMATICS AND ENGLISH IN TERMS OF TEACHER EXPERIENCE

In terms of Attitude toward the subject, it was found that there was significant difference in terms of number of years of teaching experience. It was found that students with teachers who have more than ten years of experience have more positive attitudes toward the subject than those with teachers with six to nine years of experience. Again, this result could be that, with experience, teachers are able to influence and inculcate a more positive attitude in students toward a particular subject.

Table 4.13

Item Mean and Standard Deviation in Students' Perceptions in Terms of Grade Differences Using the Actual QTI

QTI(Actual) Grades	Mean	SD	F-value	Post-hoc Test
Leadership				
1	3.58	0.88	12.98***	6 > 1, 2, 3 and 4 (p < 0.001) 5 > 1 and 3 (p < 0.05)
2	3.67	0.96		
3	3.56	0.95		
4	3.70	0.78		
5	3.95	0.58		
6	4.16	0.56		
Helping/Friendly				
1	3.51	1.08	19.28***	6 > 1, 2, 3, 4 and 5 (p < 0.001)
2	3.69	1.16		
3	3.56	0.98		
4	3.81	0.87		
5	3.85	0.74		
6	4.41	0.60		
Understanding				
1	3.42	0.96	17.90***	6 > 1, 2, 3 and 4 (p < 0.001) 6 > 5 (p < 0.05) 5 > 1 and 3 (p < 0.1)
2	3.59	1.05		
3	3.49	0.94		
4	3.72	0.81		
5	3.83	0.75		
6	4.23	0.63		
Student Responsibility				
1	2.64	0.90	4.04***	6 > 1 and 5 (p < 0.05) 2 > 1(p < 0.05)
2	2.95	0.98		
3	2.88	0.89		
4	2.80	0.66		
5	2.66	0.69		
6	3.00	0.75		
Uncertain				
1	2.05	0.68	21.23***	1 > 5 (p < 0.05) 1 > 6 (p < 0.001) 2 > 5 and 6 (p < 0.001) 3 > 5 and 6 (p < 0.001) 3 > 4 (p < 0.05) 4 > 6 (p < 0.001) 5 < 1 (p < 0.05) 5 < 2 and 3(p < 0.001) 6 < 1, 2, 3 and 4 (p < 0.001)
2	2.16	0.85		
3	2.31	0.92		
4	1.99	0.64		
5	1.69	0.67		
6	1.60	0.58		

Dissatisfied				
1	2.30	0.91	23.03***	6 < 1, 2, 3, 4 and 5 (p < 0.001)
2	2.27	1.00		3 > 2 (p < 0.05)
3	2.54	0.98		3 > 4, 5 and 6 (p < 0.001)
4	2.05	0.76		
5	2.02	0.77		
6	1.62	0.56		
Admonishing				
1	2.34	0.87	24.47***	1 > 6 (p < 0.001)
2	2.37	0.96		2 > 4 and 5 (p < 0.05)
3	2.62	0.99		2 > 6 (p < 0.001)
4	2.07	0.73		3 > 2 (p < 0.05)
5	2.07	0.81		3 > 4, 5 and 6 (p < 0.001)
6	1.70	0.61		6 < 1, 2 and 3 (p < 0.001) 6 < 4 and 5 (p < 0.05)
Strict				
1	3.02	0.84	7.25***	1 > 4 (p < 0.05)
2	2.85	0.95		6 < 1, 2, 3 and 5 (p < 0.001)
3	2.91	0.89		
4	2.69	0.67		
5	2.96	0.79		
6	2.52	0.69		
Attitude to Subject				
1	3.13	0.91	6.62***	1 < 3 and 4 (p < 0.05)
2	3.23	0.82		1 < 6 (p < 0.001)
3	3.49	0.79		2 < 3 (p < 0.05)
4	3.43	0.70		2 < 6 (p < 0.001)
5	3.36	0.65		
6	3.55	0.61		

*** $p < .001$

4.15 INTERPERSONAL PROFILES OF IDEAL AND ACTUAL MATHEMATICS TEACHERS IN SINGAPORE

This study was able to present a profile for mathematics and English teachers in Singapore. It was created and then could be compared with the existing Dutch, American and Australian typologies. In the Netherlands and USA, typologies were constructed using data of one large school with all teachers and their students participating. In the Australian study, it used a sample of voluntary teachers from a large number of schools in four Australian states. In this study, it replicated the Dutch and American studies by using teachers from one large school but also replicated the

Australian study by using a sample of voluntary teachers from two departments of a large school in Singapore.

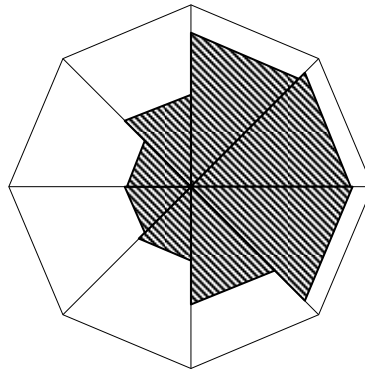


Figure 4.1. Interpersonal profile of the ideal mathematics teacher in Singapore.

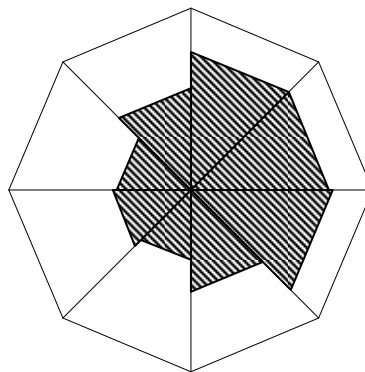


Figure 4.2. Interpersonal profile of the actual Mathematics teacher in Singapore.

The ideal mathematics teacher (see Figure 4.1) seems to be that of the directive and authoritative type which was one of the eight types mentioned in the Dutch and American typologies. Wubbels, Brekelmans, and Hooymayers (1991) commented that in the authoritative classroom:

The lessons of this type of teacher are well-structured and the atmosphere is pleasant, but also achievement- and task-oriented. Rules are clear in these lessons and now and then the teacher reminds students of the rules. Students pay good attention and the number of times that the teacher has to correct students' behaviour is lower than with the directive teacher...The favourite teaching method of these teachers is lecturing, but the teacher uses other methods as well. (p. 149)

The profile of mathematics teachers shows a slightly higher level of oppositional behaviour than the authoritative profile represents, and is more like that of the Directive teacher who:

is sometimes rather admonishing and tries to keep the reins tight. He or she has high standards for student achievement, is rather demanding, and can hold students' attention. Order and smoothness of procedures are not automatically present. The teacher has to correct students' behaviour every now and then and has to insist on rules and procedures. Students follow these teacher interventions. (p. 148)

Consequently, 'Authoritative' and 'Directive' interpersonal behaviours are reflected in the profile of the mathematics teachers in Singapore more than other interpersonal behaviours from the typology as was also the case in another Australian study (Rawnsley, 1997). The typology of the mathematics teacher in this study in

Singapore is similar to the third type in the Australian study which contained similar amounts of leadership, helping/friendly, and understanding behaviours as the Authoritative type, but also contained a high amount of strict behaviour and teachers gave a relatively small amount of responsibility to the students and exhibited a low degree of admonishing, dissatisfied and uncertain behaviours. Since, it seemed to combine characteristics of both the Dutch Directive and Authoritative types, it was labeled as Directive-Authoritative in the Australian study. It was this typology that most closely resembled the perceived deal mathematics teacher in Singapore. It was different from the other types in the Australian typology- Type 5 was labelled as Cooperative and Type 6 as Flexible. The fifth type resembled the Tolerant teacher of the Dutch typology best but gave less student responsibility and the sixth type also resembled the Tolerant teacher best but contained much more leadership.

The Actual mathematics teacher profile was also quite similar to the ideal mathematics teacher profile as shown in Figure 4.4. The students' perceptions of the mathematics teacher were characterised by relatively high scores in the leadership, helping/friendly and understanding sectors of the model. Teachers were seen as more strict than admonishing. The teacher was perceived by students to be characterised by a low degree of uncertainty.

The main characteristic for the classroom environment of the Authoritative teacher is that the atmosphere is well-structured, pleasant and task-oriented. Rules and procedures are clear and students need no reminders generally. The Authoritative teacher is enthusiastic and open to students' needs. He or she takes a personal interest in them, and this comes through in the lessons. The lessons are well-planned and logically structured. The Authoritative teacher is able to use other techniques besides

that of lecture. When teachers are more experienced, they tend to fit the more structured and task-oriented Authoritative and Directive profiles according to the students. The Directive teacher is organised efficiently and normally completes the lessons on time. He or she dominates the class discussion, but generally holds the students' interest. The teacher is not usually really close to the students though he or she is occasionally friendly and understanding. He or she sets high standards and is seen as demanding. The teacher gets angry at times and has to remind the class they are there to work. He or she likes to call on students who misbehave and are inattentive. The typology of the mathematics teacher in Singapore which is that of the Directive-Authoritative teacher has characteristics which fall between the above descriptions of both the Directive and Authoritative teachers.

The two profiles of the mathematics teacher as measured by the Actual and Ideal QTI scores shown in Figure 4.1 and Figure 4.2 were quite similar, with the major difference being that students would like their teacher to have even higher leadership (DC), be more helping/friendly (CD) and understanding (CS) than what they actually perceived them to be. We can hypothesize that the mathematics teachers are perceived to be quite exemplary in teacher interpersonal behaviour but the student would still expect the teachers to be a little more 'perfect'. This is quite in line with research that showed that students often considered their best teachers to be stronger leaders, more friendly and understanding than their teachers on average (Levy, Creton, & Wubbels, 1993).

4.16 INTERPERSONAL PROFILES OF THE IDEAL AND ACTUAL ENGLISH TEACHER IN SINGAPORE

The ideal English teacher profile seemed to be different from that of the ideal mathematics teacher (see Figure 4.3). It indicated a profile that was similar to the Tolerant/Authoritative type mentioned in one of the eight profiles in the Dutch and American samples (Wubbels & Levy, 1991) and also found in the Australian sample (Rickards, den Brok, & Fisher, 2005).

For the Tolerant-Authoritative teacher, the atmosphere is pleasant and supportive and students enjoy attending class yet the lessons are achievement-oriented and task-oriented. The rules are clear, although the teachers could need to remind the students from time to time. The teacher, according to Wubbels and Levy (1991), takes a personal interest in the students and emphasises close relationships. The Tolerant-Authoritative teacher is thought by their students to be very good. They tend to have highest affective outcome scores and high cognitive scores as well (Fisher, Fraser, & Cresswell, 1995). The class of a Tolerant/Authoritative teacher is described as follows:

Tolerant/Authoritative teachers maintain a structure which supports student responsibility and freedom. They used a variety of methods, to which students respond well. They frequently organise their lessons around small group work. The Tolerant/Authoritative teacher develops closer relationships with students. They enjoy the class and are highly involved in most lessons. Both students and teacher can occasionally be seen laughing, and there is very little need to enforce the rules. The teacher ignores minor disruptions, choosing instead to concentrate on

the lesson. Students work to reach their own and the teacher's instructional goals with little or no complaints.

(Brekelmans, Levy, & Rodriguez, 1993, p. 50)

The two profiles of the English teacher actual and ideal scores as measured by the QTI, were quite similar as seen in Figure 4.4, with the major difference being that the students considered the ideal teacher to let them have a greater degree of freedom and responsibility. One of the possible reasons for this, besides the inherent nature of the teacher's interpersonal behaviour, could be that somehow some external circumstances existed which prevented this from happening. One likely possibility was the need to finish the syllabus given the tight time constraint in the school setting and that most teachers' priority would be to ensure that they have covered what was required of them.

