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ABSTRACT

This bulletin presents research findings about the interpersonal relationships between science and mathematics teachers and their students. This research is based on studies that used the Questionnaire on Teacher Interaction which gathers data on students' and teachers' perceptions of interpersonal teacher behavior. A reproducible copy of the questionnaire is included and discussed. A study in Australia used a model for interpersonal teacher behavior with two axes--dominance/submission and cooperation/opposition. Results focused on actual classroom behavior and students' perceptions of ideal teachers. A study in the Netherlands investigated interpersonal teacher behavior and its relationship to student achievement and attitudes. Conclusions from both studies show that interpersonal teacher behavior is an important aspect of the learning environment, and is strongly related to student outcomes. (MKR)

What Research Says to the Science and Mathematics Teacher

National Key Centre for School Science and Mathematics Number 11

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TEACHER-STUDENT RELATIONSHIPS IN SCIENCE AND MATHEMATICS CLASSES

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SOME TEACHERS can get on better with their students than others. But do students learn more from teachers with whom they relate well? Although teachers often have distinct opinions about what is the best way in which to relate to students, different teachers' opinions vary markedly.

In the school staff room, it sometimes can be heard that students need a strict, disciplined environment in which to learn. "Students will not engage in learning activities themselves if teachers do not control their work and demand a lot of them. If there is too much freedom in class, students will be distracted from the real work; a cosy atmosphere will not promote student outcomes." Other teachers, however, advocate student responsibility for their learning and a pleasant classroom atmosphere for promoting student outcomes. "If students like the lessons and if there is a pleasant stimulating atmosphere, they will be stimulated to study, which is an important prerequisite for learning, and consequently they will thrive. It is more important to reward students for their efforts and the things that they do well than it is to correct their mistakes."

The language that teachers use makes their position clear. The teacher who thinks that students need tight rules will talk disapprovingly about a 'cosy classroom', whereas the one who takes the opposite position would talk about 'attractive, pleasant lessons'.

This publication presents research findings about the interpersonal relationships between science and mathematics teachers and their students. It also sheds some light on other questions such as: What preferences do students have about their relationships with their teachers? How would teachers like to behave towards students? What teacher-student relationships are common in Australian science and mathematics classrooms?

This research is based on studies that used the *Questionnaire on Teacher Interaction (QTI)* to gather students' and teachers' perceptions of interpersonal teacher behaviour. Readers who are interested in the details of the studies or the methods used are referred to Brekelmans, Wubbels and Créton (1990), Wubbels, Brekelmans and Hooymayers (1991) or Wubbels, Créton and Hooymayers (1992). Below, we first describe this questionnaire, which is yet another example of the range of instruments available for assessing classroom environments (Fraser, 1989).

QUESTIONNAIRE ON TEACHER INTERACTION (QTI)

THE QUESTIONNAIRE on Teacher Interaction can be used to map students' and teachers' perceptions using a model for interpersonal teacher behaviour. In this model, teacher behaviour has a *Proximity Dimension* (Cooperation, C – Opposition, O) and an *Influence Dimension* (Dominance, D – Submission, S). These dimensions can be represented in a coordinate system divided into eight equal sections (see Figure 1). Every instance of interpersonal 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 sectors are labelled DC, CD, etc. 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 the adjacent sector CD includes behaviours of a more cooperative and less dominant character. To clarify the concepts covered by each sector, Figure 1 shows typical behaviours for each sector.

The long form of the Australian version of the Questionnaire on Teacher Interaction has 64 items which are answered on a five-point scale. The items belong to eight scales, each consisting of eight items and corresponding to one of the eight sections of the model. Examples of items are "This teacher is friendly" (CD) and "This teacher gets angry unexpectedly" (OD). The scores for each item within the same sector 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.

The questionnaire has satisfactory reliability.

Information about the reliability of the questionnaire is presented in Appendix A for American, Australian and Dutch samples. It appears that all scales have satisfactory reliability. Information about the validity of the QTI is reported in Wubbels and Levy (1991, 1993).

An economical short version of the QTI is available for use by teachers to gather information about students' (or the teacher's) perceptions of classes. This version has 48 items, six for every sector of the model of interpersonal teacher behaviour in Figure 1. A complete copy of this short version of the QTI, in a form that may be reproduced by teachers for use in their own classrooms, is provided as a Supplement.

In order to facilitate hand scoring, the items are arranged in cyclic order and in blocks of four. Items 1 to 24 in the Supplement assess the four scales called *Leadership* behaviour, *Understanding* behaviour, *Uncertain* behaviour and *Admonishing* behaviour, whereas Items 25 to 48 assess the scales *Helpful/Friendly* behaviour, *Student Responsibility and Freedom* behaviour, *Dissatisfied* behaviour and *Strict* behaviour.

