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ABSTRACT

The general trend in Australian teacher-student interpersonal behavior has been to report the student perceptions of science learning environments. The purpose of this study was to report teacher actual and ideal perceptions of the learning environment. In addition, science students' perceptions were compared to science teacher perceptions. Thirty-five schools completed the Questionnaire on Teacher Interaction (QTI), which gathered data on teacher and student perceptions of interpersonal communication patterns. A sample of 3,515 students from 164 secondary school science classes resulted. Statistical analyses previously have confirmed the reliability and validity of the QTI for secondary school science students. This study found that there were consistent differences between the actual and ideal perceptions of teachers and the student perceptions of the actual learning environment. For example, the teachers thought they demonstrated more leadership and helpful/friendly behavior than did their students. These differences serve as a useful and practical starting point for teachers to use in reflection on teaching practice. Furthermore, they may serve as a catalyst for improving the enjoyment and achievement of students in science classes. (Contains 27 references.) (Author/SM)

Three Perspectives on Perceptions of Teacher-Student Interaction: A Seed for Change in Science Teaching.

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Abstract

The general trend in Australian teacher-student interpersonal behaviour has been to report the student perceptions of science learning environments. The purpose of this study was to report teacher actual and ideal perceptions of the learning environment. In addition, science students' perceptions were compared to science teacher perceptions. Thirty-five schools completed a questionnaire, the Questionnaire on Teacher Interaction (QTI) that gathered data on the teacher and student perceptions of interpersonal communication patterns. A sample of 3515 students from 164 secondary school science classes resulted. Statistical analyses previously have confirmed the reliability and validity of the QTI for secondary school science students. This study found that there were consistent differences between the actual and ideal perceptions of teachers and the student perceptions of the actual learning environment. For example, the teachers thought they demonstrated more leadership and helping/friendly behaviour than did their students. These differences served as a useful and practical starting point for teachers to use in reflection on teaching practice. Furthermore, it may serve as a catalyst for improving the enjoyment and achievement of students in science classes.

Introduction

Science students have been the subject of much research over the last three decades into effective teaching and learning in science classrooms. Their perceptions of the science learning environment are well reported in learning environment research. Most science teachers agree that good relationships and communication patterns with their students are important, but are the students' perceptions of teacher-student interpersonal behaviour the same as their teachers? This is an important factor to consider if we are to work toward the same goals in establishing effective science learning environments for our students.

Is there a difference in science teachers' perceptions of their actual teacher-student interpersonal behaviour in the classroom and what they perceive to be ideal for that same class of students? In setting directions and goals for improvement of science learning environments, an ideal situation should be clear to science teachers. This may help them set clear objectives for improvement of the learning environment.

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 these questions in some Australian science learning environments. The paper describes various forms of the *Questionnaire on Teacher Interaction (QTI)* and reports its use in some past research. Finally, and most importantly, the paper

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describes how science teachers have used the questionnaire to assess perceptions of their own teacher-student interpersonal behaviour and used this as a basis for reflecting on their own teaching.

Science Classroom Learning Environment Research

International research efforts over the last three decades have firmly established classroom environment as a thriving field of study (Fraser, 1994; Fraser & Walberg, 1991). Recent classroom environment research has focused on constructivist classroom environments (Taylor, Fraser, & Fisher, 1997), cross-national studies of science classroom environments (Fisher, Rickards, Goh, & Wong, 1997), science laboratory classroom environments (McRobbie & Fraser, 1993), computer-assisted instruction classrooms (Fisher & Stolarchuk, 1997; Teh & Fraser, 1995), student gender and cultural background differences (Fisher, Fraser, & Rickards), and interpersonal behaviour in online delivered asynchronous learning environments (Rickards & Vickery, 1999).

Within the systems perspective on communication, it is assumed that the behaviours of participants influence each other mutually. The behaviour of the teacher is influenced by the behaviour of the students and in turn influences student behaviour. Circular communication processes develop which not only consist of behaviour, but determine behaviour as well. In The Netherlands, Wubbels, Creton, and Holvast (1988) investigated teacher behaviour in classrooms from a systems perspective, adapting a theory on communication processes developed by Watzlawick, Beavin, and Jackson (1967). With the systems perspective in mind, Wubbels, Creton, and Hooymayers (1985) developed a model to map interpersonal teacher behaviour extrapolated from the work of Leary (1957). This model has been used in The Netherlands in the development of an instrument, the *Questionnaire on Teacher Interaction* (QTI), to gather students' and teachers' perceptions of interpersonal teacher behaviour (Wubbels, Brekelmans, & Hooymayers, 1991; Wubbels & Levy, 1993). This model maps interpersonal behaviour with the aid of an *influence* dimension (Dominance, D – Submission, S) and a *proximity* dimension (Cooperation, C – Opposition, O). These dimensions are represented in a coordinate system divided into eight equal sectors.