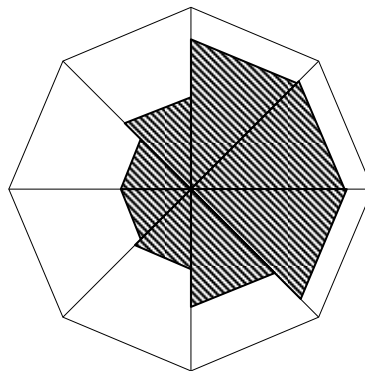


Figure 4.3. Interpersonal profile of the ideal English teacher in Singapore.

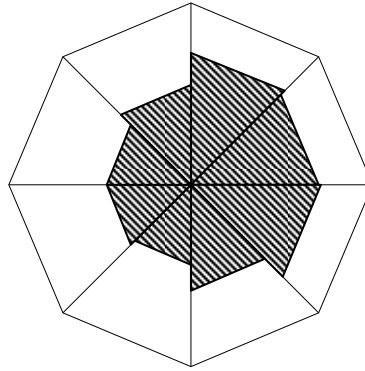


Figure 4.4. Interpersonal profile of the actual English teacher in Singapore.

In a cross-national study of secondary science classes in Singapore and Australia (Fisher, Rickards, Goh, & Wong, 1997), it was found that Australian teachers were perceived as giving more responsibility and freedom to their students than was the case for the Singapore sample. Also, teachers in Singapore were perceived as being stricter than their Australian counterparts. These differences however are not surprising given the different cultural backgrounds and education systems in the two countries.

In another study conducted in science classrooms in high schools in Korea (Kim, Fisher, & Fraser, 1999), the QTI results implied that the science teachers were directive, strict and not generous in allowing students' self- activities. This was in part due to the fact that each class had over 40 students each.

In Asian countries, there is somehow greater emphasis on achievement and examination performance in schools and as such, achievement or examination performance tends to drive much of the learning that takes place in schools. One of the key roles of a teacher is to ensure students do well in examinations. Therefore, teachers tend to be more focused in terms of academic results and cognitive development. However, if more positive teacher-student interpersonal behaviour can

lead to a more positive and conducive learning environment that would ultimately enhance students' interest to learn, then teachers would need to ensure that their behaviours would not hinder their students' learning process and be made more aware of the significance of their pivotal role they play in the facilitation of students' cognitive and affective learning.

4.17 CHAPTER SUMMARY

Quantitative analysis using reliability, the η^2 of each scale and the circumplex nature of the model, indicated that the QTI was acceptable for use in Singapore. The reliabilities and validities of both the Attitude toward mathematics and English scales were also established. It was found that significant differences existed between students' perceptions of their mathematics and English teachers in terms of Actual and Ideal QTI. Significant differences were found between students' perceptions toward mathematics and English teachers' interpersonal behaviour and also, in terms of students' attitudes toward the subject. Significant differences were also found, in student perceptions, across grade differences in students and in terms of teachers' experience. However, no significant differences were found in students' perceptions and attitudes in terms of gender of teachers.

In terms of associations between students' perceptions and attitudes, it was found that a positive attitude toward the subject was associated with stronger leadership, helping/friendly and understanding behaviours in teachers' interpersonal behaviour. Conversely, more admonishing and strict behaviour resulted in less positive attitudes.

A profile was developed for mathematics teacher and English teacher in Singapore. The typology of the mathematics teacher (both Ideal and Actual) seemed to be that of the Directive/Authoritative type found in the Australian sample whereas that of the English teacher (both Ideal and Actual) seemed to be that of the Tolerant/Authoritative type found in the Dutch/American studies.

However it was important to examine students' perceptions of each item and scale even though statistical evidence suggests that the scale is valid. Students can interpret items/scales in ways that were not originally intended. Researchers need to examine the extent of this variance and to bear all these in mind when describing the results of the questionnaire. The use of statistical measures alone runs the risk of producing interesting results that might not be acceptable by the teacher or the students involved. Guba and Lincoln (1989) stated that qualitative examination of the item can produce an 'authenticity' in the data which is essential for research results to become meaningful. The qualitative results are discussed in the next chapter.

Chapter 5

Qualitative Analysis

5.1 INTRODUCTION

As described in the methodology, following data preparation and preliminary analysis, a purposive sampling method was used in selecting students for the group interviews. For the group interviews, three students from each of the classes that had indicated very positive student-teacher interactions were selected to examine why they had such positive perceptions. The interviews were conducted to examine the veracity of the students' perceptions.

As for the individual interview, a more in-depth interview was conducted in an attempt to go deeper into the nature of the teacher-student relationship and to a fuller appreciation of the teacher-student relationship as a phenomenon that is essential to the educational experience. This is a beginning attempt to explore a little, the challenge of phenomenological research. The students were invited to talk about their experiences of effective teachers. Interviews were semi-structured. The students were randomly selected, that is, selection was not based on the QTI scores. Furthermore, teachers were also selected for interviews to find out more about their ideas of what makes an effective teacher, with a focus on teacher interpersonal behaviour.

5.2 STUDENT INTERVIEWS

For both group and individual interviews, a vacant classroom area where the students normally worked was chosen. This kept the students in familiar surroundings to reduce distraction. It also allowed the transfer time from one student or one group to the next, to be minimised.

The purpose of the interview was explained to the students and they were introduced to the interviewer. It should be noted that the interviewer was the same person, that is, the researcher, for all interviews. Efforts were made to ensure students of the confidentiality of their responses, especially in relation to the teacher and that their personal details would not be revealed. There was no student in the sample who did not want to be interviewed and all gave consent for the interviews to be used in the study. All in, a total of six individual student interviews, with each representing each grade level and six focus group interviews, with each group representing each grade level, were carried out. That is, a total of 24 students were involved in the interviews.

Each individual and focus group interview took about 15 minutes. On one hand, efforts were made to reduce the group effect of students' answers and minimise the input of the most dominant student in the group thus allowing each to say exactly what they thought. On the other hand, the focus group interviews were also meant to capture the interactional effects of the group (Merton, Fiske, & Kendall, 1990).

5.3 TEACHER INTERVIEWS

Teachers were also interviewed to talk about their own teaching practices, experiences and ideas on what makes an effective teacher, with a focus on teacher interpersonal behaviour. Teachers were selected based on their teaching experience and approached individually to ask if they consented to the interview. Altogether five teachers were selected for the interviews. They represented each age group of teaching experience: between one and five years, five and ten years, ten and twenty years and more than twenty years. The fifth teacher was selected because this teacher had been an engineer before embarking on his second career as a teacher and it was thought that it would be interesting to find out whether his perceptions were similar to the others. Each teacher interview took about 30 minutes. No teacher when approached declined to be interviewed. The rationale of the study was explained clearly to the teachers and they were asked for their consent for the interviews to be used in the study. Confidentiality was also ensured. It should be noted that the interviewer was the same person, that is, the researcher, for all interviews.

5.4 REPORT ON STUDENT FOCUS GROUP INTERVIEWS

There were six focus group interviews, with each group of three, representing each grade level. Generally the questions asked were similar to the individual interviews as no student was interviewed more than once. However, in the focus group interviews, the emphasis was on the construct validity of the QTI and students with more positive perceptions as measured by the QTI were selected. As discussed earlier, the QTI utilises opposing dimensions and it was apparent in the interviews that the students'

comments reflected these opposing dimensions. Therefore these two dimensions are reported together.

Leadership versus Uncertain

These scales were designed to measure the extent to which the teachers made it clear that they knew what they were doing in the classroom. When the students were interviewed about the degree of leadership their teacher displayed, the students indicated that they benefitted from the lessons taught in class and that the teacher could explain things clearly.

I like being in her class because I don't get confused unlike the other teachers.

I can understand even difficult concepts when he explains stuff.

She sets clear guidelines and tells us what she wants us to do.

She controls us well-not like the other teachers- I know 'cos everyone listens to her and she doesn't yell at us-she just say it softly.

If some are still noisy, she still tells them nicely to do their work and they will listen to her.

She has a way with people- she is nice-we respect her.

He is fun but still means it when he made us do work.

Helping/Friendly versus Dissatisfied

The purpose of these scales was to measure the extent that the teachers helped them and viewed them as being capable students. These students said that their teacher was very helpful and friendly and some used the term 'kind' to describe them.

She is always smiling and very approachable when I asked for help.

He tries to explain stuff to me again and again even if I don't understand.

She carries a smile, always.

He is kind and caring.

Understanding versus Admonishing

Students in these classes could see that their teachers knew the extent to which their students understood, listened to them and did not become angry easily. Also, they believed their teachers valued their contribution in class.

He really listens to you and tries to make you understand.

She doesn't make us feel stupid when we don't understand.

She seldom gets angry even when we don't understand.

Student Responsibility and Freedom versus Strict

Students felt they were given guidelines to do things and they were given some choice in how they approached their learning. Their teachers gave them responsibility and allowed them to make suggestions.

If she asks you to do something she trusts you to do it.

She is not fierce, unlike some teachers who are always screaming at you to keep quiet.

He trusts us to do our work well and believes in us.

The concept of strictness was somewhat relative. When students were asked to indicate whether they preferred more or less strictness, some students expressed the status quo while some wished for stricter teachers. Some felt that having less strict teachers would compromise their learning.

She is quite strict and that's good so the others don't try to be funny.

He is okay- not too strict but firm.

He is fair-not too strict-not too lenient either.

If you had to choose between being more or less strict, what would you choose?

More strict, so we are forced to do our work.

Less strict, so we have some flexibility.

More strict so we can learn better when the class doesn't clown around.

5.5 REPORT ON STUDENT INDIVIDUAL INTERVIEWS

In the student individual interviews, each student represented each grade level but the students were selected randomly and thus selection was not based on their QTI scores. The responses were more varied than those from the focus groups. When asked how did they perceive their teacher? The responses were:

She is very nice but a bit too mild, she doesn't scold when class gets rowdy.

He is a push-over; unable to control class but a good facilitator though.

She is okay but can be more strict though.

He is rather autocratic.

He is not dynamic, not able to adapt to changes and is impatient.

He cannot explain concepts clearly but is hardworking.

She helps us to understand things and trusts us to do work.

When asked about whether they were given opportunity for independent work in class, some younger students commented that they could do with more freedom and responsibility.

Yes, he doesn't seem to trust us sometimes. He must check that we do our work before we go for recess.

We are not allowed to talk if we have not finished our work in class.

He sometimes just got us to copy formulae and notes from the board.

However, in the case of older students, especially the year 5 and year 6 students, it was generally felt that the teachers often trusted them with more responsibility and had high expectations of them.

Yes, we can decide on things in the class, like when to hand in a piece of assignment, etc.

Somehow, we feel because we are not so juvenile anymore, teachers seem to trust us more.

When asked what they think is an ideal mathematics teacher, the responses were:

He must be able to be more engaging and teach with passion.

He must be able to conduct lessons in an interesting manner.

He must be willing to help students.

He must have in-depth knowledge of the subject.

He is able to make complicated matters easier to understand.

He must be more lenient and understanding.

He must be impartial.

He must be able to explain concepts, supplement with examples and is patient.

She must be able to enforce discipline but at the same time not too strict and be a friend too.