In the top half of the questionnaire in the Supplement, the first item in every block assesses *Leadership* behaviour (Lea), the second one *Understanding* behaviour (Und), the third one *Uncertain* behaviour (Unc) and the fourth one *Admonishing* behaviour (Adm). The items in the lower half of the questionnaire in the Supplement are also grouped in blocks of four to assess *Helpful/Friendly* behaviour (HFr), *Student Responsibility and Freedom* behaviour (SRe), *Dissatisfied* behaviour (Dis) and *Strict* behaviour (Str).

The total score for a particular scale is simply the sum of the circled numbers for the six items belonging to that scale. Omitted or invalid responses are scored 3. For example, the Uncertain behaviour scale total is obtained by adding the scores given to Items 3, 7, 11, 15, 19 and 23. Figure 2 gives an example of how the top half of the questionnaire (Items 1-24) was scored to obtain a total score of 19 for Leadership behaviour, etc.

A STUDY IN AUSTRALIA

WE GATHERED data about Australian secondary school students' perceptions of the interpersonal behaviour of their science

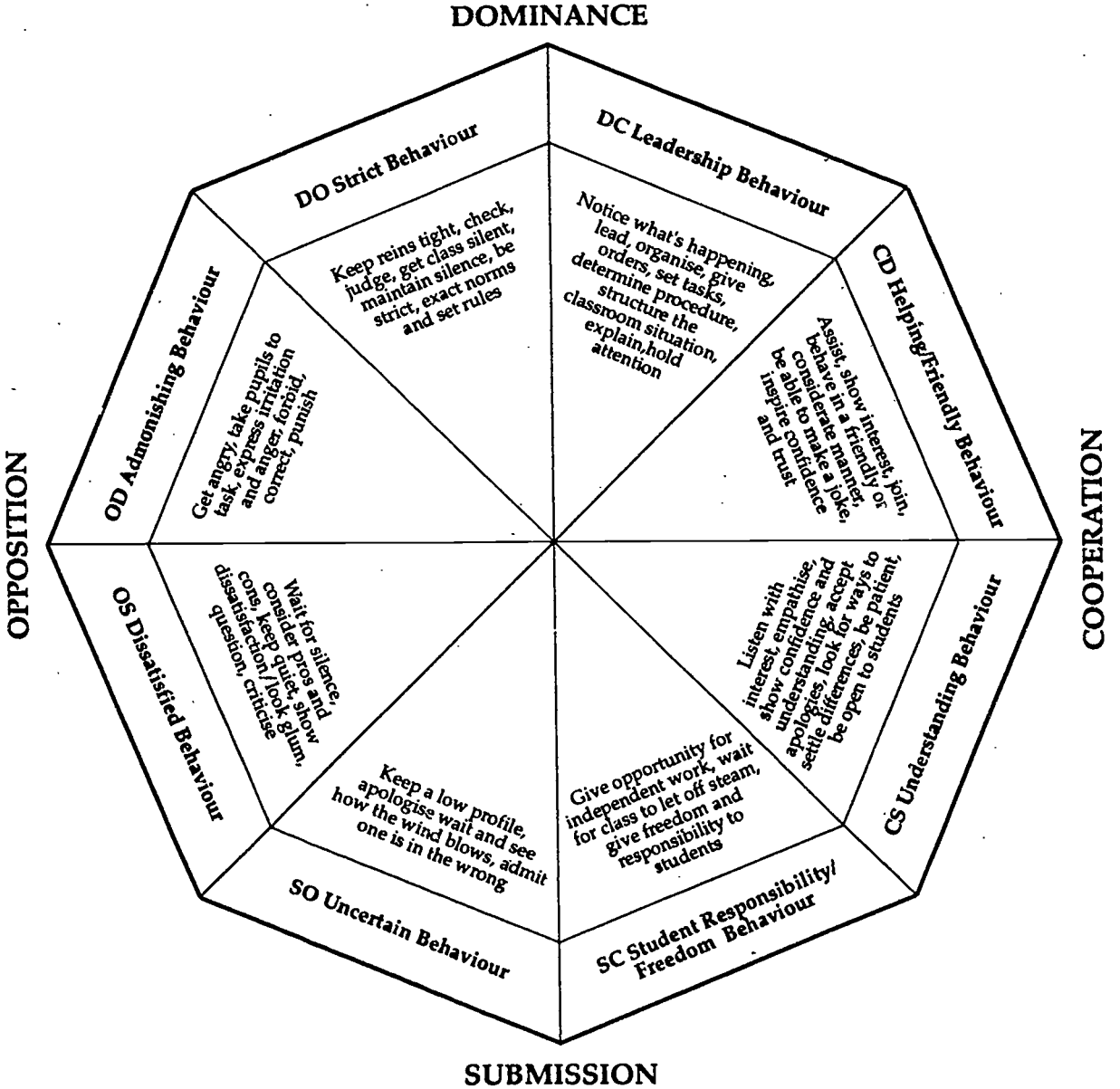

FIGURE 1: The Model for Interpersonal Teacher Behaviour

	Never Always	Teacher Use
1. This teacher talks enthusiastically about her/his subject.	0 1 2 3 (4)	Lea
2. This teacher trusts us.	0 1 2 (3) 4	Und
3. This teacher seems uncertain.	0 (1) 2 3 4	Unc
4. This teacher gets angry unexpectedly.	(0) 1 2 3 4	Adm
5. This teacher explains things clearly.	0 1 2 (3) 4	Lea
6. If we don't agree with this teacher, we can talk about it.	0 1 (2) 3 4	Und
7. This teacher is hesitant.	(0) 1 2 3 4	Unc
8. This teacher gets angry quickly.	0 (1) 2 3 4	Adm
9. This teacher holds our attention.	0 1 2 (3) 4	Lea
10. This teacher is willing to explain things again.	0 1 (2) 3 4	Und
11. This teacher acts as if she/he does not know what to do.	0 1 (2) 3 4	Unc
12. This teacher is too quick to correct us when we break a rule.	0 1 (2) 3 4	Adm
13. This teacher knows everything that goes on in the classroom.	0 1 (2) 3 4	Lea
14. If we have something to say, this teacher will listen.	0 1 2 (3) 4	Und
15. This teacher lets us boss her/him around.	0 (1) 2 3 4	Unc
16. This teacher is impatient.	0 (1) 2 3 4	Adm
17. This teacher is a good leader.	0 1 2 (3) 4	Lea
18. This teacher realises when we don't understand.	0 1 2 3 (4)	Und
19. This teacher is not sure what to do when we fool around.	(0) 1 2 3 4	Unc
20. It is easy to pick a fight with this teacher.	0 1 2 3 4	Adm
21. This teacher acts confidently.	0 1 2 3 (4)	Lea
22. This teacher is patient.	0 1 2 (3) 4	Und
