

Perceptions of student-teacher interactions in exemplary science teachers' classrooms

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ABSTRACT

The purpose of the study described in this paper was to identify and describe exemplary science teachers using the Questionnaire on Teacher Interaction (QTI). With a sample of over 493 science students, the reliability of the QTI scales ranged from 0.69 to 0.87. The better (exemplary) teachers could be identified as those whose students' perceptions were more than one standard deviation above the mean on the scales of Leadership, Helping/Friendly, and Understanding and more than one standard deviation below the mean on the Uncertainty, Dissatisfied and Admonishing scales. The construct validity of the QTI to identify exemplary teachers was confirmed through interviews with students and these views are reported in the paper.

INTRODUCTION

The recently released DETYA report *The Status and Quality of Teaching and Learning of Science in Australian Schools* (Goodrum, Hackling & Rennie, 2001) provides a contemporary, informative and disappointing picture of the current state of science education in Australia:

The actual picture of science teaching and learning is one of great variability but, on average the picture is disappointing. In some primary schools, often science is not taught at all. When it is taught on a regular basis, it is generally student-centred and activity-based, resulting in a high level of student satisfaction. When students move to high school, many experience disappointment, because the science they are taught is neither relevant nor engaging and does not connect with their interests and experiences. Traditional chalk-and-talk teaching, copying notes, and 'cookbook' practical lessons offer little challenge or excitement to students. Disenchantment with science is reflected in the declining numbers of students who take science subjects in the post-compulsory years of schooling. (p. 3)

In another recent study, *Foundations for Australia's Future - Science and Technology in Primary Schools* (Stocker, 1997, p. 1), stated that 'much has been achieved in primary science and technology education over the past ten years but much more needs to be done'. These are but two of a range of studies which over the last few decades have described the sorry state of teaching of science in secondary schools, across many countries (e.g., Brown, 1974; Harlen, 1999; Tobin & Fraser, 1988; Yager, Hidayat, & Penick, 1988).

Some researchers in science education have tried to identify and describe the behaviour of very good or exemplary science teachers believing that if we can do this the descriptions of what these teachers do may lead to an overall improvement. However, exemplary teachers have been difficult to identify and researchers have found it difficult to describe what is exemplary teaching. Just profiling effective teaching by scoring whether effective practices are present is of little value in that ineffective teachers can also display some of these practices (Cruikshank, 1986). A teacher might be able to display a variety of competencies, but lack the skills necessary to put these components together, and different teachers may put them together in quite different ways.

A wide variation in the beliefs and practices of teachers has been observed from classroom observations and interviews. Van den Akker (1998, p. 436) in describing schools that had productive primary science, revealed that these schools had : 'a high level of student involvement and enthusiasm; increased student initiative in the learning process; a lot of group work and interaction; teaching involving stimulation and facilitation; increased variety of resources (materials and objects) and experiences; extensive integration of science topics with project-oriented activities over a long period; and a lot of emphasis on process skills for exploration, learning to learn, and attitudinal goals such as curiosity, precision and perseverance'

Other attempts to delineate teacher standards lie in the description of a set of skills and techniques that good teachers embrace in their practice. These standards define, for instance, the skills and knowledge required for teachers to achieve registration, or to be promoted to master teachers. In science teaching, these standards could describe the knowledge of science content, planning and management strategies, assessment processes, utilisation of science resources.

In an attempt to promote teachers of high quality, professional standards for teachers have been developed by the Standards Council of the Teaching Profession (Standards Council of the Teaching Profession of Victoria, 1996). These standards describe what teachers should display if they are incorporating good components of teaching. It is designed around five generic dimensions of teaching, which are seen as contributing to better teaching. These standards are:

- professional responsibilities;
- content of teaching and learning;
- teaching practice;
- assessment and reporting of student learning; and
- interaction with the school and broader community.

A Western Australian study (Tobin & Fraser, 1988) focused on case studies of classroom practices employed by 'exemplary' teachers. The project was explicitly framed within constructivist principles, which are claimed to lead to greater value being placed on higher order cognitive learning (Tobin & Fraser, 1990). The project reported considerable diversity in the methods these teachers used, but nevertheless produced four assertions concerning exemplary science teachers (Tobin & Fraser, 1988, 1990) in that they used management strategies that facilitated sustained student engagement; used strategies designed to increase student understanding of science; utilised strategies that encouraged students to participate in learning activities and maintained a favourable classroom learning environment.