He must have an enormous capacity to forgive.

She must be approachable.

She must have a willingness to help individual students.

He must be more friendly.

She must be not boring - able to 'spice up' a lesson.

He must have a sense of humour.

He must make maths fun.

When asked what they think is an ideal English teacher, the responses were generally similar except for some.

He must be more understanding.

She must be more interactive and able to conduct lessons in an interesting manner.

She must be good to students.

She must be funny and entertaining.

He must be spontaneous.

He must be enthusiastic about the subject.

He must be charismatic in his approach.

He must have a great sense of humour.

He must have a good vocabulary.

He must have a high tolerance level.

She must teach more rather than keep giving us essays to write in class.

She must be more passionate about the subject and engaging.

She must be able to catch our attention.

She must have a good fashion sense.

She must go to lengths to explain text not just expect us to understand on our own.

When asked, what makes an effective teacher, the general responses were as follows:

Humorous, willing to push students (not giving up on weaker ones), gives little homework.

Dedicated to his/her job, going the extra mile, ensuring that students are cared for, loving.

Communicative, able to express and put forth one's thoughts effectively, patient and caring toward students, willing to go through questions step by step.

Strict when needed but not overly so, humorous, can joke around (but not lame), friendly outside class thus establishing a bond with the students, reasonable and unbiased.

Understanding, knowledgeable, able to convey thoughts well to the class, and at the same time behave in a way that student are able to respect.

Funny, able to joke around with the students and establish a rapport with them, while at the same time maintaining order in the class and authoritative.

Reasonable, helps students out when they are in trouble, be a friend to them, be able to teach well, able to point out students mistakes, accept criticism and make his points clear.

What effective teachers must have is passion- to be an inspiration to us-to make a difference...

When asked how their attitude to the subject was affected by the type of relationship they have with their teachers, the responses were generally that they are related.

Of course, if I like the teacher, then I like the subject.

Yes, I suppose so. I like the way she treats us like friends and I enjoy mathematics this year.

He is strict but explains things clearly and repeat when we don't understand so it helps and yes, I like Math better now.

She is very comfortable to be with, quite fun and when we have a problem, we don't hesitate to ask her, so yes, I enjoy English classes better this year.

Generally students related that the attitude they have of the subject was strongly related to how the teacher related to them as individuals. However, there were comments whereby students indicated that they did not particularly have a good relationship with the teacher yet enjoyed the subject.

Oh, he is so-so- doesn't explain very well and the class gets noisy- but I do my own things and try to understand on my own because I generally enjoy reading and the subject [English].

She gets angry very fast when we ask her to explain again but I still love mathematics because I am good at it from young.

Generally, the dimensions of the QTI were found to be significantly associated with student attitude scores. Students commented that they had a more positive attitude when their teacher exhibited more cooperative behaviours and less oppositional behaviours.

I love Math more this year because the teacher is more understanding and doesn't get angry so fast when we don't understand.

Yes, I used to dislike Math because I don't understand but this year, better, the teacher is good- very patient and understanding-tries very hard to explain when I get stuck.

When they were asked to suggest how their teachers could improve, their responses were rather varied.

She can be slightly stricter, needs to be able to control class.

She needs to give us more freedom.

She must not always get angry so fast.

He needs to be more flexible and understanding when we cannot complete our work in time.

Summary of Student Interviews

From the interviews, it appears that older students seemed happy that their teachers do give them more responsibility and freedom. Students are divided on the issue of how strict a teacher should be. While some prefer more lenient teachers, others prefer a strict teacher so that 'they are made to do work and will do well'. There seems to be no difference in terms of expectations of students between mathematics or English teachers. However, it is generally agreed that effective teachers must have control in a classroom especially when the 'class gets rowdy'. That is, effective teachers must have good leadership skills. Another factor which was raised by many students was that effective teachers need to have passion and enthusiasm in their teaching and to be able to make a difference. Students used the terms: understanding, helpful, friendly, caring and patient very often as observed in the student interviews. These are qualities which are reflected in the scales in the QTI and comments by the students showed that indeed they are important characteristics that a good and effective teacher should possess. In essence, the student interviews further substantiated the veracity of the students' perceptions as shown up in the quantitative results of the QTI and the

construct validity of the QTI. As in the study by Levy, Creton and Wubbels (1993), who analysed data from studies in The Netherlands, the USA and Australia, students rated their best teachers as being strong leaders and as friendly and understanding whereas the characteristics of the worst teachers were that they were more admonishing and dissatisfied. Similarly, these attributes seemed to feature strongly in our local context too.

However, while 'whether teachers have a sense of humour' is one of the items in the QTI, the idea of sense of humour in teachers is not weighted heavily or captured explicitly in the Model of Teacher Interpersonal Behaviour. Apparently, students think it is a very crucial and important element of positive teacher behaviour. The terms: humorous, funny, 'likes to tell jokes', 'not boring' were mentioned many times by different students across the grade levels. Perhaps, this aspect of sense of humour in teachers could be accorded more importance in the QTI in future.

In the words of a 14-year old boy, the following excerpt summed up quite succinctly what students hoped for in an ideal and effective teacher:

Teachers in general should not bore the class. They should be funny but not in a way that will just waste time. Also, as humour tends to help one remember something better, well-integrated humour makes a lesson interesting, fun and enjoyable yet fruitful. They should be able to take jokes and treat the people in class to a certain extent as 'friends' but not until there is no control established over the class. Teacher-student relationships should be democratic which basically means that students have a say in matters but teachers hold the final decision. Teachers who have a passion inspire us to want to learn...

5.6 REPORT ON TEACHER INTERVIEWS

Teachers have different ideas about the best way to relate to students and they are distinctly different across the profession. In this study, an attempt was made to establish a more qualitative understanding on what mathematics teachers think makes an effective teacher and interviews were carried out with five mathematics teachers with varied years of experience. The ways in which teachers thought about teaching and about learning and their basic philosophies formed the focus of the teacher interviews. These interviews are reported in the form of case-studies.

Case Study 1:

Ms T is a relatively young teacher with less than three years of experience teaching mathematics to lower secondary students in an independent school which is her first school. She comes across as a fresh, young teacher always willing to try out new ideas.

On what makes an effective teacher and whether she is an effective teacher, she believed:

An effective teacher is one who is able to relate to his/her students, 'transfer' knowledge to students at minimum loss and be able to listen effectively to students' feedback for assessment. An effective teacher is always ready to accept mistakes and able to understand students' learning process. An effective teacher is one who has good classroom management and is also able to prepare and conduct lessons catering to the various needs and abilities of students. By providing additional help to the weaker students and enriching the curriculum for the

higher ability such that this group of students will not be short-changed in the long term. An effective teacher is also one who is able to identify teaching moments and inculcate correct values during such critical times. Besides managing students, an effective teacher should also be able to work well in a team with other teachers...Sometimes, I think I am effective, but not all the time. I think I am striving to become a more effective teacher.

On her own perceptions of herself as a teacher, she believed:

I would not say that I am a very good leader yet as I am still learning from my mentors. I am understanding but strict but I do trust students by giving them tasks to develop their leadership skills. I try to be a role model to students.

On how he thought her students would perceive her, she said:

Firm yet open-minded. Most will think that I'm stern and strict. However, some will know that I am caring.

On whether she has a 'best' class and a 'worst' class and whether she behaves differently in different classes, she has this to say:

No. every class is equal. I think, to a certain extent, I try to cater to different needs of different students in different class, for example, some classes are noisy and they require teachers to be stricter and take fuller control of the lessons whereas some classes are more independent learners, they can be given more space for self learning and development of skills.

On what she thought are factors that will help students learn effectively:

...intrinsic motivation, relationship with teacher and effective communication between teacher and students. A conducive environment in class that allows students to ask questions freely. Pace of lessons must be catered to suit the abilities of different classes and students.

On what she does to ensure students learn in her class, she said:

...pose questions to students to check on knowledge and understanding, set homework and tests.

On whether, she thought mathematics teachers behave differently from say, English teachers, she said:

To a certain extent, yes, since they have different personalities and characteristics.

On whether she believes that students' interest in the subject is related to teacher interpersonal skills in class,

Yes. A teacher's interpersonal skills in class plays a very important role. Students are mostly still very impressionable.

And finally, when asked to describe in his opinion, an ideal teacher, she said:

An ideal teacher is one who is apt in the content subject and is able to communicate effectively with students and the relevant stakeholders of the school.

Case Study 2:

Ms Y is a teacher with seven years of experience, teaching upper secondary mathematics; she spent three years in a co-ed government school and is in her fourth year in an independent school.

On what makes an effective teacher and whether she is an effective teacher, she believed:

An effective teacher needs to have the ability to communicate effectively with students and meet their demands and needs. He or she needs to be able to break down complex problems into simpler concepts so that students are able to understand them clearer.

On her own perceptions of herself as a teacher, she believed:

...not one who is very effective yet as I am still learning how to communicate more effectively so that students are able to understand lessons clearer. I am not a good leader, but learning to be one. A bit uncertain because of I feel I am inexperienced. However, I am quite helpful and friendly. And more understanding than admonishing. And I generally trust students by giving them responsibility and freedom in class. I tend to allow the students to decide on what they think is suitable for their own learning and whether they want to hand in homework on time or a few days later as I feel they can be mature about it.

On how she thought her students would perceive her, she said:

Helpful, hardworking, kind, someone whom they are able to ask favours from...

On whether she has a 'best' class and a 'worst' class and whether she behaves differently in different classes, she has this to say:

Yes. Best and worst class in terms of academic. Class is being banded so students who are better are placed in the "Best" class while students who are weaker are placed in "Worst" class. Pace of teaching would differ...

On what she thought are factors that will help students learn effectively:

...giving more tests, quizzes and class work...

On what she does to ensure students learn in her class, she said:

I try to give clear explanation, be understanding of students' needs, being a "friend" so that are more willing to listen attentively during lessons...

On whether, she thought mathematics teachers behave differently from say, English teachers, she said:

No, it depends on the individual...

On whether she believes that students' interest in the subject is related to teacher interpersonal skills in class,

Yes, of course, if a teacher has good interpersonal skills, students may like the subject better...

And finally, when asked to describe in her opinion, an ideal teacher, she said:

One who is inspiring, helping students at all times, able to communicate effectively (academically and emotionally) with students...and well-liked by both students as well as colleagues...

Case Study 3:

Mr K is a teacher with 12 years of varied experience teaching mathematics to lower and upper secondary students from a mixed background. He has taught for two years in a girls' school, four years in a co-ed government school and six years in an independent school. He is one who comes across as a stern yet caring teacher.

On what makes an effective teacher and whether he is an effective teacher, he said:

An effective teacher is one who can break down a difficult concept into simpler terms so that the students can understand. I believe I am effective since I am able to make the students understand the lessons. I am able to use my personal experiences, during my student years, to recall what problems were encountered when I was taught a particular concept.

On his own perceptions of himself as a teacher, he believed:

I am able to impart the knowledge to the students well. I am usually prepared for the lessons to ensure that I know what I am doing in class

and more importantly to be able to anticipate what difficulties the students will face when I am delivering the lessons. I can be very strict regarding the basics etiquette and what the students must do during the lessons but can also be friendly and understanding once the students are able to fulfill my basic requirements. I have always believed that the students can perform their tasks well once ample guidelines and advice are provided. I also believed that freedom should be earned and not a right. I have always believed that the students can perform their tasks well once ample guidelines and advice are provided. I also believed that freedom should be earned and not a right.

