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ABSTRACT

A cross-national study of learning environments in Taiwan and Australia is one example of research that employs both qualitative and quantitative methods. This paper describes the part of that study related to the development and validation of an instrument called the Teacher Student Interaction (TSI) which assess student perceptions of teacher behavior. After using the questionnaire with groups of students, the data were quantitatively analyzed, the questionnaire validated, and quantitative descriptions of teacher behavior obtained. To further validate the questionnaire and understand the teacher interactions according to the perceptions of students, a qualitative approach was used. Students were interviewed and the researchers visited and observed in science classrooms. (DDR)

Combining Quantitative and Qualitative Approaches in Studying Student Perceptions of Teacher Behavior in Taiwan and Australia

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INTRODUCTION

In recent years, the combination of qualitative and quantitative methods in classroom environment research has been recommended (Fraser & Tobin, 1991; Tobin & Fraser, 1998). Qualitative methods have been used in refining questionnaires and in seeking explanations to patterns identified through statistical analysis of quantitative information. Erickson (1998) writing on interpretive research, recommends the use of quantitative information wherever possible to assist the qualitative interpretations. The current cross-national study of learning environments being carried out in Taiwan and Australia is an example of a study involving both qualitative and quantitative methods and this paper describes part of this study.

This paper describes the development and validation of an instrument, The *Teacher-Student Interaction* (TSI), which assesses student perceptions of their teachers' behaviours. Both quantitative and qualitative methods have been used in the validation and application of this questionnaire. After use of the questionnaire with a sample of Taiwanese and Australian students, the data were quantitatively analysed, the questionnaire validated and quantitative descriptions of teacher behaviour were obtained. To further validate the questionnaire and understand the teacher interactions according to the perceptions of students from the two countries, a qualitative approach was used. Students were interviewed and the researchers visited and observed science classrooms.

Past research has confirmed the important contribution made by teachers in creating a classroom environment or atmosphere conducive for science learning. In particular, teachers make a major contribution towards creating a positive learning environment in science classes through their interaction or communication with students (Wubbels & Levy, 1993). The way in which a teacher interacts with students is not only a predictor of student achievement, but also is related to such factors as teacher job satisfaction and teacher burnout. Appropriate teacher-students interactions are important to prevent discipline problems and to foster professional development (Fisher, Fraser, & Cresswell, 1995; Wubbels & Levy, 1993). Student teacher interactions also have been shown to be particularly important in a "constructivist" classroom, where emotion plays a more prominent role (Watts & Bentley, 1987). Other research has indicated that positive interaction relationships between teachers and students promote student interest and outcomes in science (Wubbels & Levy, 1993).

Classroom interactions occur rapidly in a classroom and teachers are usually not aware, or not able to describe or remember what happens in their interactions with students. For example, Good and Brophy (1974) interviewed teachers and confirmed that teachers usually were not aware how many questions they asked students and what kind of feedback they provided. Unless we can help teachers identify their interactions in teaching, and make them aware of what happens in class, it is difficult to promote positive science classroom interactions.

Table 2
Internal Consistency (Cronbach Alpha Coefficient) and Ability to Differentiate Between Classrooms for the TSI

Scale	Unit of Analysis	Alpha Reliability		ANOVA Results(eta^2)	
		Australia	Taiwan	Australia	Taiwan
Encouraging Behaviour	Individual	0.89	0.89	0.17*	0.26*
	Class Mean	0.95	0.97		
Understanding and Friendly Behaviour	Individual	0.89	0.91	0.15*	0.21*
	Class Mean	0.96	0.98		
Non-Verbal Supportive Behaviour	Individual	0.74	0.67	0.22*	0.32*
	Class Mean	0.88	0.85		
Controlling Behaviour	Individual	0.73	0.57	0.13*	0.65*
	Class Mean	0.82	0.61		

*$p<.001$ Taiwan, n = 1879 students in 50 classes.
Australia, n = 1081 students in 50 classes.

Differences in scale means between the two countries were then investigated. An examination of the scale means depicted in Table 3 indicates that students in Taiwan generally perceived their interactions with the teacher more positively than did Australian students on all scales, with the exception of Non-verbal Supportive Behaviour. Taiwanese students perceived their teachers to be considerably more controlling than the Australian students.

