TEACHER INTERPERSONAL BEHAVIOUR: ITS INFLUENCE ON STUDENT MOTIVATION IN SCIENCE

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ABSTRACT

This paper presents the findings from research in Australian Junior Science classrooms that utilized the *Questionnaire on Teacher Interaction* (QTI) and the *Students' Motivation, Attitude and Self-Efficacy in Science* (SMASES) questionnaire. It will highlight students' perceived levels of teacher interpersonal behaviour and examine to what extent teacher interpersonal behaviour influences student motivation. Not only does teacher interpersonal behaviour have a direct effect on student motivation, but it can also determine high quality and valuable learning. Three aspects of student motivation are statistically analysed in relation to teacher interpersonal behaviour in this paper: achievement goal, student learning and performance goals.

INTRODUCTION

The focus in this paper is to present an overview of the impact that teacher interpersonal behaviour has on students' motivation in science classrooms. Learning experiences in the classroom that initiate motivation may differ from those that sustain it. It is recognized that motivation is an essential tool for enhancing classroom learning. The importance that teacher interpersonal behaviour plays in influencing the responsiveness of students to set tasks cannot be underestimated. Motivated students possess a desire to learn and invariably to achieve. The level of motivation adopted by students, may be determined by the manner in which scientific concepts are delivered to them. Wubbels and Levy (1993) asserted that effective teaching involves a methodical or organisational element, but more importantly relies on interpersonal actions that create and maintain a positive classroom atmosphere.

The Questionnaire on Teacher Interaction (QTI)

Much of the work accomplished on teacher interpersonal behaviour stemmed from research that began in The Netherlands in the 1970s. The focus of the *Education for Teachers* project was to target beginning teachers and identify the problems they experienced, with the intention of providing better pre-service opportunities for teachers. In 1985, Wubbels, Créton, and Hooymayers developed a model of interpersonal behaviour (see Figure 1) that was developed from Leary's (1957) work that initiated the construction of the instrument *The Questionnaire on Teacher Interaction* (QTI) to gather information about perceptions about teacher-student interactions (Wubbels, Brekelmans, & Hooymayers, 1991; Wubbels & Levy, 1993). The Questionnaire on Teacher Interaction (QTI) 48-item economical version developed in Australia (Wubbels, 1993) was used in this study and a scale description is provided in Table 1.

The original version of the QTI that was developed in the early 1980s in the Netherlands had 77-items (Wubbels, Créton, & Hooymayers, 1985). An American version was developed that contained 64-items (Wubbels & Levy, 1991) confirmed the cross-cultural validity and usefulness of the QTI. 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. Several studies on the reliability and validity of the QTI have been implemented (Wubbels, Brekelmans, den Brok, & van Tartwijk, 2006) and in an American sample (Wubbels & Levy, 1989). Thus, the QTI can reliably present feedback to teachers about their interpersonal behaviour on the basis of class means.

Table 1
Description and Example Items for Each Scale in the QTI

Scale	Description	Item
DC Leadership	Extent to which the teacher provides leadership to the class and holds student attention	This teacher explains things clearly.
CD Helping/ Friendly	Extent to which the teacher is friendly and helpful towards students	This teacher is friendly.
CS Understanding	Extent to which the teacher shows understanding and care to students	If we don't agree with this teacher, we can talk about it.
SC Student Responsibility/ Freedom	Extent to which the students are given opportunities to assume responsibilities for their own activities	We can influence this teacher.
SO Uncertain	Extent to which the teacher exhibits her/his uncertainty	This teacher seems uncertain.
OS Dissatisfied	Extent to which the teacher shows unhappiness/dissatisfaction with the students	This teacher thinks that we know nothing.
OD Admonishing	Extent to which the teacher shows anger/temper and is impatient in class	This teacher gets angry.
DO Strict	Extent to which the teacher is strict with demands of the students	We are afraid of this teacher.