On how he thought his students would perceive him, he said:

I am fashionable, strict, systematic and purposeful. They think I am strict but I help them to do well in their studies.

On whether he has a 'best' class and a 'worst' class and whether he behaves differently in different classes, he has this to say:

The 'worst class' would be the class with the largest enrolment (36 students) which comprises of a lot of academically weak students who had a lot of 'wrong' pre-knowledge which required a lot of undoing. The 'best class' would be the class with the students who are always on-task and really paid attention to ever single detail I had mentioned during the lessons. The behaviour would depend largely on the class dynamics. A 'loose' class would require a lot of strict guidelines that I would enforce at all times.

On what he thought are factors that will help students learn effectively,

The students will learn effectively when a teacher can break down a difficult question into simpler tasks. They can also learn well in a disciplined environment where the teacher takes control of the class and addresses to the whole class at all times to ensure that there is no disruption to the lessons.

On what he does to ensure students learn in his class, he said:

By giving them the best learning environment is a must. They must be able to focus on me at all times so a quiet and focused classroom environment is very important.

On whether, he thought mathematics teachers behave differently from say, English teachers, he said:

Yes, because mathematics teachers must always ensure the students focus on the basic concepts so that they can practice what they were taught.

On whether he believes that students' interest in the subject is related to teacher interpersonal skills in class,

Sadly, the students tend to link their interests in the subjects to the teachers' interpersonal skills. They do not realize they must acquire the knowledge based on their personal needs.

And finally, when asked to describe in his opinion, an ideal teacher, he said:

An ideal teacher would be someone like me? One who is systematic and efficient in the delivery of the lessons to ensure that the students can learn the various aspects of knowledge not only based on texts but also on the other aspects of non-academic related skills.

Case Study 4:

Mr S is a very experienced teacher with 20 years of varied experience teaching mathematics across different levels of mathematics from lower secondary to upper secondary to IB mathematics in an independent school.

On what makes an effective teacher and whether he is an effective teacher, he believes:

An effective teacher is someone who is able to make a student see his worth even in his weakest subject and then help to turn that student around. I hope so.

On his own perceptions of himself as a teacher, he believed:

Someone who can make a positive influence on these young lives. I extend patience and offer hope for all.

On how he thought his students would perceive him, he said:

Patient.

On whether he has a 'best' class and a 'worst' class and whether he behaves differently in different classes, he has this to say:

There might be some perception there. Best class usually is when everything (lesson, homework, attitude) goes well and worst class when things (absenteeism, late in doing assignments, can't understand) go wrong at any time. Show even more care and patience to the worst class without showing them this perception.

On what he thought are factors that will help students learn effectively,

The right attitude and motivation

On what he does to ensure students learn in your class, he said:

Ensure conducive environment, get them to ask questions, answer questions

On whether, he thought mathematics teachers behave differently from say, English teachers, he said:

At times, they might be the same. For a Math teacher, I guess there is a need to be more patient as there are many [students] not strong in the subject.

On whether he believes that students' interest in the subject is related to teacher interpersonal skills in class,

Quite sure, you lose interest when you can't quite relate to the teacher interpersonal style.

When asked to further describe his behaviour in class, he believed:

I am a good leader only in areas that I am comfortable in. Helpful and friendly, yes. Understanding, yes. Strict, only when the need arises. Uncertain? Of course there could be times. I do generally trust students by giving them responsibility and some freedom in class. It gives them fulfillment. But freedom does not mean doing what they want.

And finally, when asked to describe in his opinion, an ideal teacher, he said:

Not sure ideal but someone who is flexible enough to understand human behaviour, patient because not everyone is quick to absorb, and teaches because they want to make a difference.

Case Study 5:

Mr Z was an engineer by training and is in his second career as a mathematics teacher teaching mathematics to IB year 5 and 6 (or equivalent of grade 11 and 12) students. He has three years of teaching experience in an independent school which is his first school. His passion is teaching, and his responses clearly showed that he probably epitomises what an 'ideal' teacher is like.

On what makes an effective teacher and whether he is an effective teacher, he believes:

An effective teacher would work towards achieving the goals that he or she has set. An effective teacher will also reflect on the optimal way to teach a particular topic. It does not mean that he or she has to teach faster. It just means that the methodology employed promotes understanding of the material. An effective teacher is also not one who

stagnates. There is room for continual improvement and experimentation of techniques and renewal of knowledge. He or she must also take on the attitude that the students have something to teach and learning is for everyone including the teacher. Attitude wise, an effective teacher is one who is firm and fair, approachable and make learning accessible. Not much point setting questions only he or she can do. The target should be the zone of proximal development where the material is deemed not too easy and not too difficult either. With a teacher saddled with so many responsibilities, a high degree of organizational skills will be a good attribute. With time a limiting factor, an effective teacher will be one who can juggle many responsibilities and get things done well and in the shortest time...To some extent I think I am effective as a classroom teacher. I spend a lot of time on classroom preparation and think through the pedagogy of a particular topic. I also try to make lessons fun.

On his own perceptions of himself as a teacher, he believed:

I think I am doing a decent job. The areas that I can improve is being more patient and be more organized. I have good content knowledge and am confident of myself. I give pretty clear in instructions and am approachable and I talk to the students, not talk at them. I understand that I don't know everything and learn together with my students and I am decently firm when needs to be. I am also a problem solver (trained as an engineer so acquired the habit early).

On how he thought his students would perceive him, he said:

I am friendly mostly but strict on particular things like punctuality. I try not to be impatient with students who asked questions which showed that they have not been listening in class.

On whether he has a 'best' class and a 'worst' class and whether he behaves differently in different classes, he has this to say:

Strangely the best or worst class that I perceive do not depend on their academic performance. My 'worst' class is academically strong but tend to be apathetic and the students are complacent. My 'best' class is academically slower but enjoyable to teach simply because they ask questions and display an attitude that show that they are willing to learn...I am fairly consistent in my classes. I am firm if they breach the OB markers like not being punctual or skipping lessons and the students know that. Otherwise I treat each class the same.

On what he thought are factors that will help students learn effectively,

We need to create a safe and inviting environment to clarify their doubts; have pedagogy that takes account their aptitude; a combination of theory and practice in mathematics to build confidence and constant encouragement and emotional support to build up the affective domain.

On what he does to ensure students learn in his class, he said:

I do give small treats (rewards) once in a while. I also issue constant reminders on why they are in school and to keep their focus on their goal. I give the opportunities to clarify doubts (one day a week is tutorial day where there is no teaching but self learning and students can ask questions on whatever they are unsure of) and I try to inculcate self-directed learning so that students feel a sense of ownership of their learning experience.

On whether, he thought mathematics teachers behave differently from say, English teachers, he said:

I don't think so. They are similar I think. Both are languages and the goal is to let the enthusiasm and appreciation for the beauty of mathematics rub off on the students. The worst thing a math teacher can do is to spoon feed knowledge that seems foreign to the students. Both English and math teachers should really pass on the flame so that the students can acquire that knowledge for themselves.

On whether he believes that students' interest in the subject is related to teacher interpersonal skills in class,

Yes, of course.

When asked to further describe his behaviour in class, he believed:

I am a good leader (but not the most humble). I can improve somewhat by being a better listener and less intimidating with knowledge- that is,

I mean, some students may be afraid to ask questions for fear of sounding stupid so I need to learn to be more welcoming with students' questions. I generally trust students by giving them responsibility and freedom in class.

And finally, when asked to describe in his opinion, an ideal teacher, he countered with:

Is there such a thing? Okay, if I have to summarise, in my opinion, an ideal teacher is one who is able to teach well and be approachable at all times.

This teacher encapsulated the essence of what it means to teach when he said:

I would not want to do anything else. At the end of the day, there is nothing more satisfying than to see your students make good in their lives and knowing in some small measure that you have contributed towards that.

Summary of Case Studies

In Case Study 1, Ms A is generally a young and impressionable teacher who is probably strict by her own words in 'noisy classes'. As a rather new teacher, and in her early twenties, according to Brekelmans, Wubbels, and den Brok (2002), her 'behavioural repertoire is probably less developed' than it would be with more years of experience. She perceived herself as 'firm yet open-minded'; 'stern and strict' and needing to improve on leadership. As a young teacher, her profile fitted that of the beginning teacher mentioned in the above study which indicated that beginning

teachers are usually strict and lack leadership skills which can however, be honed with time. Ms A, like most beginning teachers, expressed a certain level of anxiety about classroom management. Nevertheless, she is friendly, helpful and enthusiastic which are all positive traits of teacher interpersonal behaviour. These are traits that will not increase with experience (Brekelmans, Wubbels, & den Brok, 2002).

In Case Study 2, Ms Y, with her varied teaching background, comes across as a teacher who is understanding, helpful, friendly and very modest about her abilities. She seemed to have no difficulty in establishing and maintaining a consistent relationship with her students unlike that of the beginning teacher. However, in the area of leadership, her statement that 'I am not a good leader but learning to be one' shows that her leadership skills can be further nurtured with more experience.

In Case Study 3, Mr K comes across as a dominant ideal teacher as described by Levy, Creton, and Wubbels (1993) who feels that students will not initiate learning activities if teachers do not control their work, and allowing them more freedom will not help them to learn.

In Case Study 4, Mr S, a man of few words, as his brief responses attested to, is widely respected by his students. Yet with his years of experience, he does not exhibit dominant behaviour such as being overly strict. He is probably an example of a student-oriented ideal teacher, as described by Levy, Creton, and Wubbels (1993) who feels that students have to enjoy the class before they can learn anything and that if there is a pleasant, stimulating environment, they would be more motivated to study. He feels that it is more important to reward students for their efforts and the things they do well than it is to correct their mistakes.

In Case Study 5, Mr Z clearly has a passion for teaching and his responses show that he tries to interest students in the learning process, understands the needs of the students, is friendly, gives students responsibility and has a certain level of strict behaviour with which students are comfortable, and feel is conducive to their learning.

On the whole, while they each focused on different aspects of teaching which they deemed important and personal to them, the general consensus is that knowledge of subject matter, student learning and development are all important elements of teacher effectiveness. The underlying belief is that effective mathematics teaching includes primarily making mathematics relevant and meaningful for students. What is also evident is that the less experienced teachers appear to be stricter than the other teachers whereas the more experienced teachers may not be friendlier than the others. The comments in the interviews are in accord with the results obtained with the QTI.

Throughout the course of the interviews, the teachers appeared generally quite self-reflective. Arends (2001, p.18) surmised that “effective teaching requires careful and reflective thought about what a teacher is doing and the effect of his or her action on students’ social and academic learning”. The general conviction was that teacher interpersonal behaviour has a very crucial role to play in motivating students to learn. From the above interviews, it would appear that they believe “it is important for teachers to have a caring disposition toward their students, believe in their students’ ability to learn, and establish a harmonious relationship with their students” (Khine & Lourdasamy, 2005, p. 31). As found in many earlier research studies, for example, Wubbels, Creton, and Hooymayers (1985) good interpersonal relationships are a prerequisite for effective teaching.

Clearly, it is from the positive relationships between teacher and his or her students that student motivation to engage in learning can be harnessed. Indeed, it is often established that effective teachers need to have a sound knowledge base that guides what they do as teachers in the classroom in order to provide leadership to their students. However, this “teacher as leader” concept should not lead to excessive control or strictness at the expense of giving students responsibility for their own learning. The need for a balance between control and freedom cannot be overlooked. Creton and Wubbels (1994) in an analysis of profiles of best and worst teachers showed that while good teachers often score high on both proximity and influence dimensions; students respond more to friendly and understanding behaviour than to leadership and strictness. The best teachers also provide students with more responsibility and freedom (Levy, Creton, & Wubbels, 1993).

