A Report of Research into Student Attitude and Teacher-Student Interpersonal Behaviour in a large Sample of Australian Secondary Mathematics Classrooms

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This paper reports on research using the *Questionnaire on Teacher Interaction (QTI)*, and provides validation data for the first use of the QTI with a large sample of mathematics classes. The effect of teacher-student interpersonal behaviour on the students' attitude towards their mathematics class was investigated and the dimensions of the QTI were found to be associated significantly with student attitude scores. The paper also describes how mathematics teachers could use the QTI as a basis for reflecting on their own teaching.

Most mathematics teachers believe that good relationships with their students are important. But are the students' perceptions of teacher-student interpersonal behaviour the same as their teachers? Is there a difference in mathematics teachers' perceptions of their actual teacher-student interpersonal behaviour in the classroom and what they perceive to be ideal? What associations are there between student attitudes and teacher-student interpersonal behaviour in the mathematics classroom?

The purposes of this paper are to outline a convenient questionnaire designed to assess teacher-student interpersonal behaviour and to report its use in answering such questions as these. The paper describes various forms of the Questionnaire on Teacher Interaction (QTI) and reports its use in past research. Associations between QTI scales and students attitudinal outcomes in mathematics classrooms are made and further validation data for the QTI are provided. Finally, the paper describes how mathematics teachers could use the QTI as a basis for reflecting on their own teaching.

The Questionnaire on Teacher Interaction

International research efforts involving the conceptualisation, assessment and investigation of perceptions of psychosocial aspects of the classroom environment have firmly established classroom environment as a thriving field of study (Fraser, 1994; Fraser & Walberg, 1991). Recent classroom environment research has focused on science laboratory classroom environments (McRobbie & Fraser, 1993), constructivist classroom environments (Taylor, Dawson & Fraser, 1995) and computer-assisted instruction classrooms (Teh & Fraser, 1994).

Researchers in The Netherlands have extended this research by focusing specifically on the interpersonal relationships between teachers and their students as assessed by the QTI (Wubbels, Créton & Hoomayers, 1992; Wubbels & Levy, 1993). The Dutch researchers (Wubbels, Créton & Holvast, 1988) investigated teacher behaviour in a classroom from a systems perspective, adapting a theory on communications processes developed by Waltzlawick, Beavin and Jackson (1967). Within the systems perspective of communication, it is assumed that the behaviours of participants mutually influence each other. The behaviour of the teacher is influenced by the behaviour of the students and in turn influences the student behaviour. Thus, a circular communication process develops which not only consists of behaviour, but determines behaviour as well.

With the systems perspective in mind, Wubbels, Créton and Hooymayers (1985) developed a model to map interpersonal teacher behaviour using an adaptation of the work of Leary (1957). In the adaptation of the Leary model, teacher behaviour is mapped with a Proximity dimension (Cooperation, C - Opposition, O) and an Influence dimension (Dominance, D, - Submission, S) to form eight sectors, each describing different behaviour aspects: Leadership, Helpful/Friendly, Understanding, Student Responsibility and Freedom, Uncertain, Dissatisfied, Admonishing and Strict behaviour. Figure 1 shows typical behaviours for each sector. The Questionnaire on Teacher Interaction (QTI) is based on this model.

The items of the QTI belong to eight scales, each consisting of six items and corresponding to one of the eight sections in the model. Examples of items are "This teacher is friendly"(Helping/Friendly) and "This teacher gets angry unexpectedly"(Admonishing). The scores for each item within the same sector

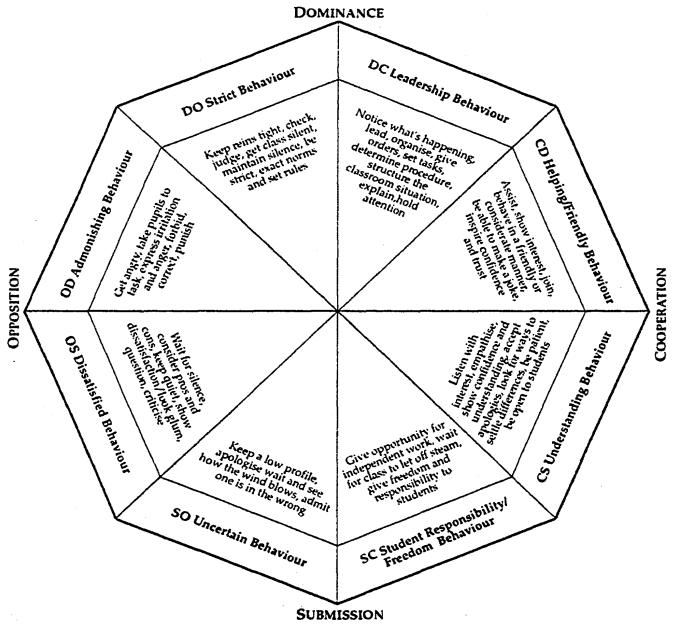

Figure 1. The model for interpersonal teacher behaviour

are added to obtain a total scale score. The higher the scale score the more a teacher shows behaviours from that sector. Scale scores can be obtained for individual students, or can be combined to form the mean of all students in a class.