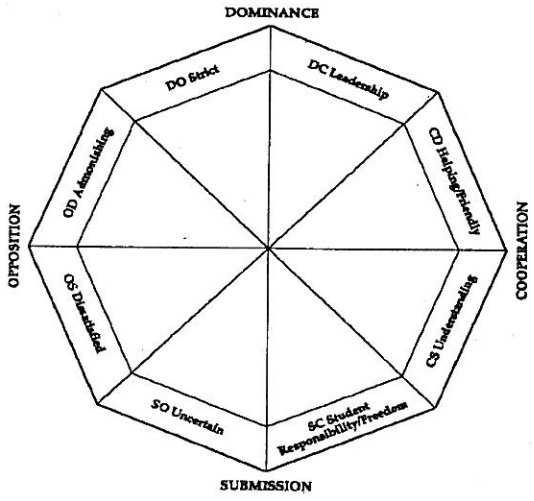

Figure 1. The Model of Teacher Interpersonal Behaviour.

Previous uses of the QTI in Australia

Initially in Australia, the QTI was utilized in a study that investigated associations between school learning environment and teacher interpersonal behaviour (Fisher, Fraser, & Wubbels, 1993; Fisher, Fraser, Wubbels, & Brekelmans, 1993). The investigation was conducted in seven schools in Western Australia and Tasmania. The total number of students who completed the QTI was 792. The major finding in this study was that there was a weak relationship between the QTI and the School Level Environment Questionnaire (SLEQ) scores and that a teacher's behaviour in class has little impact on how one perceives the school environment. Fisher, Henderson, and Fraser (1995) completed a study in Tasmania using the QTI for the first time in senior high school biology classes. The study successfully revealed cross-validation for the QTI when used in biology classes. The Cronbach alpha reliability figures for different QTI scales ranged from 0.63 to 0.83 for individual student analysis, and from 0.74 to 0.95 when the class mean was the unit of analysis. Results confirmed the internal consistency of the QTI and were similar to results reported in the USA (Wubbels & Levy, 1991).

Students' motivation toward science learning

The 32-item SMASES that was used in this study was formed by adapting relevant sections of the *Students' Motivation Towards Science Learning* (SMTSL) (Tuan, Chin, & Shieh, 2005) to measure student motivation (14 items); the Attitudes Towards Science scale (10 items) based on the *Test of Science-Related Attitudes* (TOSRA) (Fraser, 1981) that measured students' enjoyment of science; and an academic self-efficacy scale (8 items) taken from an instrument called the *Attitude and Efficacy Questionnaire* (AEQ) (Fisher, Aldridge, Fraser, & Wood, 2001). All three instruments had high internal consistency and proved to be valid for use in this research. The combination of aspects of the SMTSL, TOSRA and the AEQ and an extensive review of their past uses, secured the need to devise the SMASES. Fourteen questions assessed three aspects of motivation, *Science Learning Value, Performance Goals and Achievement Goals.* Table 2 provides a description of each scale and a sample item from the SMASES.

Table 2
Description and Example Items for Each of the Motivation Scales of the SMASES

Scale	Description	Item
Science Learning Value	The importance of science in learning	I think that learning science is important because I use it in my everyday life.
Performance Goal	Reason for participating in science classes	I participate in science to get a good grade.
Achievement Goal	Explaining student fulfillment in science classes	During a science course I feel most fulfilled when the teacher accepts my ideas.

METHODOLOGY

The purpose of this study was to investigate teacher interpersonal behaviour and its effect on student motivation in science. The research was conducted in a private girls' college in Brisbane, Australia, where the researcher was employed. The school's population was approximately 520 students who were of varying socio-economic background. The study entailed collecting data from 313 students from the 12 classes of junior (year levels 8, 9 and 10) science, that is, the classes of five female science teachers including the researcher's classes. Students who answered the questionnaires were studying various topics in science, including anatomy and physiology, earth science, chemistry and physics units. Both questionnaires, the QTI and the SMASES were designed so that the students answered the questions directly on to the answer sheet and in close proximity to the question. Students responded to the QTI on a scale from 0 to 4 (Never to Always) and to the SMASES on a scale ranging from 5 (Strongly Agree) to 1 (Strongly Disagree).