5.7 CHAPTER SUMMARY

This chapter provided further validation evidence for using the QTI to assess teacher interaction with students. Overall, the findings from both student and teacher interviews replicated the results from using the QTI, which provided additional support for the construct validity of the QTI. For instance, the observation that older students perceived their teachers to be less strict, admonishing, uncertain and dissatisfied than did the younger students, occurred in both the QTI findings and the student interviews. While naturally each student and teacher would have different opinions of what makes an effective teacher, nevertheless, common traits surfaced in the interviews. Factors commonly mentioned such as leadership, being helpful and friendly, understanding; giving students responsibility and also, freedom, not being too strict and admonishing are strongly endorsed. From the viewpoint of students, an

effective teacher exhibits all of the above and yet, must possess a good sense of humour. Moreover, the word `passion' featured prominently in both student and teacher interviews. Teachers believe that to be effective, one must have the passion and drive to want to make a difference. An effective teacher, besides possessing basic teacher competencies and good teaching strategies, is one who is able to have good interpersonal relationships in the classroom. The teacher interviews provided anecdotal evidence that generally, teachers do see that the key to real effective teaching lies in the nature of teacher interpersonal behaviour and communication styles. Both the perceptions of students and teachers, as culled from the interviews support the contention that as teachers communicate greater uncertainty, impatience and dissatisfaction, they display fewer instructional techniques associated with effectiveness.

Chapter 6

Conclusion

6.1 INTRODUCTION

This study reports the findings of research into the teacher interpersonal behaviour of mathematics and English teachers in an independent school with grade seven to twelve (Year 1 to Year 6) students in Singapore. While research has been conducted in the classroom environments in the past 25 years or so, little is known about the teacher interpersonal behaviour of mathematics teachers compared with English teachers in Singapore. This study has investigated associations between teacher interpersonal behaviour and students' attitudinal outcomes together with some student characteristics such as grade level and teacher characteristics, such as gender and years of experience. In particular, whether the typical profile of a mathematics teacher and an English teacher in Singapore can be matched to those, as established in the research conducted by the Dutch and Australian researchers, has been discussed in earlier chapters. The QTI which was used to measure students' perceptions of their teacher's interpersonal behaviour, was also validated with a large sample of classes.

One way in which this study is significant is its contribution to the understanding of mathematics classroom environments. Little research has been conducted in Singapore in this area and there are no reported studies which parallel this study in examining students' perceptions of their mathematics and English

teacher's interpersonal behaviour, and which also examine associations between these perceptions and students' attitudinal outcomes in mathematics classrooms. This study also uses qualitative data gathered from interviews with students and teachers to support and explain the quantitative data. This further serves to enhance understanding of the learning and teaching process that goes on in the classroom.

6.2 OVERVIEW OF THE STUDY

The context of this study is the field of classroom environment research, particularly the interpersonal behaviour of teachers. This research began in the early seventies and has become firmly established since then. Chapter 2 outlines the literature in this area and traces the development of the instruments which have been used in classroom environment research. It also highlights previous research into classroom environments and that this research often involves science classes, sometimes humanities classes and not that often, mathematics classes. Comparative studies of mathematics and English teachers' interpersonal behaviour are even more uncommon. The review of literature on classroom environment research highlighted the need for further studies. Particular attention is given to the development of the QTI and research which involved the use of the QTI in classroom research. The methodology to achieve these ends is described in Chapter 3. The two instruments used in the gathering of data were the QTI and an attitude scale, which was developed based on TOSRA. Chapter 4 reported the descriptive statistics which confirmed the reliability and validity of the QTI and its circumplex nature. It also showed that the attitudinal scale was both reliable and valid. Underlying the research is a desire to improve the teaching of mathematics. Consequently, the chapter also described associations

between students' perceptions of their mathematics and English teacher and their attitudinal outcomes. These are important foci of the study because they added to the limited knowledge base of mathematics classroom environments in Singapore. Chapter 5 reported on the qualitative data gathered through interviews with students and teachers.

6.3 MAJOR FINDINGS OF THE STUDY

The first research question of this study was:

Is the Questionnaire on Teacher Interaction (QTI) a valid and reliable instrument for use in Singapore?

The QTI was developed to measure the perceptions of students of their interactions with their teachers, that is, their teachers' interpersonal behaviour. The reliability and validity of the QTI was determined through three statistical measures- Cronbach alpha reliability, circumplex nature, and ANOVA scores. Each scale's internal consistency was shown to be above minimum acceptable levels through the use of the Cronbach alpha coefficient with the individual student as unit of analysis. As reported in Chapter 4, the alpha reliability coefficients for the scales of the Actual QTI ranged from 0.79 to 0.92 with the highest alpha reliability obtained for the Helping/Friendly scale and lowest for the Strict scale, while that of the Ideal QTI, ranged from 0.69 to 0.90. Consequently, the QTI was considered a reliable instrument.

Further analyses were also completed to explore the inter-scale correlation in the QTI. The scales of the QTI are arranged to form a circumplex model and are

expected to correlate most with their adjacent scales. The results of the inter-scale correlations from the study generally reflected the circumplex nature of the QTI and further confirming the validity of the instrument. For example, the scale Leadership is correlated closely and positively with Helping/Friendly (0.79) and Understanding (0.81). This correlation decreases with other scales with the highest negative correlation of -0.65 occurring with the Admonishing scale. The results from these analyses confirmed the circumplex nature of the QTI.

A one-way analysis of variance (ANOVA) compares the means for different groups, in this study the classes. The η^2 statistic is the proportion of variance in the dependent variable that is explained by the independent variable. It is also an indication of how well an instrument is able to measure the difference between classes (Nair & Fisher, 1999). In this study, the difference between the means of the classes was significant for all the eight scales. It was shown that each scale differentiated satisfactorily between classes to at least the $p < 0.01$ level. The amount of variance in scores accounted for by class membership, ranged from 0.05 to 0.21. It appears that the instrument is able to differentiate clearly between the perceptions of students in different classes. Overall, based on all these results, it can be concluded that the QTI was a valid and reliable instrument for use in this study.

The second research question was:

Is the Attitude to mathematics and Attitude to English Scale a valid and reliable instrument for use in Singapore?

The internal consistencies of items in both scales were good as the Cronbach alpha coefficient was found to be 0.89 for the Attitude to mathematics scale and 0.91 for the Attitude to English scale which showed a high level of correlation between the items in each scale. Consequently, it is a valid and reliable instrument for use.

The third research question was:

Are there any differences between students' perception of their Actual and ideal mathematics teachers' interpersonal behaviour?

In all eight scales, the difference between students' perceptions in the Actual and Ideal QTI were found to be statistically significantly different. The means of the Leadership, Helping/Friendly, Understanding and Student Responsibility scales in the actual versions were lower than those found in the ideal versions. Similarly, for Dissatisfied, Admonishing and Strict, the means of the actual scales were higher than the ideal. In general, while students showed relatively favourable perceptions of their mathematics teachers' interpersonal behaviour, comparisons between actual and ideal QTI scores indicated that in an ideal situation students would prefer more leadership, helping friendly and understanding behaviours in their teachers and would prefer to be given more responsibility and freedom. However, ideally they would prefer less uncertain, dissatisfied, admonishing and strict behaviour.

The fourth research question was:

Are there any differences between students' perception of their actual and ideal English teachers' interpersonal behaviour?

In all eight scales, the students' perceptions were found to be statistically significantly different between the actual and ideal QTI in their English classes. The

means of the Leadership, Helping/Friendly, Understanding and Student Responsibility scales in the actual were lower than those found in the ideal scales. Similarly, for Dissatisfied, Admonishing and Strict, the means of the actual scales were higher than the ideal. In general, as in the case for mathematics teachers, while students showed relatively favourable perceptions of their English teachers' interpersonal behaviour, comparisons between actual and ideal QTI scores indicated that ideally students would prefer more leadership, helping friendly and understanding behaviours in their teachers and be given more responsibility and freedom. However, in an ideal situation they would prefer less uncertain, dissatisfied, admonishing and strict behaviour.

The fifth research question was:

Are there any differences of students' perception of their actual mathematics and English teachers' interpersonal behaviour?

It was found that in terms of Actual QTI, there were significant differences found in five out of the eight scales ($p < 0.001$). Mathematics teachers scored higher on the Leadership, Helping/Friendly, Understanding scales and lower on the Uncertain and Admonishing than English teachers.

The sixth research question was:

Are there any differences of students' perception of their ideal mathematics and English teachers' interpersonal behaviour?

In terms of expectations, that is, in Ideal QTI, there were also significant differences in Leadership, Helping/Friendly, Understanding, Uncertain and Admonishing though less than in the Actual QTI ($p < 0.01$) for the mathematics and English teachers. However, it was found that in the Ideal QTI, there was a strong

significant difference ($p < 0.001$) in Dissatisfied in students' perceptions toward mathematics and English teachers with a higher mean for English teachers.

The seventh research question was:

Are there any differences in students' attitudes toward mathematics and English as measured by the Attitude to mathematics/English Scale?

It was found that in terms of attitude toward the particular subject, there is a significant difference between attitude toward mathematics and attitude toward English teachers. Students seemed to have a more positive attitude toward mathematics teachers than English teachers as shown by the difference in means.

The eighth research question was:

What associations are there between students' perception of their teachers' interpersonal behaviour in mathematics and their attitudes toward mathematics?

Perceptions of the mathematics teacher's interpersonal behaviour were significantly associated with students' attitudes toward mathematics in all eight scales of the QTI. The most positive attitude was found to be associated with strong leadership, helping/friendly and understanding behaviour and with minimal admonishing and strict behaviour. The Student Responsibility and Freedom scale was found to be positively associated with the development of students' attitudes. The more conservative standardised regression coefficient (β) which measures the association between students' perceptions on each scale of the QTI and their attitudes toward mathematics, when the effect of relationships between the scales is controlled,

was also computed. The beta (β) weights showed that in classes where the students perceived greater leadership and helping/friendly behaviours in their teachers, there was a more favourable attitude toward mathematics. The multiple correlation, R was significant for the actual QTI and shows that when the scales are considered together, there is a significant ($p < 0.01$) association with the Attitude scale. The R^2 value indicated that 19% of the variance in students' attitude to mathematics was attributable to their perceptions of their teachers' interpersonal behaviour. The associations reported here replicate the findings of previous research with the QTI (Brekelmans, Levy, & Rodriguez, 1993; Fraser, Fisher, & Wubbels, 1993; Henderson, 1996; Wubbels, Brekelmans, & Hooymayers, 1991).

The ninth research question was:

What associations are there between students' perception of their teachers' interpersonal behaviour in English and their attitudes toward English?

Perceptions of the English teacher's interpersonal behaviour were significantly associated with students' attitudes toward the subject in all scales of the QTI except for Uncertain and Strict. The most positive attitude was found to be associated with helping/friendly, strong leadership and understanding behaviour and with minimal admonishing and dissatisfied behaviour. The Student Responsibility and Freedom scale was found to be positively associated with the development of students' attitudes as well. The beta (β) weights showed that in classes where the students perceived greater helping/friendly behaviour in their teachers, there was a more favourable attitude toward English. The multiple correlation, R was significant for the Actual QTI and shows that when the scales are considered together, there is a significant ($p < 0.01$) association with attitudes. The R^2 value indicated that 13% of the

variance in students' attitude to English was attributable to their perceptions of their teachers' interpersonal behaviour. It is interesting that this was less than for mathematics teachers.