An Australian Version of the QTI

The original version of the QTI developed in the early 1980s in The Netherlands had 77 items (Wubbels, Créton, & Hooymayers, 1985). Later, an American version of the QTI was developed which had 64 items (Wubbels & Levy, 1991). The Australian version of the QTI described in this paper, is more economical and has 48 items which are answered using a five-point response scale. This version of the QTI is available for use by mathematics teachers to gather their own perceptions and the perceptions of their students about their mathematics classrooms.

One advantage of the QTI is that it can be used to obtain the perceptions of interpersonal behaviour of either students or teachers. When the QTI is administered to both mathematics teachers and their 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 behaviour of the teacher towards the students as a class, and reflects relatively stable patterns of behaviour over a considerable period. Similarly, teachers can be asked for their perceptions of their own behaviour or the behaviour that they consider to be ideal. The wording of the questionnaire is varied slightly when used to obtain

teachers' self-perceptions and ideals. For example the question "This teacher talks enthusiastically about his/her subject", becomes "I talk enthusiastically about my subject" in the teacher self-perception version, and "This teacher would talk enthusiastically about his/her subject" in the teacher ideal version. These latter two versions are also available from the authors.

By using these three separate forms of the QTI it is possible to collect data on students' perceptions of teacher-student interpersonal behaviour, teachers' perceptions of their actual teacher-student interpersonal behaviour in the classroom and what they perceive to be ideal? These three sets of data can be represented graphically for ease of analysis by participants.

Past uses of the QTI

The QTI has been shown to be a valid and reliable instrument when used in The Netherlands (Wubbels & Levy, 1993). When the 64-item USA version of the QTI was used with 1,606 students and 66 teachers in the USA, the cross-cultural validity and usefulness of the QTI were confirmed. Using the Cronbach alpha coefficient, Wubbels and Levy (1991) reported acceptable internal consistency reliabilities for the QTI scales ranging from 0.76 to 0.84 for student responses and from 0.74 to 0. 84 for teacher responses.

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.

When teachers described their perceptions of their own behaviours, they tended to see it a little more favourably than did their students. On average, the teachers' perceptions were between the students' perceptions of actual behaviour and the teachers' ideal behaviour. An interpretation of this is that teachers think that they behave closer to their ideal than their students think that they do.

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 & Hooymayers, 1991). That is, student responsibility and freedom, understanding, helpful/friendly and leadership behaviours were related positively to student attitudes. Uncertain, dissatisfied, admonishing and strict behaviours were related negatively to student attitudes. 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.

Australian Applications of the QTI

In one of the first uses of the 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.

Methodology

This study is distinctive in that it is centred on students in mathematics classes, whereas previous research using the QTI has focused largely on students in science classes. The study involved students in grades 8, 9 and 10 mathematics classes in Australia and was composed of 405 students in 9 schools with their 21 teachers.

Associations between students' perceptions of their interpersonal relationships with their teachers and their attitudinal outcomes were examined in this study. The 48-item version of the QTI (Wubbels, 1993) was used to gauge students' perceptions of student-teacher interpersonal behaviour and student attitudes were assessed with a seven-

item Attitude To This Class scale, which was based on the the Test of Science-Related Attitudes [TOSRA] (Fraser, 1981).

Using the scales of the QTI as independent variables, associations were computed with attitude to the class. Simple correlations were calculated between each QTI scale and each student attitude. Also a multiple regression analysis, involving the whole set of QTI scales, was conducted to provide a more conservative test of the association between each QTI scale and attitude when all other QTI scales were mutually controlled.

Results

Validity of the QTI

Table 1 provides some cross-validation information for the QTI when used specifically in the present sample of mathematics classes. Statistics are reported for two units of analysis, namely, the student's score and the class mean score. As expected, reliabilities for class means were higher than those where the individual student was used as the unit of analysis. Table 1 shows that the alpha reliability figures for different QTI scales ranged from 0.62 to 0.88 when the individual student was used as the unit of analysis, and from 0.60 to 0.96 when the class mean was used as the unit of analysis. The values presented in Table 1 for the present sample provide further cross-validation information supporting the internal consistency of the QTI, with either the individual student or the class mean as the unit of analysis.