RESULTS AND DISCUSSION

Validation of the QTI

Table 3 shows that the alpha coefficient calculated in this study for different QTI scales ranged from 0.64 for the Admonishing scale to 0.87 for the Helping/Friendly scale, which are above the recommended 0.60 (Nunnally, 1967), thus illustrating solid reliability.

Table 3
Internal Consistency (Alpha Reliability) and Ability to Differentiate Between Classrooms for the QTI Scales

Scale	Alpha Reliability	ANOVA results (eta^2)
DC Leadership	0.84	0.16***
CD Helping/Friendly	0.87	0.26***
CS Understanding	0.82	0.19***
SC Student Responsibility/ Freedom	0.65	0.10***
SO Uncertain	0.75	0.07***
OS Dissatisfied	0.79	0.13***
OD Admonishing	0.64	0.21***
DO Strict	0.74	0.30***

*** $p<0.001$ n = 313

Copious amounts of research using a one-way ANOVA have been carried out. It has been concluded that the QTI has the ability to be able to differentiate between the perceptions of students in different classrooms. Students in the same classroom should perceive their environment similarly, however, class perceptions should alter from class to class. This concept was checked for the classes in this study by using a one-way ANOVA, with class membership as the main effect. It was found that that each QTI scale differentiated significantly between classes ($\rho<0.001$) and the eta^2 statistic (Table 3), representing the proportion of variance in scale scores (class membership) ranged from 0.07 for the Uncertain scale to 0.30 for the Strict scale, indicating adequate scale differentiation. This analysis indicates that each scale of the QTI is capable of differentiating significantly between classes and it is a valid instrument to measure students' perceptions of teacher-student interpersonal behaviour.

Scale means

The scale means in Table 4 reveal that students perceived that their teachers were strongest in understanding and helping/friendly behaviour, followed closely by displaying good levels of leadership. Students perceived their teachers as exhibiting low levels of uncertain, dissatisfied and admonishing behaviour and seldom allowing student responsibility or being overly strict.

Table 4
Scale Means and Standard Deviations for QTI Scales

Scale	Scale Means	Standard Deviation
DC Leadership	2.74	0.74
CD Helping/Friendly	2.86	0.86
CS Understanding	2.91	0.76
SC Student Responsibility/Freedom	1.53	0.60
SO Uncertain	0.74	0.65
OS Dissatisfied	0.84	0.72
OD Admonishing	1.37	0.67
DO Strict	1.81	0.74

n = 313

Inter Scale correlations

The circumplex nature of the QTI was also checked. Generally, the scale correlations test the circumplex nature of the QTI, that is, the scales should correlate closely with adjacent scales and negatively with those opposite. That is, as one moves around the model, the correlations should become lower. These figures and the scale correlations in Table 5 and the example in Figure 2 confirm the assumptions of the circumplex nature of the Model of Interpersonal Behaviour (Wubbels, Créton, Levy, & Hooymayers, 1993).

Table 5
QTI Inter Scale Correlations

	CD	CS	SC	SO	OS	OD	DO
DC	0.73	0.74	0.11	-0.53	-0.57	-0.41	-0.39
CD		0.81	0.34	-0.46	-0.60	-0.47	-0.56
CS			0.34	-0.47	-0.63	-0.57	-0.58
SC				0.11	-0.10	-0.13	-0.32
SO					0.57	0.42	0.34
OS						0.55	0.60
OD							0.50

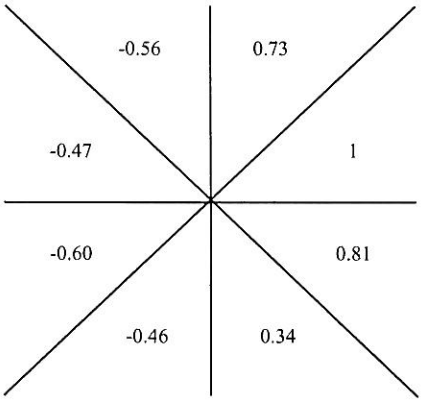

Figure 2. Example of interscale correlations for the Helping/Friendly scale.