23. It's easy to make a fool out of this teacher	(0) 1 2 3 4	Unc
24. This teacher is sarcastic.	0 (1) 2 3 4	Adm

For Teacher's Use Only: Lea 19 Und 17 Unc 4 Adm 7

FIGURE 2. Illustration of Hand Scoring Procedures for the Four Scales in the QTI Assessed by Items 1-24

and mathematics teachers and perceptions of the behaviour of teachers that students consider to be their best teacher. Teachers were asked for their perceptions of their behaviour and of the behaviour that they would like to display (their ideal). A total of 792 students and their 46 teachers were involved in the study. The sample came from 46 typical Year 11 science and mathematics classes in Western Australia and Tasmania.

Actual Classroom Behaviour

In Figure 3, the average teachers' perceptions and the average students' perceptions of the teachers' behaviour in the classroom are shown graphically as profiles. These profiles for the Australian sample closely resemble those previously found in other countries. According to the teachers themselves and to their students, these teachers are rather high on Leadership, Friendly and Understanding behaviour. Uncertain, Dissatisfied and Admonishing behaviours are far less prominent.

However, there were some important differences between the teachers' and students' perceptions. Teachers on average had higher scores on Leadership, Helpful/ Friendly and Understanding behaviours than their students.

Best Teachers and Teacher Ideals

The teachers' actual behaviour can be compared with the students' perceptions of their best teachers and the teachers' ideals (Figure 3). On average, the teachers do not

Teacher's Name _____ Class _____ School _____

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

For Teacher's Use Only: Lea ____ Und ____ Unc ____ Adm ____ HFr____ SRe ____ Dis ____ Str ____

SUPPLEMENT

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. Thank you for your cooperation.

Don't forget to write the name of the teacher and other details at the top of the reverse side of this page.

This page is a supplement to a publication entitled *Teacher and Student Relationships in Science and Mathematics Classes* authored by Theo Wubbels and published by the national Key Centre for School Science and Mathematics at Curtin University of Technology.

reach their ideal. Also they differ from the best teachers as perceived by students. Best teachers, according to their students, are stronger leaders, more friendly and understanding and less uncertain, dissatisfied and admonishing than teachers on average. Best teachers also give students a little bit more responsibility.