Allied to this project, a study by Treagust (1991) of two exemplary biology teachers, created a similar but sharper list of assertions. Treagust described how the two teachers had rather different styles of structuring the lessons, and how their interactions with and expectations of students, related to their personalities and teaching philosophies. Treagust made five assertions to describe what the teachers had in common that characterised the exemplary nature of their practice. The assertions were that these teachers exhibited classroom management and organization styles that resulted in smooth transitions between one class structure and another, encouraged learning from students of different ability levels, manipulated the social environment to encourage students to engage in academic work, set academic work that had a high level of cognitive demand, and used the laboratory in an inquiry mode and as an integral part of the course.

It was thus decided to build on this past research and focus this study on the identification and description of exemplary science teachers. However, the study is distinct in that it uses the perceptions of students in the identification of these teachers. Because this was our first investigation of the use of the QTI in such a way, we have preferred to use the term better to describe these good or exemplary teachers.

STUDENT-TEACHER INTERACTIONS

Recent reviews (e.g. Fraser, 1998; Fraser & Walberg, 1991) show that science education researchers have led the world in the field of classroom environment over the last two decades, and that this field has contributed much to understanding and improving science education. For example, classroom environment assessments provide a means of monitoring, evaluating and improving science teaching and curriculum. A key to improving student achievement and attitudes is to create learning environments that emphasise those characteristics that have been found to be linked empirically with student outcomes.

However, classroom environment research has been somewhat limited at the primary level compared with the secondary level.

One particular development in classroom environment research occurred in The Netherlands where the focus was on the interactions that occurred between teachers and students. 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). 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.

With the systems perspective in mind, Wubbels, Creton and Hoymayers (1985) developed a model to map interpersonal teacher behaviour extrapolated from the work of Leary (1957). The 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 (Figure 1).

This model has been used in The Netherlands in the development of an instrument, the Questionnaire on Teacher Interaction (QTI), to gather students' perceptions of their interactions with their teacher (Wubbels & Levy, 1993). The QTI contains eight scales based on the eight parts of the model. A typical item in the OD scale is "This teacher gets angry unexpectedly". Table 1 presents a description and a sample item of each scale of the QTI.

The QTI is an unusual 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.

Figure 1. The model for interpersonal teacher behaviour.

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 and structures the classroom situation. | This teacher knows what is going to happen next in this class. |
| Helping/Friendly | ...shows interest, behaves in a friendly or considerate manner and inspires confidence and trust. | This teacher helps us with our work. |
| Understanding | ...listens with interest, empathises, shows confidence and understanding and is open with students. | This teacher trusts us. |
| Student Responsibility/ Freedom | ...gives opportunity for independent work, gives freedom and responsibility to students. | This teacher allows us to take responsibility for what we do. |
| Uncertain | ...behaves in an uncertain manner and keeps a low profile. | This teacher allows us to tell him/her what to do. |
| Dissatisfied | ...expresses dissatisfaction, looks unhappy, criticises and waits for silence. | This teacher thinks that we cheat. |
| Admonishing | ...gets angry, express irritation and anger, forbids and punishes. | This teacher gets angry quickly. |
| Strict | ...checks, maintains silence and strictly enforces the rules. | This teacher is strict. |

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 (1993) 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.

An initial use of the QTI in The Netherlands involved an 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 helping/friendly behaviour, the higher were cognitive outcomes scores. Conversely, student responsibility and freedom, uncertain and dissatisfied behaviours were related negatively to achievement. Wubbels and Brekelmans (1998) stated that student outcomes are related to student perceptions of teacher behaviours with affective outcomes displaying a greater association than cognitive outcomes. In fact, studies into student teacher interactions suggest that teachers 'using open teaching styles are able to control student input and procedures in class in order to avoid disorder (Wubbels & Brekelman, 1998). Wubbels and Levy (1993) claimed that student perceptions of interpersonal teacher behaviour appear to account for 70% of the variability in student achievement and 55% for attitude outcomes.

The Australian version of the QTI containing 48 items was used in studies involving upper secondary science classes in Western Australia and Tasmania (Fisher, Fraser & Wubbels, 1993; Fisher, Fraser, Wubbels & Brekelmans, 1993; Fisher, Henderson, & Fraser, 1995). These studies confirmed the reliability and validity of the QTI and noted that 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, helpful/friendly, and understanding behaviours in their teachers.