The tenth research question was:

Are there any factors affecting the students' perception of their teachers' interpersonal behaviour and attitudes toward subject such as gender of teachers, number of years of experience and grade-level of students?

In this study, it was found that there were no significant differences in any of the eight scales of the QTI between male and female teachers in terms of students' perceptions using QTI and in terms of attitudes toward the subject.

However, significant differences existed between the number of years of teaching experience in the following scales in the QTI: Leadership, Uncertain, Admonishing, Student Responsibility, Strict. For instance, in terms of Leadership, teachers with six to nine years of teaching experience seemed to show more leadership than those with less than five years of experience. In terms of Uncertain, teachers with less than five years seemed more uncertain than those with six to nine years and those with more than 20 years. In terms of Strict, teachers with fewer than five years seemed less strict than teachers with six to nine years of experience. Also, it was found that teachers with more than 20 years experience were less strict than those with six to 19 years of experience. Moreover, no significant difference was found in the Understanding, Helping/ Friendly and Dissatisfied scales. This seems to be in line with the findings of Brekelmans, Wubbels, and den Brok (2002) who found that teachers somehow do not become more friendly and understanding as they become more experienced.

In terms of grade-levels of students, the difference between grades was found to be significant for all eight scales of the QTI. Generally speaking, year 6 students tend to have a more positive perception compared with the other grade levels in terms of Leadership, Helping/Friendly, Understanding and Student Responsibility. They also perceived teachers to be less strict, admonishing, uncertain and dissatisfied. These are also substantiated in the student interviews. This could be because they are more mature students and as in the study by Brekelmans (1989), one can assume that students in higher grades behave better and thus need less teacher discipline. Also, as in the same study, where Dutch teachers seem to allow students in the higher grades more responsibility and freedom than those at the lower levels; the same is also reflected here in this study.

The eleventh research question was:

What is the average interpersonal profile of the sample of secondary school Mathematics and English teachers and how do they compare to the types of profiles found in previous research studies?

The ideal mathematics teacher seemed to be that of the directive and authoritative type which was one of the eight types mentioned in the Dutch and American typologies. The actual mathematics teacher profile was also quite similar to the ideal mathematics teacher profile. The students' perceptions of the mathematics teacher were characterised by relatively high scores in the Leadership, Helping/Friendly and Understanding scales. Teachers are seen as more strict than admonishing. The teacher is perceived by students to be characterised by a low degree of uncertainty.

Characteristic for the classroom environment of the Authoritative teacher is that the atmosphere is well-structured, pleasant and task-oriented. Rules and

procedures are clear and students do not need to be reminded. The Authoritative teacher is enthusiastic and open to students' needs. He or she takes a personal interest in them, and this comes through in the lessons. The lessons are well-planned and logically structured. The two profiles of mathematics teacher actual and ideal scores as shown in Figure 4.2 were quite similar, with the major difference being that students would like their teacher to demonstrate even more leadership, be more helping and friendly, and understanding than what they actually perceived them to be. We can hypothesize that the mathematics teachers are perceived to be quite exemplary in teacher interpersonal behaviour but the student would still expect the teachers to be more 'perfect'.

The ideal English teacher profile seemed to be different from that of the ideal mathematics teacher - it indicates a profile that is similar to the Tolerant-Authoritative type mentioned in one of the eight profiles in the Dutch and American samples (Wubbels & Levy, 1991). For the Tolerant-Authoritative teacher, the atmosphere is pleasant and supportive and students enjoy attending class yet the lessons are achievement-oriented and task-oriented. The rules are clear, although the teachers could need to remind the students from time to time. The teacher, according to Wubbels and Levy (1991), takes a personal interest in the students and emphasises close relationships. The Tolerant-Authoritative teacher is thought by their students to be very good. They tend to have highest affective outcome scores and high cognitive scores as well (Fisher, Fraser, & Cresswell, 1995).

While in general, the profile of the typical Singaporean mathematics teacher is that of the directive and authoritative type and that of the typical Singaporean English teacher is the Tolerant-Authoritative type which were two of the eight types mentioned in the Dutch, American and Australian research, there are some

differences. The profile of the interpersonal behaviours of teachers in Singapore seems to be well balanced except in the area of giving freedom to students to be responsible for their own learning. Teachers generally like to have a tight control of their students' learning and to tend to allow less room for student responsibility and freedom in their classroom than our Dutch, American and Australian counterparts. Though no quantitative comparisons were made in this study, it was evident from student interviews that this came across as a point which was brought up quite often and something which the students would have preferred more of. There are, of course, cultural differences one needs to take note of. As shown in previous studies (Rickards & Fisher, 2000), students' cultural background is indeed significantly related to the perceptions that they have of their teachers' interaction behaviour. Our Asian upbringing and context somehow does value the role of a teacher more than in other cultures and as such, there seemed to exist a paradox where education authorities, parents, stakeholders and students do tend to expect a teacher to do more and yet at the same time, to be able to allow more room for student responsibility and freedom.

And finally, the last research question was:

From the viewpoints of both students and teachers, what makes an effective mathematics teacher?

Naturally, each student and teacher would have different opinions of what makes an effective teacher. Nevertheless, common traits run through the interviews. Factors which are commonly mentioned such as leadership, being helpful and friendly, understanding; giving students responsibility and freedom yet without being too strict and admonishing, are strongly endorsed. In essence, from the students' viewpoint, an effective teacher exhibits all of the above, and yet must possess a good sense of

humour too. The use of 'passion' featured prominently in the students' comments too. Likewise, teachers believe that to be an effective teacher, one must have the passion and drive to want to make a difference in another's life and from this basic belief, positive values would surface. Values like good leadership; being helpful and friendly; understanding and believing in each of them by giving responsibility, granting freedom, and constantly ensuring motivation and encouragement.

6.4 IMPLICATIONS

Teachers are often called upon to do so much more than impart knowledge- they influence students through the quality of their teacher-student interactions. Having a reflective perspective can help teachers to create the image of the kind of teacher they want to be and that no matter how uncertain they are about their potential, each can learn to become a more effective and responsive communicator. Perhaps professional development can be in the form of personal changes strategies that teachers can be exposed to in order to transform classroom practices for more effective teacher-student interaction. Especially in teacher-training programmes, beginning teachers must be encouraged to be mindful of their influence over their students. Teachers need to strengthen not only their content knowledge but classroom management skills to give them the confidence to lead the class. While research has shown that maintaining discipline continues to be one of the most problematic areas faced by trainee teachers in the classroom (Tulley & Lian, 1995) and thus could cause them to lack leadership and appear uncertain in class when they are new, more must be done to equip them with skills to ensure a more positive teacher-student relationship.

One of the reasons why teachers prefer teacher-centred approaches in teaching is so that they can control the class better rather than having collaborative learning situations that may lead to disruptive student behaviour and hence, less positive teacher-student relationship. If learner-centred learning environments are to be created, teachers must be made more confident in the handling of interpersonal behaviour and interaction with their students. As most students prefer a constructivist approach to education, where the teacher is a proactive facilitator of learning and both teacher and students are equally involved in learning from the other in a dynamic relational interaction (von Glasersfeld, 1996), teacher education must keep up to date with all these measures of encouraging teachers to create and maintain favourable classroom learning environment through positive interpersonal behaviours. It would even be more desirable if teachers could be more proactive and the QTI could be used more frequently by teachers as a feedback instrument to seek improvement in their classroom relationships. The use of a formative, authentic assessment procedure for interpersonal competence of beginning teachers such as that designed by Nijveldt, Beijaard, Verloop, Brekelmans, and Wubbels (2006) may be a helpful impetus for teacher professional development in the area of teacher interpersonal relationships in class.

Although the mathematics and English teachers' interpersonal behaviours in this study were perceived favourably by students, evidence from this study and other research studies, has shown that there existed a gap between students' perceptions of actual and ideal teacher interpersonal behaviours in classes. Students preferred teachers to exhibit more positive leadership, helping/friendly, understanding, and student responsibility/freedom behaviours; and less of the negative teacher interpersonal behaviours. Therefore, it is important for teachers to improve their

interpersonal behaviour toward students so that this gap between students' actual and ideal teacher interpersonal behaviour can be bridged. Thus, teachers should develop strategies in classes that would enable them to exhibit more cooperative and less oppositional behaviour.

This study has shown that experience in teachers does play a significant role—whether be it in the area of influencing student perceptions or attitudes and thereby affecting student outcomes. It is therefore imperative for education policymakers to continue to enhance the professional development of experienced teachers, treasure their contribution and retain them in the teaching service. While the focus on recruitment of new and quality teachers in terms of salary expectations and perks in the teaching service is important, other policies must also be well in place to ensure that the teaching service continues to thrive and ultimately contribute to the well-being of educational, social, moral and economic success in Singapore. It is also vital that educational policymakers understand that certain physical constraints like class size can only put pressure on the relational interaction of the teacher and student and that such considerations must be in place when planning or making policies. All who are involved in the business of educating a child must realise that the interpersonal relationship with each child is as important as delivering a well-planned and executed lesson if not more so. If schools can be less depersonalised, and teachers can connect to students' lives in meaningful ways, fostering positive teacher interpersonal relationships can be part of reorganising the ecology of the classroom as an environment to provide greater success for all students. Teachers can use the QTI as a self-evaluation of their own teacher-student interactions and constantly seek to build a more effective learning environment by improving their own relationships with students, which clearly is within their own area of control, unlike other factors which

may be more difficult to change. As Hargreaves (1994, p. ix) puts it ‘The teacher is the ultimate key to educational change and school improvement... it is what teachers think, what teachers believe and what teachers do at the level of the classroom that ultimately shapes the kind of learning that young people get’.

6.5 LIMITATIONS OF THE STUDY

As in any study, this study has limitations and therefore, its findings should be generalised with caution. One main limitation of the study was that conclusions drawn from this study related only to this sample. Any inferences made with regard to the wider population of students in mathematics and English and mathematics and English teachers must be interpreted with care. The sample used in the study may not be totally representative of the secondary mathematics and English teacher in Singapore though it was still a representation. Also since teachers and students participated in this study on a voluntary basis, some bias in outcomes seemed likely.

A second limitation of the study was that it was co-relational and not causal. Therefore caution must again be applied in drawing conclusions about teacher interpersonal behaviour or classroom environments causing certain attitudinal outcomes.

A third limitation was that it focused on students’ attitudes, in particular attitudes toward mathematics and English. Other attitudinal outcomes or achievement scores were not investigated. It also did not include prior attitudes which students may have brought to their classes which would have determined their attitudes as measured in the present study to a large extent. Further effort to include such data could be undertaken in future studies. In such research, the number of covariates (student, teacher and class) could also be expanded.

A fourth limitation was that since each teacher participated with only one class, it was not able to distinguish between the teacher and class level. It would have been interesting to see if there existed other findings with respect to stability of perceptions across classes of the same teacher.