Table 1
Internal Consistency (Cronbach Alpha Coefficient) and Ability to Differentiate between Classrooms of the QTI

Scale		Alpha Reliability		ANOVA Results
		Student	Class	Eta^2
DC	Leadership	0.86	0.93	0.43*
CD	Helping/friendly	0.88	0.94	0.29*
CS	Understanding	0.88	0.96	0.36*
SC	Student responsibility/ freedom	0.69	0.79	0.23*
SO	Uncertain	0.78	0.87	0.29*
OS	Dissatisfied	0.83	0.91	0.28*
OD	Admonishing	0.84	0.89	0.36*
DO	Strict	0.62	0.60	0.14*

*p < .001 n = 405 students in 21 mathematics classes

Another desirable characteristic of any instrument like the QTI is that it is capable of differentiating between the perceptions of students in different classrooms. That is, students within the same class should perceive it relatively similarly, while mean within-class perceptions should vary from class to class. This characteristic was explored in mathematics classrooms for each scale of the QTI using one-way ANOVA, with class membership as the main effect. It was found that each QTI scale differentiated significantly ($p<.001$) between classes and that the eta^2 statistic, representing the proportion of variance explained by class membership, ranged from 0.14 to 0.43 for different classes.

To investigate further validation data for the QTI, interscale correlations were used to test the validity of the circular two dimensional model for interpersonal behaviour upon which the QTI is based. The two dimensional model would be validated if the interscale correlations were highest between adjacent scales and lowest between scales opposite to one and other on the model. Table 2 reports interscale correlations for the student version

of the QTI with the student as the primary unit of analysis and serves to further validate the circumplex nature of the QTI in that, with a few minor exceptions, the highest correlations are found in scales adjacent on the two-dimensional model (eg. between Helping/Friendly and Understanding behaviour for example) and the lowest correlations between scales that are opposite to one and other on the model (eg. between Helping/Friendly and Dissatisfied behaviour for example).

Table 2
Means for QTI scales for grades 8,9 & 10 secondary mathematics classes

Scale	Hfr	Und	Sre	Unc	Dis	Adm	Str
Lea	0.73	0.75	-0.17	-0.67	-0.54	-0.48	-0.06
Hfr		0.83	0.17	-0.50	-0.66	-0.62	-0.32
Und			0.10	-0.56	-0.67	-0.69	-0.24
Sre				0.38	0.03	-0.11	-0.27
Unc					0.53	0.50	0.06
Dis						0.72	0.46
Adm							0.56

n = 405 students in 21 mathematics classes

Associations between Interpersonal Teacher Behaviour and Student Outcomes

Table 3 reports the results for associations between students' perceptions of teacher-student interpersonal behaviour and students' attitudinal outcomes when the data were analysed using both simple and multiple correlations. Whereas the simple correlation (r) describes the bivariate association between attitudinal outcome and a QTI scale, the standardized regression weight (ß) characterises the association between attitudinal outcome and a particular QTI scale when all other QTI dimensions are controlled.

An examination of the simple correlation (r) figures in Table 3 indicates that there were eight significant relationships ($p<.05$), out of eight possible, between student-teacher interactions and the student attitudinal outcome; this is 20 times that expected by chance alone. An examination of the beta weights reveals four out of eight significant relationships ($p<.05$), which is ten times that expected by chance alone.

The simple correlation (r) figures indicate statistically significant associations between the students' attitude to class and all QTI scales. The beta weights show that some of these associations retain their significance in a more conservative test with all other QTI scales controlled. In classes where the students perceived greater leadership and helpful/friendly behaviours in their teachers, there was a more favorable attitude towards the class. The converse was true when the teacher was perceived as strict and dissatisfied.

Table 3
Associations between QTI Scales and Students' Attitudinal Outcomes in terms of Simple Correlations (r) and Standardized Regression Coefficients (§).

QTI Scale	Strength of Environment – Outcome Association Attitude to Class	
	r	§
Leadership	0.53**	0.24**
Helpful/friendly	0.64**	0.19*
Understanding	0.61**	0.13
Student responsibility/freedom	0.15**	0.07
Uncertain	-0.35**	0.07
Dissatisfied	-0.58**	-0.15*
Admonishing	-0.54**	-0.06
Strict	-0.40**	-0.18**
Multiple Correlation, *R*		0.71**

*$p < .05$ **$p < .01$ n = 405 students in 21 mathematics classes

Conclusions

This study confirmed the reliability and validity of the QTI when used in secondary school mathematics classes. Generally, the dimensions of the QTI were found to be significantly associated with student attitude scores. In particular, students' attitude scores were higher in classrooms in which students perceived greater leadership and helpful/friendly behaviours in their teachers' interpersonal behaviours. If mathematics teachers want to promote favorable student attitudes to their class, they should ensure the presence of these interpersonal behaviours. Conversely students' attitude scores were lower in classrooms in which students perceived greater dissatisfaction and strictness in their teachers' interpersonal behaviours.

Mathematics teachers can make use of the QTI to monitor students' views of their classes, investigate the impact that different interpersonal behaviours have on student outcomes, and provide a basis for guiding systematic attempts to improve this aspect of their teaching. Furthermore, the QTI could be used in assessing changes that result from the introduction of new curricula or teaching methods, and in checking whether the mathematics teacher's interpersonal behaviour is seen differently by students of different genders, abilities or ethnic backgrounds. Further research may wish to consider the impact of learning environment measures on the achievement of students in mathematics classes.

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