In a study of middle secondary science classes, students' attitude scores were higher in classrooms in which students perceived greater leadership, helping/friendly, and understanding behaviours in their teachers. Females perceived their teachers in a more positive way than did males and students from an Asian background tended to perceive their teachers more positively than those from the other cultural groups identified in the study (Fisher & Rickards, 1997).

In another study in which the QTI was used in Australia, the perceptions of 490 mathematics students were used. It was found that students developed more positive attitudes towards their mathematics in classes where the teacher showed leadership, helping-friendly behaviour and minimal admonishment of students. Student cognitive gains were least in classes where students perceived that the teacher was dissatisfied, gave them too much freedom and responsibility, and where they were involved in investigations (Rawnsley & Fisher, 1997).

Now the Australian version of the QTI has been used in many studies involving science classes across Australia (Fisher, Fraser & Wubbels, 1993; Fisher, Fraser, Wubbels & Brekelmans, 1993; Fisher, Henderson & Fraser, 1995; Fisher, Rickards & Fraser, 1996; Fisher, & Waldrip, 1999). These studies all confirm the validity and usefulness of the QTI.

Generally, higher cognitive outcome scores and positive student attitudes are associated with leadership, helping, friendly and understanding teacher behaviours while strict or controlling behaviours are associated with higher cognitive outcomes and to a lesser extent with attitudes (She & Fisher, 2000). Thus, it was decided to investigate the usefulness of the QTI to identify good science teachers, those who would receive higher scores on leadership, helping/friendly and understanding behaviours. The study reported here, was concerned with student-teacher interactions in secondary classrooms. The underlying premise of this research was that if we can identify current student-teacher interactions in secondary classrooms, then it follows that we have an opportunity to identify the better or exemplary teachers.

METHODOLOGY

The aim of this study was to use the QTI to identify and describe the better science teachers. These better teachers were identified through very favourable scores on particular scales of the Questionnaire of Teacher Interaction (QTI). The usefulness of the QTI in this identification process was checked by interviewing school principals. Finally, the construct validity of the QTI to identify better teachers was confirmed through interviews with students.

The study involved a sample of 493 science students and their 25 teachers in 25 Australian secondary school classrooms. Each student in the sample responded to the QTI and the results for each class were calculated as scores on each scale of the QTI. The better teachers were identified as those whose students' perceptions were more than one standard deviation above the mean on the scales of Leadership, Helping/Friendly, and Understanding and more than one standard deviation below the mean on the Uncertainty, Dissatisfied and Admonishing scales.

A number of students from classes that had indicated very positive student-teacher interactions were interviewed to examine why these students had such positive perceptions. The interviews thus examined the veracity of student perceptions. A maximum of two classes within a school were involved in the interview process. From each class, four students were interviewed separately. The students were chosen by the teacher concerned so that a range of ability and interest in science were achieved. The resulting students fell into four groups; high achieving/high interest; high achieving/ low interest; struggles academically/high interest; and struggles academically/low interest.

During the interviews, we were interested in examining what were the students' perceptions of the scales that the statements were examining? What did they think the statement 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 for each scale? Did the scales reflect characteristics of exemplary teachers?

RESULTS

Instrument Reliability

The reliability and validity of the QTI instrument was checked. The internal consistency/reliability (Cronbach alpha reliability coefficient) and scale item mean of each of the QTI scales are shown in Table 2. The table shows that for the sample of students, the alpha coefficients ranged from 0.69 to 0.87 confirming that each QTI scale has acceptable reliability, especially for scales containing a relatively small number of items. The scale item means (range 0 to 1) showed that the scales of Leadership, Helping/Friendly, Understanding, Student Responsibility/Freedom and Strict behaviour were the most strongly perceived scales while their were lower perceptions of the less desirable scales of Uncertain, Dissatisfied and Admonishing. A desirable characteristic of the QTI is that it is capable of differentiating between perceptions of students in different classes. This was of added importance here because we were interested in whether the QTI could distinguish between the classrooms of the better teachers and others. This characteristic was explored using a one-way ANOVA with class membership as the main effect using the individual as the unit of analysis. The results in Table 2 indicated that each scale differentiated significantly ($p < 0.01$) between classes. The η^2 statistic represents the amount of variance in student-teacher interaction scores accounted for by class membership and in this study it ranged from 0.17 to 0.42.