Table 3
A Comparison of Means Between Science Classes in Australia and Taiwan

Scale	No.of Items	Mean				Standard Deviation			
		Australia		Taiwan		Australia		Taiwan	
		Class Mean n=50	Indiv n=1081	Class Mean n=50	Indiv n=1879	Class Mean n=50	Indiv n=1081	Class Mean n=50	Indiv n=1879
Encouraging	9	29.06	29.08	30.35	30.41	2.97	6.45	3.29	7.47
Non-Verbal Supportive	7	23.80	23.75	21.20	21.26	2.33	4.93	2.40	4.98
Understanding and Friendly	9	31.30	31.25	32.35	32.47	3.44	7.99	3.68	8.11
Controlling	5	13.50	13.59	15.17	15.14	1.56	3.99	1.13	3.49

The result of this initial development was the 41-item *Teacher-Student Interaction* (TSI) instrument which assesses students' perceptions of the following five important teacher-students interaction behaviours:

Challenging Behaviour
the extent to which the teacher uses higher-order questions to challenge students in their learning;

Encouragement and Praise Behaviour
the extent to which the teacher praises and encourages students;

Non-Verbal Supportive Behaviour
the extent to which the teacher uses non-verbal communication to interact positively with his/her students;

Understanding and Friendly Behaviour
the extent to which the teacher is understanding and friendly to the student when interacting; and

Controlling Behaviour
the extent to which the teacher dominates and controls student behaviour in the classroom.

THE QUANTITATIVE ANALYSIS

The revised questionnaire was administered to a sample of 1,081 grades 8 and 9 general science students from 50 classes in Australia and 1,879 grades 7-9 students from 50 classes in Taiwan.

The a priori factor structure of the questionnaire necessitated the removal of some items and the merging of other items, from the two scales Challenging Behaviour and Encouragement and Praise Behaviour, to form what was renamed the Encouraging Behaviour scale. Thus, the final 30-item version of the questionnaire had four scales, two with nine items (Encouraging Behaviour, and Understanding and Friendly Behaviour), one with seven items (Non-Verbal Supportive Behaviour) and one with five items (Controlling Behaviour). The a priori factor structure of this version of the questionnaire was replicated with nearly all items loading on their a priori scale and no other scale. The factor loadings of these 30 items are depicted in Table 1.

The rest of the initial quantitative analyses were conducted on the remaining four scales, but because of the authors' belief in its importance when describing teacher behaviour, the Challenging Behaviour scale is being re-written. Furthermore, this aspect of the teacher's behaviour was retained and examined in the qualitative part of the study.

Estimates of the internal consistency of the four new scales of the TSI instrument, calculated using Cronbach's alpha coefficient and shown in Table 2, were found to be generally satisfactory for both the Australian and Taiwan data, although the Strict Behaviour scale was somewhat low in Taiwan The reliability (Cronbach alpha coefficient) for each scale, using the individual student as the unit of analysis, ranged between 0.73 and 0.89 in Australia and between 0.57 and 0.91 in Taiwan. The reliability (Cronbach alpha coefficient) for each scale, using the class mean as the unit of analysis, ranged between 0.82 and 0.96 in Australia and between 0.61 and 0.97 in Taiwan.

Again in relation to number 7 another student said

Because, well we haven't really done things about like your opinion except for when we did something like genetics and that sort of stuff.

So that was mainly because of what science was like.

Because of the curriculum.

Another student said

Yes, well we rarely have discussions during science it is just basically, correct answers.

So you told me the first group of items here were about questioning and for number 5 you gave 1. Can you tell me why 1?

(5. This teacher asks me questions that allow me to express my opinion.)

Because a lot of the questions requires a real answer not your opinion.

So the questions make you think?

Yes. She gives us work and we just do it. I don't know it just makes me think about solutions and stuff?

Right and that's good?

Yes.

Taiwan

Does your teacher ask questions very often?

Yes, the teacher asks a lot of questions.

What types of questions does your teacher ask?

The teacher asks questions that will make us think a while.

The teacher likes to ask us, "Why would it happen?", types of questions.

The teacher rarely asks us yes or no questions.

Why did you circle always or very often to these items?

Because the teacher always asks a lot of questions to all of us.

Encouraging Behaviour

Australia

Um, those ones they were like encouraging you to answer questions.

Here's another one with 5 circled, question 14, this teacher praises my answers?

Yes, even though it (the answer) is wrong she just still says good attempt.

And here's a 5 here at number 12, the teacher does that a lot does she?

(This teacher praises me for asking a good question.)

Yes and it really boosts your confidence as well.

Yes, it's a good thing to do?

Yes. It is. And even if you don't get the answer right, they say yeah, like they know its wrong but they like go on to correct it as well.

Yes she often says yeah, that was good and stuff like that.

