

# SETTING A SCENE FOR CO-TEACHING AND CO-GENERATIVE DIALOGUE FOR TEACHING ENVIRONMENTAL SCIENCE

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## ABSTRACT

This paper reports on the first phase of a three-year long longitudinal study which aims to investigate the effectiveness of co-teaching and co-generative dialogue, in the learning and teaching of environmental education in lower secondary classes. In this part of the study, a total of 265 students (51% male and 49% female) from 13 classes in three different West Australian High Schools were asked for their perceptions of their teachers' interpersonal behaviour using the *Questionnaire on Teacher Interaction* (QTI) and *Place-based Learning And Constructivist Environment Survey* (PLACES). Preliminary data analyses establish the reliability of all the scales of QTI and PLACES. Alpha reliability of the scale of these two instruments is between 0.6 to 0.8. Statistically no significant differences were found between genders and some differences were found between schools. All scales (excluding student responsibility and shared control) of the instruments are significantly correlated. Several classroom observations provided an understanding on teacher student interaction and students' engagement in environmental education. In the next stage researchers will be implementing coteaching and cogenerative dialogue through case study in three selected classes in these schools.

## INTRODUCTION

Co-teaching and co-generative dialogue has been proposed by Roth and Tobin and has had an international impact in educational research (Tobin, 2007). Coteaching and cogenerative dialogue as collaborative teaching and learning provides a dynamic structure in the classroom which help teachers to improve their pedagogical practices as well as their students' learning. According to Stith and Roth (2008), involving students in cogenerative dialogue, will help them to engage and contribute to their learning which lead to the classroom transformation. In this study, coteaching and cogenerative dialogue will be integrated in environmental education. According to Gough (1997) and Fien and Maclean (2000), environmental education should stimulate individual responsibility and action on both physical and aesthetic qualities of the environment. The study is conducted in Australian schools, where environmental education has been included in the Society and Environment Learning Area. This learning area provides students opportunity to engage with the environment as well as empower their critical thinking, collaborate with others and actively participate in the environment (Gough, 1997; Curriculum Council, 1998). As part of the study, this paper reports on the first phase of the study on establishing the scene for coteaching and cogenerative dialogue in lower secondary classes in Western Australia to engage students in environmental education and student-teacher interactions. In the first year, the learning environment instruments (QTI and PLACES) were administered and several science classes observed to set a scene for coteaching and cogenerative dialogue in environmental education.

## CO-TEACHING/CO-GENERATIVE DIALOGUE

Tobin (2005) described co-teaching occurring when two or more persons collaborate to teach a group of students. The presence of multiple teachers provides a greater array of dynamic structures than is possible when only one teacher is present. Accordingly, the students in a class experience an expanded agency and associated opportunities for learning and creating new identities. A higher incidence of teaching in co-taught classrooms is not only experienced by students, but also the teachers who can appropriate the enacted teaching of others to expand their own repertoire of teaching practices. By being in a class with other teachers, and co-teaching with them, all co-teachers experience many more interactions between teachers and students and they also experience teacher-teacher interactions. The increased experience with interactions provides a framework for learning to teach through co-teaching. Over the past decade in the USA, co-teaching has been developed not only as a form of teaching but also as a way of learning to teach, doing research, supervising new teachers and evaluating teaching in classrooms (Roth, 1998; Roth & Boyd, 1999; Roth & Tobin, 2001). Co-teaching is requiring researchers to co-participate in the teaching in order to understand it. This first-person perspective provides a radically different view of classroom events and classroom environment.