A fifth limitation was that teachers in this study selected their own classes for the study. In selecting their own classes many teachers may have selected classes with whom they felt they had a healthy rapport and the nature of this sample was more of a volunteer group and therefore the results may have suggested more positive teacher student interactions than if the sample was random. This point was noted by Levy, Creton, and Wubbels (1993) in their research whereby volunteer teachers showed slightly more Leadership, Helping/Friendly and understanding behaviour than teachers in a random sample. However, since each teacher chose his or her own class to participate, the effect is across all classes and therefore would not have caused much difference when comparisons are made in the study.

Finally, last but not least, the effect of class size on the perception of influence and proximity was not investigated in the study as the class sizes in this particular school, where the study was conducted, were more or less the same.

6.6 SUGGESTIONS FOR FURTHER RESEARCH

There are several areas of further research which can arise from this study. Firstly, future research should call for a closer look at our relational practices in education (Palmer, 1997, 1998). The phenomenological research approach could be further explored to look deeper into the ontological nature of the teacher-student relationship

(Giles, 2007). Ontological considerations are concerned with 'how' we are as beings together in the teacher-student relationship; 'how' we are with another person. It would be meaningful to explore the dynamic nature of the relating that occurs between teacher and student. How is it that a particular teacher-student relationships can have such spontaneity whereas a different teacher-student relationship appears to be dysfunctional or non-existent? To return to a fuller appreciation of the teacher-student relationship as a phenomenon that is essential to the educational experience would be the right path to explore. There is a need in our present educational practice to ensure a growing acknowledgement and interest in the teacher-student relationship as a holistic experience (Beattie, 2002; Hooks, 2003; Lorenzo, 1998; Palmer, 1998).

Secondly, it would be valuable to extend the work of this study by examining the causal aspect of the classroom relationships. To determine more accurately the extent to which teacher behaviour causes certain classroom environments or specific student outcomes would help teachers to be more mindful of their behaviour and help in the teaching-learning process. At the same time, determining the extent to which the student and classroom characteristics determine the teacher's behaviour would also be useful knowledge.

A third and interesting follow-up study would be a comparative study which addresses the classroom environments and teacher interpersonal behaviour across a wider range of subjects. This study has shown a particular profile of students' perceptions of their mathematics and English classroom environments and of the interpersonal behaviour of their mathematics and English teachers. However, more data could be gleaned to draw conclusions about the similarities and differences between these results and similar results from other subject areas.

This study has found strong associations between students' perceptions of their mathematics teacher's interpersonal behaviour, and students' attitudes toward mathematics. However, the associations with cognitive achievement was not determined. Consequently, a fourth area of study could be to determine if associations with students' cognitive achievement. This would be particularly useful for various subject teachers.

Since studies have shown that different grade levels prefer different environments (Hattie, Byrne, & Fraser, 1987), a fifth area of study would be to further focus and research more on the profiles and classroom environments of various grade levels so that teachers can be more aware of the changes in the way students perceive their classroom environments during their length of time in the school.

A sixth area of study could involve the multilevel analysis of the data gathered in this study. While data has been analysed at the student level, the nesting effect of students and classes within the school has not been taken into account.

Also, the use of more qualitative sources of information in examining the factors impacting learning environment which in turn affects students' learning is consistent with classroom epistemology and to understand more fully what is going on in a complex and dynamic classroom is to be encouraged.

Furthermore, instruments that could cater to the local multi-racial, cultural and social nuances of the Singapore classroom could be developed to enhance the research process. Further insights into classroom environments could include variables such as class size, student variables, such as ethnic and gender composition, as students from different backgrounds or gender may perceive teachers differently.

6.7 FINAL COMMENTS

This study provided validation data for the QTI which could be used more extensively in research in learning environment in the Singaporean context. It also investigated differences in students' perceptions of mathematics teachers using English teachers as a comparison. More importantly, it identified associations between students' perceptions of their mathematics classroom environment, in particular teacher-student interpersonal behaviour and the attitudinal outcomes and also factors which contributed to students' perceptions of teachers' interpersonal behaviour. Finally, its aim of developing a typology of mathematics and English teachers helped to provide a clearer perspective of teaching styles in Singapore.

The results thus shown in this study have implications for teachers of mathematics who are interested in the development of positive attitudes in their students. It clearly showed the importance of student and class attitude in predicting students' perceptions of their learning environment and served as a valuable comparative study for future research.

It is evident that teacher-student interaction has become a potentially powerful determinant of student learning and as such, we should try to look toward creating an educational environment whereby students find a friend in their teachers and teachers have the social skills to engage their students and foster a more congenial atmosphere in learning. Knowledge of different perceptions would help teachers in establishing teaching methods that affirm all students and be more flexible and less didactic in approach. Not only has past research consistently replicated the advantages of positive teacher interpersonal behaviour in terms of improving outcomes, but fostering positive teacher-student relationships are definitely worthy goals of education in

itself. Further studies could be made to determine how such environments can be created by forging more positive teacher student interactions so that the entire learning journey can be made more interesting and meaningful.

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APPENDIX A

Questionnaire on Teacher Interaction

Your Ideal Teacher Questionnaire

The following questionnaire asks for your view of an ideal teacher's behaviour. Think about your ideal teacher and keep this ideal teacher in mind as you respond to these sentences.

The questionnaire has 48 sentences about the ideal teacher. For each sentence, circle the number corresponding to your response. For example:

	Never			Always	
The teacher would express herself/himself clearly.	0	1	2	3	4

If you think that ideal teachers always express themselves clearly, circle the 4. If you think ideal teachers never express themselves clearly, circle the 0. You also can choose the numbers 1, 2 and 3 which are in-between. If you want to change your answer, cross it out and circle a new number. Thank you for your cooperation.

In order for us to provide you with a report of the results, please write your name and other details at the top of the reverse side of this page.

Name_____ (Optional)	Class_____	Never					Always				
1.	The teacher would talk enthusiastically about her/his subject.	0	1	2	3	4					
2.	The teacher would trust students.	0	1	2	3	4					
3.	The teacher would seem uncertain.	0	1	2	3	4					
4.	The teacher would get angry unexpectedly.	0	1	2	3	4					
5.	The teacher would explains things clearly.	0	1	2	3	4					
6.	If students did not agree with the teacher, they could talk about it.	0	1	2	3	4					
7.	The teacher would be hesitant.	0	1	2	3	4					
8.	The teacher would get angry quickly.	0	1	2	3	4					
9.	The teacher would hold the students' attention.	0	1	2	3	4					
10.	The teacher would be willing to explain things again.	0	1	2	3	4					
11.	The teacher would act as if she/he did not know what to do.	0	1	2	3	4					
12.	The teacher would be too quick to correct students when they broke a rule.	0	1	2	3	4					
13.	The teacher would know everything that goes on in the classroom.	0	1	2	3	4					
14.	If students had something to say, the teacher would listen.	0	1	2	3	4					
15.	The teacher would let the students take charge.	0	1	2	3	4					
16.	The teacher would be impatient.	0	1	2	3	4					
17.	The teacher would be a good leader.	0	1	2	3	4					
18.	The teacher would realise when students did not understand.	0	1	2	3	4					
19.	The teacher would not be sure what to do when students fooled around.	0	1	2	3	4					
20.	It would be easy to have an argument with the teacher.	0	1	2	3	4					
21.	The teacher would act confidently.	0	1	2	3	4					
22.	The teacher would be patient.	0	1	2	3	4					
23.	It would be easy to make a fool out of the teacher.	0	1	2	3	4					
24.	The teacher would make mocking remarks.	0	1	2	3	4					
25.	The teacher would help students with their work.	0	1	2	3	4					
26.	Students could decide some things in the teacher's class.	0	1	2	3	4					
27.	The teacher would think that students cheat.	0	1	2	3	4					
28.	The teacher would be strict.	0	1	2	3	4					
29.	The teacher would be friendly.	0	1	2	3	4					
30.	Students could influence the teacher.	0	1	2	3	4					
31.	The teacher would think that students did not know anything.	0	1	2	3	4					
32.	Students would have to be silent in the teacher 's class.	0	1	2	3	4					
33.	The teacher would be someone students can depend on.	0	1	2	3	4					
34.	The teacher would let students decide when they would do work in class.	0	1	2	3	4					
35.	The teacher would put students down.	0	1	2	3	4					
36.	The teacher's tests would be hard.	0	1	2	3	4					
37.	The teacher would have a sense of humour.	0	1	2	3	4					
38.	The teacher would let students get away with a lot in class.	0	1	2	3	4					
39.	The teacher would think that students can't do things well.	0	1	2	3	4					
40.	The teacher's standards would be very high.	0	1	2	3	4					
41.	The teacher could take a joke.	0	1	2	3	4					
42.	The teacher would give students a lot of free time in class.	0	1	2	3	4					
43.	The teacher would seem dissatisfied.	0	1	2	3	4					
44.	The teacher would be severe when marking papers.	0	1	2	3	4					
45.	The teacher's class would be pleasant.	0	1	2	3	4					
46.	The teacher would be lenient.	0	1	2	3	4					
47.	The teacher would be suspicious.	0	1	2	3	4					
48.	Students would be afraid of the teacher.	0	1	2	3	4					

Questionnaire on Teacher Interaction

Teacher Self Questionnaire

This questionnaire has 48 sentences about your behaviour in a particular class.

For each sentence, circle the number corresponding to your response. For example:

Never				Always	
I express myself clearly.	0	1	2	3	4

If you think that you always express yourself clearly, circle the 4. If you think you never express yourself clearly, circle the 0. You also can choose the numbers 1, 2 and 3 which are in-between. If you want to change your answer, cross it out and circle a new number.

Thank you for your cooperation.

In order for us to provide you with a report of the results, please write your name and other details at the top of the reverse side of this page.

Name _____ Subject: _____ Never Always
 Please circle : Gender: M/F Years of Teaching: 1-5 6-10 >10 >20

1.	I talk enthusiastically about my subject.	0	1	2	3	4
2.	I trusts the students,	0	1	2	3	4
3.	I seem uncertain.	0	1	2	3	4
4.	I get angry unexpectedly.	0	1	2	3	4
5.	I explain things clearly.	0	1	2	3	4
6.	If students don't agree with me, they can talk about it.	0	1	2	3	4
7.	I am hesitant.	0	1	2	3	4
8.	I get angry quickly.	0	1	2	3	4
9.	I hold the students' attention.	0	1	2	3	4
10.	I am willing to explain things again.	0	1	2	3	4
11.	I act as if I do not know what to do.	0	1	2	3	4
12.	I am too quick to correct students when they break a rule.	0	1	2	3	4
13.	I know everything that goes on in the classroom.	0	1	2	3	4
14.	If students have something to say, I will listen.	0	1	2	3	4
15.	I let the students take charge.	0	1	2	3	4
16.	I am impatient.	0	1	2	3	4
17.	I am a good leader.	0	1	2	3	4
18.	I realise when students don't understand.	0	1	2	3	4
19.	I am not sure what to do when students fool around.	0	1	2	3	4
20.	It is easy for students to have an argument with me.	0	1	2	3	4
21.	I act confidently.	0	1	2	3	4
22.	I am patient.	0	1	2	3	4
23.	It's easy to make me appear unsure.	0	1	2	3	4
24.	I make mocking remarks.	0	1	2	3	4
25.	I help us with their work.	0	1	2	3	4
26.	Students can decide some things in my class.	0	1	2	3	4
27.	I think that students cheat.	0	1	2	3	4
28.	I am strict.	0	1	2	3	4
29.	I am friendly.	0	1	2	3	4
30.	Students can influence me.	0	1	2	3	4
31.	I think that students don't know anything.	0	1	2	3	4
32.	Students have to be silent in my class.	0	1	2	3	4
33.	I am someone students can depend on.	0	1	2	3	4
34.	I let students decide when they will do the work in class.	0	1	2	3	4
35.	I put students down.	0	1	2	3	4
36.	My tests are hard.	0	1	2	3	4
37.	I have a sense of humour.	0	1	2	3	4
38.	I let students get away with a lot in class.	0	1	2	3	4
39.	I think that students can't do things well.	0	1	2	3	4
40.	My standards are very high.	0	1	2	3	4
41.	I can take a joke.	0	1	2	3	4
42.	I give students a lot of free time in class.	0	1	2	3	4
43.	I seem dissatisfied.	0	1	2	3	4
44.	I am severe when marking papers.	0	1	2	3	4
45.	My class is pleasant.	0	1	2	3	4
46.	I am lenient.	0	1	2	3	4
47.	I am suspicious.	0	1	2	3	4
48.	Students are afraid of me.	0	1	2	3	4

Questionnaire on Teacher Interaction

Student Questionnaire

This questionnaire asks you to describe the behaviour of your teacher.