The average teachers' perceptions of their behaviour take a position between the students' perceptions of actual behaviour and the teachers' ideal: the teachers on average think that they behave somewhat more according to their ideal than what their students think. So, they tend to see the learning environment a little more favourably than do their students.

A closer look at the ideals of individual teachers revealed two distinct types of ideals. In the first type, there is a lot of cooperative behaviour and a fair amount of leadership and strictness. The second type, however, shows a lot of behaviour that allows responsibility and freedom for the students in addition to cooperative behaviour. Among students' perceptions of best teachers, two similar types were found. Apparently some students prefer a strict teacher, whereas others prefer to have a lot of responsibility and freedom. From studies in The Netherlands, we know that by and large younger students prefer a teacher who holds the reins tight, whereas older students want to have more responsibility themselves.

A STUDY IN THE NETHERLANDS

WE INVESTIGATED relations between interpersonal teacher behaviour and student achievement and attitudes in the Dutch option of the Second International Science

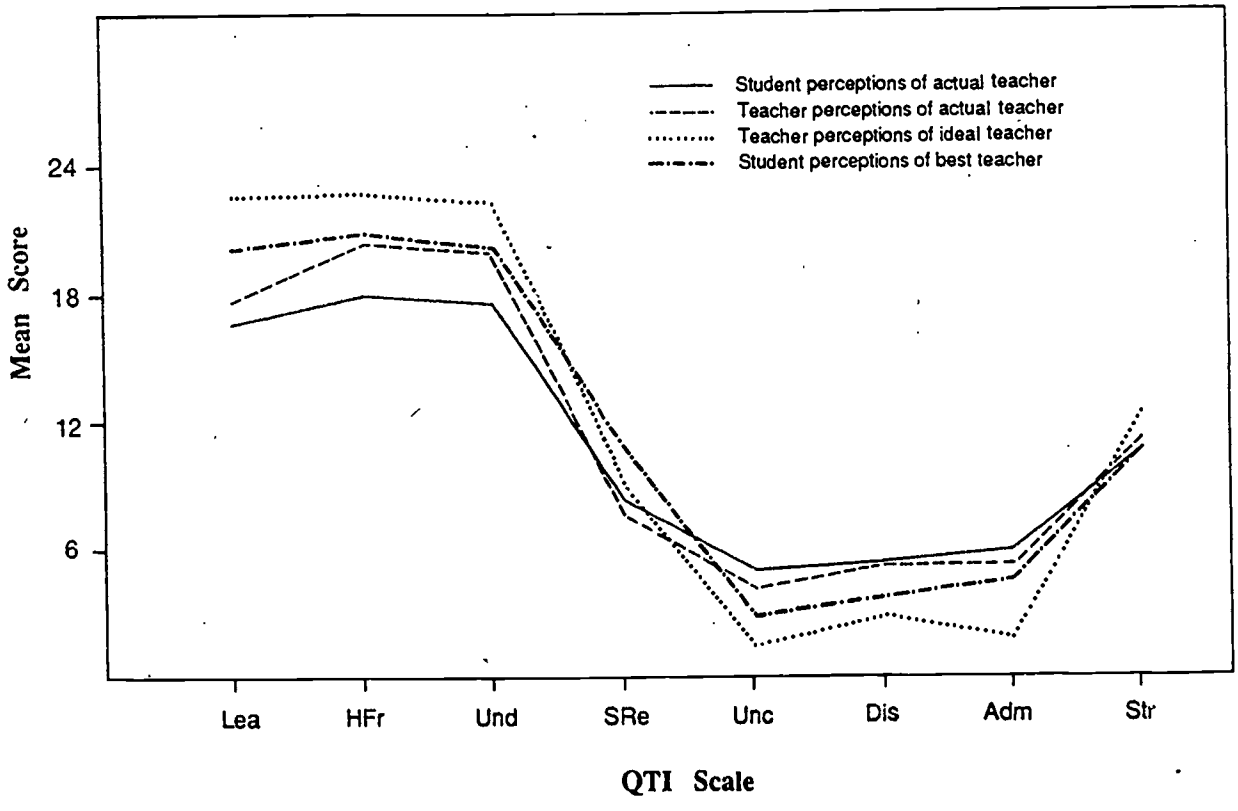

FIGURE 3. Profiles of Mean QTI Scores for Australian Teachers

Study. Teacher characteristics and opinions, teachers' perceptions of their interpersonal behaviour, and different curricula were incorporated into this study. Data were gathered in 66 Grade 9 physics classes. Student achievement was measured with a 23-item standardised and internationally developed test of physics subject matter. Attitudes were assessed with questionnaire items involving the students' experience of and motivation for physics and physics lessons.