Table 2

Cronbach Alpha Reliability, Item Mean, Standard Deviation and Ability to Distinguish between Classes for Each Scale of the QTI

| Scale | No of Items | Unit of Analysis | Alpha Reliability | Scale Item Mean | Standard deviation | ANOVA Results | |
|-----------------------|-------------|------------------|-------------------|-----------------|--------------------|-------------------------|---|
| | | | | | | <i>Eta</i> ² | |
| Leadership | 6 | Individual | .82 | .58 | .20 | .36 | * |
| Helping/ Friendly | 6 | Individual | .86 | .65 | .23 | .36 | * |
| Understanding | 6 | Individual | .87 | .61 | .22 | .36 | * |
| Student Resp/ Freedom | 6 | Individual | .75 | .54 | .18 | .32 | * |
| Uncertain | 6 | Individual | .77 | .26 | .17 | .26 | * |
| Dissatisfied | 6 | Individual | .80 | .29 | .20 | .35 | * |
| Admonishing | 6 | Individual | .84 | .33 | .23 | .42 | * |
| Strict | 6 | Individual | .69 | .46 | .18 | .17 | * |

n= 493 students and 25 teachers **p*<0.01

Identification of Better (Exemplary) Teachers

Of the 25 teachers involved in the study, there were five teachers whose students reported significantly favourable interactions. We referred to these teachers as the better teachers. Table 4 and Figure 2 illustrate these differences.

Table 4

Mean Scores for Average and Better Teachers and Difference in Standard Deviations for each Scale

of the QTI

| Scale | Average teacher | Better teachers | Difference in s.d.'s |
|------------|-----------------|-----------------|----------------------|
| Leadership | .58 | .82 | + 1.20 |

| | | | |
|-----------------------|-----|-----|--------|
| Helping/ Friendly | .65 | .91 | + 1.13 |
| Understanding | .61 | .85 | + 1.05 |
| Student Resp/ Freedom | .54 | .74 | + 1.11 |
| Uncertain | .26 | .13 | - 0.76 |
| Dissatisfied | .29 | .11 | - 0.95 |
| Admonishing | .33 | .10 | - 1.00 |
| Strict | .46 | .42 | - 0.22 |

Figure 2. *Mean Scores for Average and Better Teachers for each Scale of the QTI.*

In order to check the QTI scores, we discussed the quality of each of these five teachers with their principals. The principals had been told that these teachers were being chosen from classes that had reported very favourable student-teacher interactions. The principals indicated that they were not surprised that these teachers were chosen and that they could

understand why these classes were chosen as these teachers were considered to be highly exemplary. As some principals stated:

I can easily understand why you chose these teachers,

She/he is my best teacher.

The students really like her and feel that she has empathy with them.

He always respects his students and they feel that he wants them to learn.

The students want to be in her class, she takes a real interest in what they are learning.

Results from Student Interviews

As described in the methodology four students from each of the five classes that had indicated very positive student-teacher interactions were interviewed to examine why these students had such positive perceptions. The interviews therefore examined the veracity of the students' perceptions.

As discussed earlier, since the QTI utilises opposing dimensions, the following discussion combine these dimensions. When the students were interviewed about the opposing dimension, they tended to state that the negative dimension was not important. When they were asked to explain their response, they always focussed on the positive aspects about their teacher.

Leadership versus Uncertain

These scales were designed to measure the extent to which the teachers made it obvious that they knew what they were doing in the classroom. When we interviewed the students about the degree of leadership their teacher displayed, students indicated that they learnt a lot from the teacher and all course-related material was explained clearly in the class. These students when asked about how uncertain their teacher was, always emphasised the positive leadership qualities of their teacher.

S: She knows how to communicate with the kids - explains things really well. Some teachers can't communicate with the kids. It's really hard to teach and to learn. She really does bring it down to our level. She is really friendly

I: Does he know what is happening in the classroom?

S: Yes, most of the time

I: How do you know that he is listening?

S: He answers when I ask him. He always knows what we are doing or what we have done wrong

S: She is a pretty good teacher. You can hardly ever get her mad. She comes in with positive attitude. Everyone starts. I don't know what is. There is something about her that makes everyone want to learn. My science has just skyrocketed because of her. She makes it fun and enjoyable

I: Would you want to change teachers?

S: *No. because she is leaving at the end of this year, I am dropping science for next year. I know that if I get our male teacher, my marks will go down again*

S: *She is interested in hearing people's answers and wants to know what they have to say. Even if they get it right first off, she will ask if anyone has something different. So she is interested in what you have got*

S: *Looks at you in the eye. She has got that way that when she wants us to listen she just stops and we know that she wants us to listen. We get told that we have to stop and listen and she acts that way.*

I: Does she know what is happening in the classroom?