This is NOT a test.

Your opinion is what is wanted.

This questionnaire has 48 sentences about the teacher. For each sentence, circle the number corresponding to your response. For example:

	Never			Always
This teacher expresses himself/herself clearly.	0	1	2	3 4

If you think that your teacher always expresses himself/herself clearly, circle the 4. If you think your teacher never expresses himself/herself clearly, circle the 0. You also can choose the numbers 1, 2 and 3 which are in-between.

If you want to change your answer, cross it out and circle a new number.

Please answer all questions.

Thank you for your cooperation.

Name (optional) _____	Never	Always
1. This teacher talks enthusiastically about her/his subject.	0	1 2 3 4
2. This teacher trusts us.	0	1 2 3 4
3. This teacher seems uncertain.	0	1 2 3 4
4. This teacher gets angry unexpectedly.	0	1 2 3 4
5. This teacher explains things clearly.	0	1 2 3 4
6. If we don't agree with this teacher, we can talk about it.	0	1 2 3 4
7. This teacher is hesitant.	0	1 2 3 4
8. This teacher gets angry quickly.	0	1 2 3 4
9. This teacher holds our attention.	0	1 2 3 4
10. This teacher is willing to explain things again.	0	1 2 3 4
11. This teacher acts as if she/he does not know what to do.	0	1 2 3 4
12. This teacher is too quick to correct us when we break a rule.	0	1 2 3 4
13. This teacher knows everything that goes on in the classroom	0	1 2 3 4
14. If we have something to say, this teacher will listen.	0	1 2 3 4
15. This teacher lets us boss her/him around.	0	1 2 3 4
16. This teacher is impatient.	0	1 2 3 4
17. This teacher is a good leader.	0	1 2 3 4
18. This teacher realises when we don't understand.	0	1 2 3 4
19. This teacher is not sure what to do when we fool around.	0	1 2 3 4
20. It is easy to pick a fight with this teacher.	0	1 2 3 4
21. This teacher acts confidently.	0	1 2 3 4
22. This teacher is patient.	0	1 2 3 4
23. It's easy to make this teacher appear unsure.	0	1 2 3 4
24. This teacher makes mocking remarks.	0	1 2 3 4
25. This teacher helps us with our work.	0	1 2 3 4
26. We can decide some things in this teacher's class.	0	1 2 3 4
27. This teacher thinks that we cheat.	0	1 2 3 4
28. This teacher is strict.	0	1 2 3 4
29. This teacher is friendly.	0	1 2 3 4
30. We can influence this teacher.	0	1 2 3 4
31. This teacher thinks that we don't know anything.	0	1 2 3 4
32. We have to be silent in this teacher's class.	0	1 2 3 4
33. This teacher is someone we can depend on.	0	1 2 3 4
34. This teacher lets decide when we will do the work in class.	0	1 2 3 4
35. This teacher puts us down.	0	1 2 3 4
36. This teacher's tests are hard.	0	1 2 3 4
37. This teacher has a sense of humour.	0	1 2 3 4
38. This teacher lets us get away with a lot in class.	0	1 2 3 4
39. This teacher thinks that we can't do things well.	0	1 2 3 4
40. This teacher's standards are very high.	0	1 2 3 4
41. This teacher can take a joke.	0	1 2 3 4
42. This teacher gives us a lot of free time in class.	0	1 2 3 4
43. This teacher seems dissatisfied.	0	1 2 3 4
44. This teacher is severe when marking papers.	0	1 2 3 4
45. This teacher's class is pleasant.	0	1 2 3 4
46. This teacher is lenient.	0	1 2 3 4
47. This teacher is suspicious.	0	1 2 3 4
48. We are afraid of this teacher.	0	1 2 3 4

Attitude to Mathematics Scale

Items 1-10 below consist of a number of statements about any mathematics lessons you might have in this class.

You will be asked what you think about these statements.

There are no 'right' or 'wrong' answers.

Your opinion is what is wanted.

For each statement, draw a circle around

- 1 if you **STRONGLY DISAGREE** with the statement
- 2 if you **DISAGREE** with the statement
- 3 if you are **NOT SURE**
- 4 if you **AGREE** with the statement
- 5 if you **STRONGLY AGREE** with the statement

		Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1.	I look forward to mathematics lessons.	1	2	3	4	5
2.	Mathematics lessons are fun.	1	2	3	4	5
3.	I enjoy the activities we do in mathematics.	1	2	3	4	5
4.	What we do in mathematics is among the most interesting we do at school.	1	2	3	4	5
5.	I want to find out more about the world in which we live.	1	2	3	4	5
6.	Finding out about new things is important.	1	2	3	4	5
7.	I enjoy mathematics lessons in this class.	1	2	3	4	5
8.	I like talking to my friends about what we do in mathematics.	1	2	3	4	5
9.	We should have more mathematics lessons each week.	1	2	3	4	5
10	I feel satisfied after a mathematics lesson	1	2	3	4	5

Thank you for your kind cooperation!

Attitude to English Scale

Items 1-10 below consist of a number of statements about any English/Language Arts lessons you might have in this class.

You will be asked what you think about these statements.

There are no 'right' or 'wrong' answers.

Your opinion is what is wanted.

For each statement, draw a circle around

- 1 if you **STRONGLY DISAGREE** with the statement
- 2 if you **DISAGREE** with the statement
- 3 if you are **NOT SURE**
- 4 if you **AGREE** with the statement
- 5 if you **STRONGLY AGREE** with the statement

		Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1.	I look forward to English/Language Arts lessons.	1	2	3	4	5
2.	English/Language Arts lessons are fun.	1	2	3	4	5
3.	I enjoy the activities we do in English/Language Arts.	1	2	3	4	5
4.	What we do in English/ Language Arts are among the most interesting we do at school.	1	2	3	4	5
5.	I want to find out more about the world in which we live.	1	2	3	4	5
6.	Finding out about new things is important.	1	2	3	4	5
7.	I enjoy English/Language Arts lessons in this class.	1	2	3	4	5
8.	I like talking to my friends about what we do in English/Language Arts.	1	2	3	4	5
9.	We should have more English/Language Arts lessons each week.	1	2	3	4	5
10	I feel satisfied after a English/Language Arts lesson	1	2	3	4	5

Thank you for your kind cooperation!

APPENDIX B

Students' Interview Questions:

Possible Starter Questions:

1. How do you perceive your Maths/ English teacher?
2. Describe what you think is an ideal Mathematics/ English teacher.
3. What do you find interesting about Mathematics/ English?
4. Given what you have in your current Mathematics/ English teacher, what do you think can be improved upon or changed?
5. How do you think your attitude to the subject is related to the type of relationship you have with your teacher?
6. What qualities does your teacher have that may have helped you to like the subject?

APPENDIX C

Teachers' Interview Questions:

Possible Starter Questions:

1. What makes an effective teacher?
2. Do you think you are an effective teacher?
3. What are the characteristics you have that makes you an effective teacher?
4. How do you perceive yourself as a teacher?
5. How do you think your students will describe you?
6. Do you have a 'best' class that you teach and a worst class? Can you elaborate?
7. How are you likely to behave differently in different classes?
8. What do you think are factors that will help students learn effectively?
9. What do you do to ensure students learn in your class?
10. Do you think mathematics teachers behave differently from say, English teachers? Are they stricter, etc?
- 11a. Do you think you are a good leader? Are you ever uncertain?
 - b. Are you helpful/friendly? Or often dissatisfied?
 - c. Are you more understanding? admonishing?
12. Do you generally trust students by giving them responsibility? And freedom in class? Are you strict? Can you give examples?
13. Do you think students' interest in the subject is related to teacher interpersonal skills in class?
14. Can you describe, in your opinion, an ideal teacher?
15. Can you comment further on anything related to mathematics teaching that you would like to add?

APPENDIX D

Information Sheet for Participants

Title of Study: **A Study of the Perceptions of Interpersonal Behaviour of Mathematics Teachers in Singapore**

The study for a doctoral thesis investigates:

- a. students' and teachers' perceptions of teacher interpersonal behaviour using the Questionnaire on Teacher Interaction (QTI).
- b. students and teachers' ideas (from interviews) on what constitutes an effective teacher, from the point of view of teacher interpersonal behaviour.

This study will involve mathematics and English teachers and the students in one of their classes they teach. The students will be asked to fill in the QTI (both the ideal and actual versions). Teachers will fill in the teacher version of the QTI. Responses will be collected and analysed using related statistical software.

In addition, some students will be approached in the later part of the study to take part in individual or group interviews. Student interviews (or discussions) will explore facets of teacher interpersonal behaviour that they deem important for effective teaching.

Teachers (about 5) will also be selected for a more in-depth individual interview based on the number of years of teaching experience. Teacher interviews will explore their views on what makes an effective teacher and their perception of the importance of the role that teacher interpersonal behaviour plays in the classroom.

All information will be treated in complete confidence and data will be stored securely. All steps necessary to ensure that individual staff and students cannot be identified will be taken with codes being used in any written or oral reports.

Please note that you may withdraw without prejudice from the study at any time up to the stage of data analysis. Should you elect to withdraw you will not be included as a subject in any oral, written, or electronic report or presentation derived from the study.

The thesis will be stored in the Curtin University and a summary of the overall findings and all reports and presentations arising from the study will be made available to you, if you so wish.

Thank you

Jeann Woo
Mathematics Department
Anglo-Chinese School (Independent)

This study has been approved by the Curtin University Research Ethics Committee. If needed, verification of approval can be obtained either by writing or calling:

Curtin University Research Ethics Committee
Office of Research and Development
Curtin University of Technology
GPO BOX U1987
Perth 6845
Tel No: 92662784

APPENDIX E

Consent form for Participants

Title of Study: **A Study of the Perceptions of Interpersonal Behaviour of
Mathematics Teachers in Singapore**

I have read and understood the information in the letter and the purposes of the study. I have been given an opportunity to ask questions. I agree to my participation in the research project as outlined above. I understand that I may withdraw from the research at any time without prejudice. Any information which might potentially identify me will not be used in any published material. I also understand that the research will involve the following data gathering activities, and consent to the researcher using these materials for her research:

Teacher questionnaires

Student questionnaires

Student interviews (audio and/or video recording)

Teacher interviews (audio and/or video recording)

If you have any questions about this study, please do not hesitate to contact me at 68700332.

Name of participant: _____

Signature: _____

Date: _____

This consent form will be kept in a secure location for a period of three years.