In an effort to involve students as researchers, the practice of co-generative dialogue emerged (Tobin, 2005). In this practice, two students from each class are identified to provide an answer to their teacher's question, 'How could I teach better so that my students like my lessons?' The value of getting teachers and students together to discuss their shared experiences has been highly appreciated (Tobin, 2005). What can be improved, what is working well, what is frustrating, and what is most enjoyable, are topics that have been discussed? The use of this conversational format allows teachers to get beyond lists of things that need improvement and to delve more deeply into the nature of teaching. Interactions allow deeper probing of classroom life and a meeting of the minds. Therefore, integration of co-teaching and co-generative dialogue will engage student and teacher into classroom transformation. Several research studies show that coteaching and cogenerative dialogue have been used for teacher evaluation (Roth & Tobin, 2001), for classroom praxis (Roth & Tobin, & Zimmermann, 2002; Martin, 2006), for transforming classroom culture (Lehner, 2007), and for transforming teachers' beliefs and practices (Carambo & Stickney, 2009). In this basis for study, a co-teaching/co-generative dialogue has been studied to improve the teacher-student interactions in classrooms thus enhancing student learning of Environmental Science.

## ENVIRONMENTAL EDUCATION

Environmental education was proposed in 1975 in Belgrade in a UNESCO meeting (Gough, 1997). Research studies indicate that students develop genuine appreciation and respect for the environment when exposed to environmental education (Basile, 2000; Corral-Verdugo & Fraix-Armenta, 1996; Cummins & Snively, 2000; Kenney, Price-Militana & Horrocks-Donohue, 2003; Lieberman & Hoody, 2000; Lord, 1999). Other studies show that environmental education programs motivate children to engage with content at all levels of ability (Basile, 2000; Cummins & Snively, 2000; Kenney, Price-Militana & Horrocks-Donohue, 2003; Lord, 1999) which is attributed to a concrete experience of real issues that come to be perceived as personally meaningful. The National Environment Education and Training Foundation (NEETF, 2000) has published several case studies showing that all students, including those formerly struggling in school, became more interested in school because they felt they could make a difference in their environment and this empowered them to strive for more knowledge. Beyond improving students' engagement, environmental education programs improve academic achievement across the curriculum especially in science (NEETF, 2005).

Recently in Australia, various government reports have emphasised the importance and urgent need to improve science education with special emphasis on environmental education at various educational levels (Brennan, 1994; NBEET, 1996), including the Prime Minister's Chief Scientist's report *The Chance to Change* (Batterham, 2002) and a DETYA-commissioned project on the quality of science education (Goodrum, Hackling, & Rennie, 2001). The most recent Australian upper school enrolment statistics again confirm low enrolments in the more 'rigorous' physical sciences and mathematics subjects, particularly among girls and ethnic minorities (Dekkers, Malone, & de Laeter, 2003).

## LEARNING ENVIRONMENT RESEARCH

The study draws upon and contributes to the field of learning environments (Fraser, 1994, 1998). Contemporary research on school environments partly owes inspiration to Lewin's (1936) seminal work in non-educational settings, which recognised that both the environment and its interaction with characteristics of the individual are potent determinants of human behaviour. Since then, the notion of person-environment fit has been elucidated in education by Stern (1970). Similarly, Walberg (1981) has proposed a model of educational productivity in which the educational environment is one of nine determinants of student learning. Over the last four decades, learning environment research has become a firmly established form of research on teaching and learning (Fraser, 1998; Fraser & Walberg, 1991; Haertel, Walberg, & Haertel, 1981). Although earlier researchers used questionnaires alone, more recent studies enact and recommend the inclusion of a range of observational and interpretive methods (Tobin & Fraser, 1998). Questionnaires and interpretive methods enhance each other in the sense that interviews are used to probe in greater depth what individual students and teachers have to say about their classrooms and the resources used to support their learning.

In this study, a different way of conducting classroom research conducted. The theoretical framework has as its basic value the primacy of human agency grounded in it. This agency, or power-to-act, includes the capacity of individuals to participate in creating their lived-in world rather than being merely determined by it. The fundamental value that researchers can select in this form of inquiry is what researchers find appropriate to explore the puzzles that underpin their research on learning environments. The existing practice of learning environment research is elaborated upon, to overcome two persistent gaps in education, those between educational theory and teaching practice and between the practice of research and the practice of teaching. In this

study, the existing learning environment instruments are used to investigate the classroom environment which are Questionnaire on Teacher Interaction (QTI) and Place-based Learning and Constructivist Environment Survey (PLACES). The characteristics of these two instruments are shown on Table 1. Combination of these instruments provides the big picture of classroom culture to help researchers to engage with the science teachers and students through co-teaching and co-generative dialogue.