These results confirm the circumplex nature of the QTI, further justifying that the QTI can be used with confidence to examine teacher interpersonal behaviour and classroom environment.

VALIDATION OF SMASES

Another main objective of this study was to determine the validity of the motivation scales of the SMASES. It was the intent of this research to use the SMASES to measure students' levels of motivation in science. These measures were then able to be correlated against the scales of the QTI to identify the type of teacher that students' perceived enhanced their motivation to learn science.

Internal consistency

The alpha reliabilities for the three motivation scales of the SMASES recorded in Table 6, show 0.80 for Student Learning, 0.75 for Performance Goal and 0.81 for Achievement Goal. These values provide evidence

to suggest that the SMASES is a reliable instrument designed to evaluate students' perceptions of their motivation in science.

Table 6

Internal Consistency Alpha Reliability for the SMASES

Scale	Alpha Reliability
Student Learning	0.80
Performance Goal	0.75
Achievement Goal	0.81

n = 313

Having provided evidence of the reliability and validity for the QTI and SMASES, associations between the QTI scales and the SMASES scales were then investigated.

ASSOCIATIONS BETWEEN QTI SCALES AND SMASES SCALES

This study investigated associations between the outcomes of student motivation and the eight scales of the QTI. Simple (r) and multiple (R) correlation analyses were used on the data that were collected from 313 students. In this research, the simple correlations (r) describe the bivariate associations between the outcomes and each scale of the QTI. The multiple correlation (R) describes the multivariate association between an outcome and a specific scale, when all other scales are controlled.

Achievement goals and teacher-student interpersonal behaviour

The simple correlation data (r) in Table 7 indicate that all associations between students' achievement goals and the QTI scales are statistically significant, except for the Strict scale. That is, teachers' strict behaviour does not have a significant statistical influence on determining students' achievement goals. Again the Leadership, Helping/Friendly, Understanding and the Student Responsibility and Freedom scales have a positive influence on students being motivated to achieve in science. Whereas, uncertain, dissatisfied and admonishing behaviours have a negative impact on students' desire to achieve. When the interrelationships of the QTI scales are controlled and the standard regression weights (β) are examined, two out of the eight scales produce significant relationships. The Leadership scale remains a significant ($p<0.05$) influence on student achievement goals in science and the Strict scale becomes significant ($p<0.05$). It is noted that the effect of the Strict scale is apparently masked by associations with the other scales in the simple correlation. The multiple correlation (R) statistic of 0.39 ($p<0.001$) suggests that there is a strong association between students' perceptions of teacher-student interpersonal behaviour, as measured by the QTI and students' achievement goals, thus, motivation in science. The R^2 statistic indicates that 15% of the variance in students' achievement goals is explained by students' perceptions of teacher-student interpersonal behaviour.

Table 7

Significant Associations between QTI Scales and Achievement Goals in Science in terms of Simple Correlations (r) and Standardised Regression Coefficients (β)

Scales	r	β
Leadership	0.35**	0.20*
Helping/Friendly	0.33**	0.14
Understanding	0.32**	0.13
Student Responsibility/Freedom	0.13*	0.07
Uncertain	-0.18**	-0.01
Dissatisfied	-0.21**	-0.02
Admonishing	-0.15**	0.01
Strict	-0.10	0.18*
Multiple R	$R = 0.39$***	$R^2 = 0.15$

*$p< 0.05$ **$p< 0.01$ ***$p<0.001$ n=313

Student learning and teacher-student interpersonal behaviour

The simple correlation (r) data in Table 8 indicates that all associations between the value students place on learning and the QTI scales are statistically significant, except for the Student Responsibility and Freedom scale. Moreover, there are significant positive associations with the Leadership, Helping/Friendly and Understanding scales and negative associations with the Uncertain, Dissatisfied, Admonishing and Strict in relation to student learning. Thus, the positive influences on student learning can be attributed to teacher interpersonal behaviour that displays leadership, helping/friendly and understanding traits. The uncertain, dissatisfied and admonishing behaviour of teachers has a significant negative impact or decreases the importance that students place on learning. An examination of the student learning outcomes regression weights (β) indicate that only one of the seven scales retain their statistical significance. Thus teachers' leadership behaviours are most influential on students' motivation to learn science. The multiple correlation (R) statistic of 0.53 ($p<0.001$) indicates a significant association between teacher-student interpersonal behaviour and students' learning value aspect of motivation. The R^2 statistic indicates that 28% of the variance in students' learning can be attributed to their perceptions of teacher interpersonal behaviour.