Students' perceptions of interpersonal teacher behaviour appear to account for a large amount of the differences in outcomes between classes of the same ability level. The perceptions account for 70% of the variability in student achievement and 55% for attitude outcomes. So, at the class level, interpersonal teacher behaviour is an important factor related to student outcomes. The analyses also showed that the differences between the outcomes of teachers displaying different types of behaviours are far larger than differences in outcomes between teachers using different curricula or teachers of different age or teaching experience.

What interpersonal teacher behaviour is most favourable for student outcomes? When this question was addressed in several ways, the different analyses all pointed in the same direction.

Attitude Outcomes

The Cooperation scales of the model of interpersonal teacher behaviour (SC Student Responsibility and Freedom behaviour, CS Understanding behaviour, CD Helpful/ Friendly behaviour, DC Leadership behaviour) are positively related to student attitudes. The more that teachers show behaviours from these sectors, the more positive are their students' attitudes. The Opposition scales (DO Strict behaviour, OD Admonishing behaviour, OS Dissatisfied behaviour, SO Uncertain behaviour) are all negatively related to attitudes. In terms of the model of interpersonal teacher behaviour, this means that students taught by teachers who show more than the 'average teacher' behaviour in the sectors on the right of the D-S axis and less in the sectors on the left of this axis on average viewed their physics lessons more positively.

Achievement Outcomes

Of the Dominance scales of the model, three scales (DO Strict behaviour, DC Leadership behaviour and CD Friendly behaviour) are positively related to student achievement, whereas three Submission scales (SC Student Responsibility behaviour, SO Uncertain behaviour and OS Dissatisfied behaviour) are negatively related to achievement.

The results presented are in keeping with those from other research, such as Haertel, Walberg and Haertel's (1981) finding that better achievement is found in classes perceived by students as having greater cohesiveness, satisfaction and goal-directedness and less disorganisation and friction.

We can relate the Australian students' perceptions of their best teachers and the teachers' perceptions of the ideal teacher to the results presented about Dutch students' outcomes. Looking at the average profile of the best and ideal teacher, we can expect that this kind of teacher will have superior student outcomes, because they have high scores on scales related positively to student outcomes and low scores on the negatively related scales.

CONCLUSION

THE STUDIES described in this publication show that interpersonal teacher behaviour is an important aspect of the learning environment. It is strongly related to student outcomes. However, strong relations between the curriculum that a teacher uses and student outcomes were not found, thus suggesting that the importance of the curriculum factor in science teaching should not be overestimated. To improve student outcomes, the introduction of new curriculum materials probably has to be accompanied by appropriate changes in teacher behaviour.

Interpersonal teacher behaviour is related to student outcomes.

Most Australian science and mathematics teachers in our sample displayed a lot of interpersonal behaviours that foster student outcomes. Emphasising behaviours from

the leadership, friendly and understanding sectors of the model is likely to promote student outcomes. For uncertain, dissatisfied and admonishing behaviours, the relation is in the opposite direction. If teachers aim to promote both student achievement and attitudes, they are pulled in opposite directions by the conflicting demands of the sectors DO and SC. In order to promote higher achievement, teachers have to be stricter but, to promote better attitudes, they have to be less strict. The other six sectors of the model do not present conflicting demands.

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APPENDIX A

Reliability (Alpha Coefficient) for QTI Scales for Students and Teachers in Three Countries

QTI Scale	Reliability					
	Students			Teachers		
	USA	Australia	The Netherlands	USA	Australia	The Netherlands
DC Leadership	0.80	0.83	0.83	0.75	0.74	0.81
CD Helpful/friendly	0.88	0.85	0.90	0.74	0.82	0.78
CS Understanding	0.88	0.82	0.90	0.76	0.78	0.83
SC Student responsibility/freedom	0.76	0.68	0.74	0.82	0.60	0.72
SO Uncertain	0.79	0.78	0.79	0.79	0.78	0.83
OS Dissatisfied	0.83	0.78	0.86	0.75	0.62	0.83
OD Admonishing	0.84	0.80	0.81	0.81	0.67	0.71
DO Strict	0.80	0.72	0.78	0.84	0.78	0.61
Sample Size	1 606	792	1 105	66	46	66

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