S: *Yep. She is fully aware. If someone is talking, she will separate them.*

Helping/ Friendly versus Dissatisfied

The intent of these scales was to measure the extent that the teachers helped them and viewed them as being capable students. These students saw that their teacher was very helpful and friendly.

S: *He is like, so laid back and is a good teacher and knows what he talking about mainly and helps like when he is helping us, he is not talking to us as if we know how to do it and saying we should know, he helps us a lot*

S: *She knows how to communicate with the kids, explains things really well. Some teachers can't communicate with the kids. It's really hard to teach and to learn. She really does bring it down to our level. She is really friendly*

S: *She goes through the question with you and she explains it a bit by bit so that you understand what the question is about*

In particular, students saw that their teachers were willing to help them, especially to explain material with which they had difficulty.

S: *He listens to things I have to say. Sometimes he can be mean to kids in the class which kind of gets on my nerves. He does lots of experiments that I like. He is a pretty fun sort of teacher but he can get really mean which isn't kind of nice. He does pretty easy work for those not up to date with everything*

S: *She does when at the start that there used to be a unit like VCE science, she takes us through parts of it, we can do this part now and she explains what's in them and we choose which order we want to do them in. in assignments, when we did minerals, we got to choose which mineral we want to do and pretty well how we want to present it*

S: *Helpful, yeah, he's a very helpful person, we have to come and do an assignment and he'll come and work with everybody, answer our questions, and help when it's needed.*

S: If we're having trouble, we'll usually go ask him, he'll come up to people and ask if they're having trouble, how they're getting started with this, and yeah, he'll help kids with work that needs to be helped with.

S: Once he left these, he was away one lesson and he left these books and equipment, and he made this teacher count everything before he gave it to us, and then count it all back to make sure we didn't steal anything. Oh, he does kind of, like he trusts us to get work done, like he'll give us homework, and he'll trust us to do it and he won't check it, just read off the answers and we tick it off or whatever.

Understanding versus Admonishing

Students in these classes saw that their teachers knew the extent to which their students understood, listened to them and did not become angry quickly.

S: She is interested in hearing people's answers and wants to know what they have to say. Even if they get it right first off, she will ask if anyone has something different. So she is interested in what you have got

S: She is really kind. She always tries to make everyone understand it. If you don't, she will go back and tell you again and she will have maths help. She does lots of things for us like makes up booklets for us to do when we have spare time. She makes it really fun and games

Schools that emphasized concepts of 'caring' had their students emphasizing the view that students and staff did care for each other. Finally, these students emphasized that their contribution in class were valued by the teacher, they were active in the learning process and challenged by their teachers.

S: Yes, she is always asking people for their opinions even if the other kids don't think that it is very good. She always tries to understand. She tries to explain to the others in a bit better way than you did to try and have them understand what you mean

S: He would go through it all over again if you say that you don't understand that bit, especially in physics or all the formulas and stuff. He will write it all up on the board and you will say I don't get it and he will go over it and say it all over again

S: He makes you feel really comfortable in the class and if you don't really understand things, he won't make you feel embarrassed about it. If you don't understand it, he won't get you out the front and explain it.

S: Yes, she is always asking people for their opinions even if the other kids don't think that it is very good. She always tries to understand. She tries to explain to the others in a bit better way than you did to try and have them understand what you mean

S: He, because if we don't understand we know that we're allowed to ask him questions. So he knows that I think that everyone will ask him if they don't get it.

S: No, he doesn't really get angry. He sometimes does when everyone's talking, like a lot of the time no one's listens to him. The other day I was just looking around the class and I just noticed the different things that everyone was doing. Like one person was playing with their hair, and the next person was chatting, there were some writing letters to people, there were only like a couple of people listening. Sometimes he just keeps on talking anyway, or sometimes he just stops and yells, and then everyone listens.

S: I've never seen him angry.

Student Responsibility or Freedom versus Strict

Students in the better classrooms felt that they were given some choice in how they approached their learning. Their teachers gave them responsibility and allowed them to make suggestions.

The students felt that they were given responsibility.