And does that feel good to you?

Yes.

Your answer to number 9 is a little different in that you have circled 1, the teacher encourages me to discuss the answers to questions. Can you tell me why you circled 1 for that item?

Well she doesn't actually ever say to me while you are joining in you should be discussing the answers, she never says that or anything like that.

Yes! She will look at all of the students while she is teaching in order to check our level of understanding.

Well, she rarely looks at me to stop me talking to someone.

Does your teacher walk toward you while she is teaching?
No, she stays up the front while she is teaching.

Understanding and Friendly Behaviour

Australia
The students had little difficulty understanding the nature of the Understanding and Friendly scale and made such comments as

Yes, because everything she says is clear and you can understand it.
Yes there is freedom to ask questions and stuff like and she is clear and explains things.
Yes, she is kind and friendly and not that strict.

Taiwan
Is your teacher friendly to you?
Yes, she is very friendly to us. She usually will not get angry unless we are too noisy.

Does your teacher know when you do not understand?
Yes, while I do not understand my face will show kind of confuse. Then teacher will try to explain again.

Controlling Behaviour

Australia
The alpha reliability for this scale was lower than for the other scales and it was of considerable interest to discuss this with students. The general responses included

She is not that strict and that's why people like her. She gets the job done.
You say she is not strict with you, how do you understand the word strict?
Like disciplined and very disciplined.

Do you understand what strict used here means?

Strict, isn't it saying, um, like we have to obey her every instruction?

The teacher does not always expect you to do everything she tells you to do. Is that what you are saying here.
Oh, sometimes if it is too hard she will let us not do it and she will explain it to us later. If she sets homework, its alright if we weren't able to do one if we really didn't understand it.
I see so that is a positive thing is it?
Yes.

Well when people are mucking around the teacher deals with them like and then they will know what behaviour is expected because they know she is not strict and they know that mucking around isn't good and know that she doesn't go over things more than twice. If they don't really know it then they will get it wrong in the test.

students' answers were not exactly right, she would make it a teaching point and lead to the correct answer rather than negating or criticising the students. Most students answered the teacher's questions after putting up their hand and being called on. Only a few students on few occasion called out answers. Lisa brought a mouse into the class to illustrate a story about mouse breeding and genetic inheritance. This supported the involvement of the students in the content of the lesson. Generally, there appeared to be a friendly and happy atmosphere in this class. The students were very well motivated.

An examination of the profile obtained from student response to the TSI for Lisa's class indicated that the students perceived higher than average levels of all the behaviours except the controlling behaviour which was somewhat lower than average.

Australia: Classroom 2

Barry had invited two mothers and their babies to his human biology class on human physical development. One baby was a nine-month old boy and the other was a three-month old girl. We felt the teacher was quite brave to bring these babies into the class, because what the babies mothers responded to Brain did not quite fit with what he was teaching according to his books. The students, particularly the boys, were not that interested in the class and soon became bored with the novelty of the babies. Barry seemed to realise that the students were becoming disinterested and frequently directed critical comments and lower order questions mostly to the boys. It was notable that there were many more girls than boys in this class. This teacher was appearing stricter than the others we had observed. After the lesson, Barry indicated that usually girls took biology classes at this age, and only a few of boys would take this course, because girls are more interested in careers like nursing.

In contrast to Lisa's class Barry's students perceived lower than average behaviours on each scale except the Controlling Behaviour scale which was higher than average.

Taiwan: Classroom 1

Laura taught the topic of mole. She asked many questions designed to make students think. She asked a lot of higher-level questions and she frequently gave students praise, clarification, and expanded on their answers. When her students did not know the answers, she would give them hints or repeat questions to further encourage students to try to answer. Her students also asked a great number of questions to herwhich is not usual in other Taiwanese science classes we have observed. In her class, the students were very well motivated, and the atmosphere was friendly and happy. At the conclusion of the class, several students walked towards the front of the room to ask her questions. As students were likely to call out the answer, the teacher had decided to draw numbered straws from a container on her desk to decide specific students to answer the question. She explained that she had decided to do this because very often the students were likely to answer questions at the same time, and she could not hear the answer.

In their responses to the TSI the students perceived this teacher's behaviour in the same way we did with high levels of challenging, encouraging and understanding and friendly behaviours.

Taiwan: Classroom 2

Julie is an experienced teacher and the students in the class we observed were categorised as gifted. The topic was taught was factors that influence of the rate of a chemical reaction rate. The way she taught was very organized, she gave students very complete and clear

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