Every instance of interactional teacher behaviour can be placed within this system of axes. The closer the instances of behaviour are in the chart, the more closely they resemble each other. The sections are labelled DC, CD, CS, SC, SO, OS, OD and DO according to their position in the coordinate system. For example, the two sectors DC and CD are both characterised by Dominance and Cooperation. In the DC sector, however, the Dominance aspect prevails over the Cooperation aspect, whereas in the adjacent sector CD Cooperation prevails over the Dominance aspect (Wubbels, T., Créton, H., Levy, J., & Hooymayers, H., 1993). Table 1 shows the names of the behaviours (eg. leadership behaviour, helping/friendly behaviour, understanding behaviour) given to each sector. These sector names are the names given to the eight scales of the QTI. Table 1 clarifies further the nature of the QTI by providing a scale description and a sample item for each of the eight scales.

One advantage of the QTI is that it can be used to obtain the perceptions of interpersonal behaviour of either students or teachers. It is the purpose of this paper to capitalise on the ability of the QTI to collect information on teacher actual and teacher ideal perceptions of the science learning environment as well as the student perceptions of their actual science learning environment.

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. The wording of the questionnaire is varied slightly when used to obtain teachers' self-perceptions. 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.

Table 1

Description of Scales and Sample Items for each Scale of the QTI

Scale Name	Description of Scale (The extent to which the teacher...)	Sample Item
Leadership	...leads, organises, gives orders, determines procedure & structure the classroom situation.	This teacher talks enthusiastically about his/her subject.
Helping/Friendly	...shows interest, behaves in a friendly or considerate manner & inspires confidence and trust.	This teacher helps us with our work.
Understanding	...listens with interest, empathises shows confidence and understan & is open with students.	This teacher trusts us.
Student Responsibility/Freedo	...gives opportunity for independ work, gives freedom and responsibility to students.	We can decide some things in this teachers class.
Uncertain	...behaves in an uncertain manne keeps a low profile.	This teacher seems uncertain.
Dissatisfied	...expresses dissatisfaction, looks unhappy, criticises & waits for silence.	This teacher thinks that we cheat.
Admonishing	...gets angry, express irritation an anger, forbids & punishes.	This teacher gets angry unexpectedly.
Strict	...checks, maintains silence & strictly enforces the rules.	This teacher is strict.

Some Previous International Studies with 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 .76 to .84 for student responses and from .74 to .84 for teacher responses.

Another use of the QTI in The Netherlands involved investigation of relationships between perceptions on the QTI scales and student learning outcomes (Wubbels, Brekelmans, & Hooymayers, 1991). Regarding students' cognitive outcomes, the more that teachers demonstrated strict, leadership and helpful/friendly behaviour, then the higher were cognitive outcomes scores. Conversely, student responsibility

and freedom, uncertain and dissatisfied behaviours were related negatively to achievement.

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 they do.

Variations in the students' attitudes toward 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, helping/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.

Levy, Créton, 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. Students rated their best teachers as being strong leaders and as friendly and understanding. The characteristics of the worst teachers were that they were more admonishing and dissatisfied.

Levy, Wubbels, Brekelmans, and Morganfield (1997) investigated a sample of 550 high school students in 38 classes comprised of three primary investigation groups, namely 117 Latinos, 111 Asians and 322 from the United States. The primary foci of this study were the language and cultural factors in students' perceptions of teacher communication style. This study focused on identifying ways in which the students' culture relates to student perceptions of their teachers. The results from this study suggested that the students' cultural background is indeed significantly related to the perceptions that they had of their teachers' interaction behaviour. The study also concluded that teachers do not seem to be aware of cultural differences in their interactions with students in their classes in the same way as their students were, despite altering their behaviour in classes with different cultural compositions. These findings are also supported in a study by Rickards, (1998) with an examination of multiple cultural backgrounds in an Australian context.

The Australian version of the QTI containing 48 items was used in a pilot study involving upper secondary science classes in Western Australia and Tasmania (Fisher, Fraser, & Wubbels, 1993; Fisher, Fraser, Wubbels, & Brekelmans, 1993; Fisher, Henderson, & Fraser, 1995). This pilot study strongly supported the validity and potential usefulness of the QTI within the Australian context, and suggested the desirability of conducting further and more comprehensive research involving the QTI.

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.