S: He gives us lots of choice. Like sometimes we have choices how to do maths problems. He gives us problems on the board and gives us all day to solve them. At the end of the day, if we get them right he will give us rewards like lollies and stuff like that. He understands and lets us use the video camera. He trusts us a lot with that. We look after the bins at school, take the bins out the front. We have to look after the tuckshop. The principal has to trust us as well.

S: If we are doing practical, she lets us do it and she will just watch us. If we are doing something wrong, she will tell us what we are doing wrong

I: Does he give you much choice?

S: yes, like when we did designs, this house design, we could do what design we wanted but we had to make sure that it had passive heating and stuff like that

S: If we come in to do an assignment he'll let us work it out and let us start our own way off sometimes, and just let us try and think things out for ourselves.

S: Every time he goes a way he trusts us to be good with the other teacher, and he trusts us when we're using chemicals and all that.

S: Once he left these, he was away one lesson and he left these books and equipment, and he made this teacher count everything before he gave it to us, and then count it all back to make sure we didn't steal anything. Oh, he does kind of, like he trusts us to get work done, like he'll give us homework, and he'll trust us to do it and he wont check it, just read off the answers and we tick it off or whatever.

The concept of strictness was somewhat relative. When students were pressed to indicate whether they preferred more or less strictness, students expressed the status quo or for their teachers to be slightly more strict. They felt that teachers becoming less strict would provide a negative effect on learning. They saw that the present level of strictness was fair and essential for learning.

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

S: probably more strict. In physics, because that is his main subject, he is probably more stricter and pushes it a bit more. He probably doesn't push chemistry as much which is the hardest. So I think, more stricter in certain areas

S: she is not so strict that people don't really like her because kids can get really annoyed at that. She does have discipline.

I: if you had to choose between being more or less strict, what would be your choice?

S: more strict. We would learn more. She is good as she is

When they were asked to suggest how their teachers could improve, typical of good teaching, the students struggled to provide an answer for this question. Students from one class suggested that they would like more challenges than they were currently having. Another common request was for more opportunity for student-student discussion of issues. These students do enjoy their science lessons. All these students made a point that they felt that they were involved in the learning science process.

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

S: sometimes he is strict in the way of saying do this and get it done by then and then we don't know how to do it and some times he is not. It just depends on what we are doing. In a way yes probably

I: how would it help you if he was more strict?

S: I think that we would be taught, not as freely. Like taught more about what we are learning

Even when they were pushed to state what faults their teacher had, they tended to struggle to identify any.

S: Tell him his faults, um, I can't really see any, other than, I don't know, I just think that I don't really like science, but he is a good teacher.

DISCUSSION

This article has provided further evidence on the validation of the QTI which assesses eight scales of teacher interactions with secondary school students. The reliability for each scale

was obtained and the Cronbach alphas ranged between acceptable values of 0.69 and 0.87. Importantly, the QTI's ability to distinguish between classes was confirmed.

It was found that better teachers could be identified through the perceptions of their students on the scales of the QTI. The better teachers could be identified as those whose students' perceptions were more than one standard deviation above the mean on the scales of Leadership, Helping/Friendly, and Understanding and more than one standard deviation below the mean on the Uncertainty, Dissatisfied and Admonishing scales. The construct validity of the QTI to identify better teachers was confirmed through interviews with students and these views are reported in the paper.

It was interesting to note that even though students did not use the term constructivism, it was clear that the students of the better teachers were describing constructivist principles driving their learning. When asked if they would like to have a different teacher, they typically responded as

S: No. I would reckon that she is the best science teacher. Out of all the others, she is easy to understand. She helps you with everything. Some teachers don't want to help you if you have problems

I: Would you want to change her?

S No. Because she is leaving at the end of this year, I am dropping science for next year. I know that if I get our male teacher, my marks will go down again

It is apparent from these interviews that these better teachers tried to interest students in the learning process, involve students in developing understanding, were friendly, gave students responsibility and had a level of strictness that students were comfortable and such that they felt was conducive to learning.

Overall, this study has shown that identifying the better (exemplary) teachers using students' perceptions of their interpersonal behaviour is worthwhile and that further study employing the QTI would be valuable. In particular, we now need to obtain good descriptions of the classrooms where these teachers are operating.

The authors do not propose that teachers who wish to be better teachers, should copy characteristics positively related in this study but rather reflect on their teaching and use the QTI as a tool to provide feedback to them as they endeavour to improve their own teaching. However, the results from teachers using the QTI could be used as evidence of change when teachers self-report their assessment of their own teaching.

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