Table 8
Significant Associations between QTI Scales and Student Learning Value in Science in Terms of Simple Correlations (r) and Standardised Regression Coefficients (β)

Scales	r	B
Leadership	0.50**	0.36***
Helping/Friendly	0.45**	0.15
Understanding	0.43**	0.04
Student Responsibility/Freedom	0.09	-0.02
Uncertain	-0.24**	0.10
Dissatisfied	-0.37**	-0.12
Admonishing	-0.26**	-0.01
Strict	-0.25**	0.03
Multiple R	$R = 0.53$***	$R^2 = 0.28$

**$p<0.01$ ***$p<0.001$ n=313

Performance goals and teacher-student interpersonal behaviour

In Table 9, the simple correlation (r) data identifies four of the eight scales of the QTI as being positively associated with students' performance goals. With performance goals as the dependent variable, the Leadership, Helping/Friendly, Understanding and Student Responsibility and Freedom scales are statistically significant. Using the more conservative standardised regression coefficient (β) it is obvious that the Leadership and Student Responsibility and Freedom retained their significance, and the Strict scale became significant, thus having an impact on the level of students' performance goals. The multiple correlation was 0.38 which was statistically significant and the R^2 value of 0.15 illustrated that 15% of the variance in students' performance goals was indicative of their teachers' interpersonal behaviour.

Table 9
Significant Associations between QTI Scales and Performance Goals in Science in terms of Simple Correlations (r) and Standardised Regression Coefficients (β)

Scales	r	β
Leadership	0.32**	0.31**
Helping/Friendly	0.27**	0.16
Understanding	0.24**	-0.01
Student Responsibility/Freedom	0.15**	0.13*
Uncertain	-0.11	0.02
Dissatisfied	-0.11	0.04
Admonishing	-0.10	-0.02
Strict	-0.02	0.19**
Multiple R	$R = 0.38$***	$R^2 = 0.15$

*$p<0.05$ **$p<0.01$ ***$p<0.001$ n=313

CONCLUSIONS

The primary goal of this study was to confirm the validity of the QTI in junior science classrooms. The QTI demonstrated acceptable reliability and validity and substantiated its ability to differentiate between classrooms. The interscale correlations fitted the circumplex model and the scale means illustrated that students perceived their teachers to be good leaders, helping/friendly and understanding. The second goal was to investigate the associations between the QTI and the motivation scales of the SMASES.

This research is effective, in that for the first time it presents the feasibility of using the QTI in conjunction with the SMASES to assess teachers' impact on students' motivation towards science. Comparisons of teachers' interpersonal behaviour and its effectiveness on student motivation as perceived by students, evinced that students are most receptive to teachers who display understanding, helpful/friendly and leadership qualities in the classroom.

This study certainly alerts teachers to the perceptiveness of young adolescents. Such research offers avenues by which teachers can reflect upon ways in which they can modify their interpersonal behaviour in order to increase, re-direct or challenge students' motivation. It is a distinctive study by the manner in which it identifies viable means for teachers to better manage their classroom environment. It is evident from this research that deterioration in teacher-student relationships in the classroom can repress students' motivation for science.

The three areas of motivation addressed in the SMASES, Achievement Goals, Student Learning and Performance Goals were influenced by students' perceptions of teacher interpersonal behaviour. These results were highlighted in Tables 7, 8 and 9 and suggested that students' achievement goals were positively influenced by teachers' leadership and strict behaviours. Student learning was significantly influenced by the depth of leadership teachers exhibited in the science classroom. Performance goals by students were influenced by the quality of teacher leadership, the perceived amount of student responsibility and freedom teachers provided for their students and by teachers' strict behaviours they illustrated when controlling the class.

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