The cultural aspects of teacher-student interpersonal behaviour have been investigated in several recent studies. For example, Fisher, Rickards, Goh, and Wong(1997) examined perceptions of interpersonal teacher behaviour in secondary science classrooms in Singapore and Australia. Another by Rickards(1998) reported on gender and cultural differences in teacher-student interpersonal behaviour. These studies both reported that there were cultural differences in teacher-student interpersonal behaviour and that Asian students in particular perceived their learning environments more positively than did other cultural groups for two indicator variables for cultural background, namely birthplace of parents and primary language spoken at home.

Design and Procedure

The aims of the proposed study were to provide further validation information for the student and teacher versions of the QTI, (in terms of reliability and ability to differentiate between different groups of students), when used with a large Australian sample. To investigate differences in the perceptions of science teachers and their students; and to investigate differences in teachers' actual and ideal perceptions of teacher interactions. The final practical application of the study was to examine the use of the QTI as an effective means by which to monitor and reflect on teacher-student interpersonal behaviour.

The following research questions were proposed.

1. Are the three forms of the QTI that examine student and teacher perceptions of the classroom leaming environment valid and reliable in lower secondary science classes in Australia?
2. Are there differences in teachers' and students' perceptions of teacher-student interpersonal behaviour?
3. Are there differences in teacher actual and teacher ideal perceptions?
4. Can the QTI be efficiently used by teachers as a tool for self-reflection?

The total sample involved 3,589 students in 173 science classes spread approximately equally between grades 8, 9 and 10 in 35 different schools. The sample was composed of 173 science classes at the lower secondary levels in two Australian states, namely, Tasmania and Western Australia. Each student in the sample responded to the student version of the QTI while their 164 teachers completed the teacher self and teacher ideal versions.

Findings

Validation of the Questionnaire

The responses to the QTI from this study resulted in a large database consisting of 3,589 students in 173 classes. The responses provide further validation data for the QTI. Table 2 provides information for the QTI when used specifically in the present sample of science classes. Statistics for the student version are reported for two units of analysis, namely, the individual 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 2 shows that the alpha reliability figures for different QTI scales ranged from .63 to .88 when the individual student was used as the unit of analysis, and from .78 to .96 when the class mean

was used as the unit of analysis. These values provide further information supporting the internal consistency of the QTI, with either the individual student or the class mean as the unit of analysis.

Table 2
Internal Consistency (Cronbach Alpha Coefficient) and Ability to Differentiate Between Classrooms for Student and Teacher versions of the QTI

Scale	Teacher		Student		
	Actual	Ideal	Unit of Analysis	Alpha Reliability	ANOVA Results(eta^2)
Leadership	.88	.81	Individual	.82	.33*
			Class Mean	.93	
Helping/ Friendly	.92	.86	Individual	.88	.35*
			Class Mean	.96	
Understanding	.88	.83	Individual	.85	.32*
			Class Mean	.95	
Student Resp/ Freedom	.79	.65	Individual	.66	.26*
			Class Mean	.82	
Uncertain	.78	.69	Individual	.72	.22*
			Class Mean	.87	
Dissatisfied	.84	.78	Individual	.80	.23*
			Class Mean	.93	
Admonishing	.79	.75	Individual	.76	.31*
			Class Mean	.87	
Strict	.72	.62	Individual	.63	.23*
			Class Mean	.78	

*$p<.001$ n = 3515 students and 164 teachers in 173 classes.

Table 2 also indicates that the alpha reliability figures for different QTI scales using the teacher sample was somewhat lower and ranged from .72 to .92 for the teacher actual version of the QTI and .62 to .86 for the teacher ideal version of the QTI. These reliability figures are all above the 0.60 level proposed by Nunnally (1967; 1978), as a "suggested acceptable level for research purposes".

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 for each scale of the QTI using a 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 .22 to .35 for different scales.

Differences Between Students and Their Teachers

In order to investigate if students perceived teacher-student interactions differently from their teachers, scale mean scores were calculated for each of the teacher and student samples and compared.

As indicated in Table 3, statistically significant differences were apparent in the responses to six of the eight scales of the QTI. Teachers considered that they exhibited greater leadership, helping/friendly and understanding behaviours than did their students.

Table 3
Scale Means and Standard Deviations for Teachers and Science Students' Scores on the Eight Scales of the QTI

Scale	Scale Mean		Difference	Standard Deviation		F value	
	Teacher Actual	Student Actual	(Tchrs score - Studs score)	Teachers	Students		
Leadership	3.04	2.74	.30	.34	.73	26.26	**
Helping/ Friendly	3.31	2.83	.48	.41	.86	50.18	**
Understanding	3.19	2.83	.36	.37	.79	34.37	**
Student Resp/ Freedom	1.48	1.75	-.27	.45	.65	26.31	**
Uncertain	.81	1.01	-.20	.48	.69	14.17	**
Dissatisfied	.92	1.11	-.19	.44	.78	9.22	**
Admonishing	1.04	1.40	-.36	.45	.80	31.98	**
Strict	1.98	1.78	.20	.44	.65	14.09	**

* $p<.05$ teachers n = 164
** $p<.01$ students n = 3515

The students considered their teachers were more uncertain, dissatisfied and admonishing than did their teachers. The differences generally indicate that teachers believed they were more cooperative and less oppositional in the classrooms than their students perceived.

Student data generally indicates that students saw their classroom as less positive than did their teachers who believed they were more cooperative and less oppositional in the classrooms than did their students.

Differences Between Teachers' Self Perceptions and Their Ideals
Table 4 presents the differences that were recorded between the teacher ideal and teacher actual perceptions as collected using the QTI.

Scale mean scores ranged from 0.81 to 3.31 for the teacher actual version and from 0.46 to 3.75 for the Teacher ideal version. These scales were scored on a Likert type scale that ranged from 1 to 5.

If these scale mean scores are examined more closely is possible to see that teacher ideal scale mean scores are higher for the scales of Leadership, Helping/Friendly and Understanding. This suggests that teachers' perceive their ideal teacher as exhibiting more positive behaviours than they currently do.

The teachers considered that they gave more student responsibility and freedom and exhibited more uncertain, dissatisfied and admonishing behaviours than did their ideal teachers. The differences in the teacher actual and teacher ideal scores suggest that teachers would generally like to see increased leadership, helping friendly and understanding behaviours exhibited in the classroom.

Table 4
Scale Means and Standard Deviations for Teacher Actual and Teacher Ideal Scores on the Eight Scales of the QTI

Scale	Scale Mean		Difference	Standard Deviation		F Value	
	Teacher Actual	Teacher Ideal	(Ideal-Actual)	Actual	Ideal		
Leadership	3.04	3.75	0.71	.34	.25	461.05	**
Helping/ Friendly	3.31	3.69	0.38	.41	.33	90.00	**
Understanding	3.19	3.62	0.43	.37	.33	122.33	**
Student Resp/ Freedom	1.48	1.42	-0.06	.45	.42	1.88	
Uncertain	0.81	0.46	-0.35	.48	.49	42.3	**
Dissatisfied	0.92	0.69	-0.23	.44	.49	19.87	**
Admonishing	1.04	0.51	-0.53	.45	.46	109.80	**
Strict	1.98	1.98	0.00	.44	.47	0.09	

* $p<.05$ teachers n = 164 **$p<.01$ students n = 3351

Use of QTI by Teachers as a Tool for Self Reflection

After having completed the QTI and having had time to consider the results supplied to them, science teachers reported that they had been stimulated to reflect on their own teaching and verbal communication in the classroom. For example, one teacher concluded that she had become more aware of her students' need for clear communication and that this had become a focus for her in improving her classroom teaching.

One teacher, who had recently retumed to teaching full-time after an absence from teaching of 14 years, found the information provided particularly useful in comparing the classroom environment perceptions of her students with her own perceptions. It was interesting for her to note that the perceptions of the classroom environment that the students held were very similar to her own. This proved to be a reassuring and reinforcing finding because it suggested that she was meeting the individual needs of the students without compromising her own standards.

When teachers were asked if they agreed with the results for their classrooms, the findings were revealing. Though teachers agreed with the results, they acknowledged they raised further questions relating to their individual teaching practice. For example, the dimension of Helping/Friendly on the QTI produced a surprise for one teacher where students' perceived a lower level of teacher helping/ friendly behaviour than did the teacher. This suggested to the teacher that the students either needed more help than the teacher was able to give, or perhaps that the students really 'lapped up' the nurturing and wanted more.

Conclusions

In response to the initial research questions, this study has found that the three forms of the QTI that examine student and teacher perceptions of the classroom learning environment are valid and reliable instruments. They can be used

effectively by science teachers to assess teacher-student interpersonal behaviours in their lower secondary science classes in Australia.

This study showed that there were differences in teacher and student perceptions of teacher-student interpersonal behaviour and that teachers tend to perceive their classes more positively than their students.

Differences in teacher actual and teacher ideal perceptions were apparent. The data tended to suggest that teachers perceived their ideal teacher as being more positive than they currently are.

The QTI can be efficiently used by teachers as a tool for self-reflection. The three versions of the QTI allow science teachers to obtain their students' perceptions of their interpersonal behaviour, their own perceptions and the behaviour that they consider being ideal. Teachers can use this valuable information as a basis for self-reflection. Based on this information, teachers might decide to change the way they behave in an attempt to create a more desirable classroom environment for their students.

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