**Table 1. The Selected Learning Environment Questionnaires**

<i>Instrument</i>	<i>Questionnaire on Teacher Interaction (QTI)</i>	<i>Place-based Learning and Constructivist Environment Survey (PLACES)</i>
Aim	to gather students' perceptions of their interactions with their teacher	to gather information on students' perception of their learning about environment both in field-based as well as classroom-based activities
Level Education	High School (year 8)	
Number of Item	49	40
Scale	8 scales (leadership, helping/friendly, understanding, student freedom, uncertain, dissatisfied, admonishing and strict)	8 scales (relevance/integration, critical voice, student negotiation, group cohesiveness, student involvement, shared control, open endedness, environmental interaction)
Scoring: 1,2,3,4,5 (never, almost never, sometimes, often, always)		

### **Questionnaire on Teacher Interaction (QTI)**

The importance of teacher and students interaction to improve teaching and learning has been investigated in classroom learning environment research. 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 this in turn influences student behaviour. Circular communication processes develop which not only influence behaviour, but determine behaviour as well. With the systems perspective in mind, Wubbels, Creton, and Hooymayers (1985) in The Netherlands extrapolated the seminal interpersonal behaviour research of Leary (1957) to develop an instrument, the Questionnaire on Teacher Interaction (QTI), to gather students' perceptions of their interactions with their teacher (Wubbels & Levy, 1993). The QTI assesses eight dimensions of teacher behaviour: leadership, helping/friendly, understanding, student freedom, uncertain, dissatisfied, admonishing and strict. These dimensions provide a comprehensive description of teachers' interactions with their students. The description of each scale of QTI is shown on table 2.

The Dutch version of the QTI was translated into English and modified for use in Australian secondary schools. The Australian version of the QTI has been used in studies involving secondary science classes (Fisher, Fraser, & Wubbels, 1993; Fisher, Henderson, & Fraser, 1995; Fisher & Rickards, 1998). These studies strongly supported the validity and potential usefulness of the QTI within the Australian context, and suggested the desirability of conducting further and more comprehensive research involving the QTI. Generally, higher cognitive achievements are positively associated with leadership, helping/friendly and understanding teacher behaviours. Conversely, admonishing, dissatisfied and uncertain teacher behaviours are negatively associated with students' cognitive achievements (Fisher & Rickards, 1998; Koul & Fisher, 2003; Wubbels & Levy, 1993). In terms of the instruction and achievement, the proposed study focuses on both these areas in an enhanced manner, where additional emphasis is given to teacher-student interactions for the first time in Australia. Additionally, the present study extends the use of the QTI into middle schools, an area of formal schooling receiving considerable attention nationally and internationally (Koul & Fisher, 2005).

**Table 2: Description and Examples Items for each Scale in the QTI**

Scale	Description	Item
Leadership [DC]	Extent to which teacher provides leadership to class and holds student attention.	This teacher explains things clearly.
Helping/Friendly [CD]	Extent to which teacher is friendly and helpful towards students.	This teacher is friendly.
Understanding [CS]	Extent to which teacher shows understanding/concern/care to students.	If we don't agree with this teacher, we can talk about it.
Student Responsibility/ Freedom [SC]	Extent to which students are given opportunities to assume responsibilities for their own activities.	We can influence this teacher.
Uncertain [SO]	Extent to which teacher exhibits her/his uncertainty.	It is easy to make a fool out of this teacher.
Dissatisfied [OS]	Extent to which teacher shows unhappiness/dissatisfaction with student.	This teacher thinks that we don't know anything.
Admonishing [OD]	Extent to which teacher shows anger/temper/impatient in class.	This teacher is impatient.
Strict [DO]	Extent to which teacher is strict with and demanding of students.	We are afraid of this teacher.

Based on the Leary model, Wubbels et.al (1993) provides the map of teachers' behaviour with the proximity dimension (Cooperation and Opposition) and Influence dimension (Dominance-Submission) from the each scales of QTI.

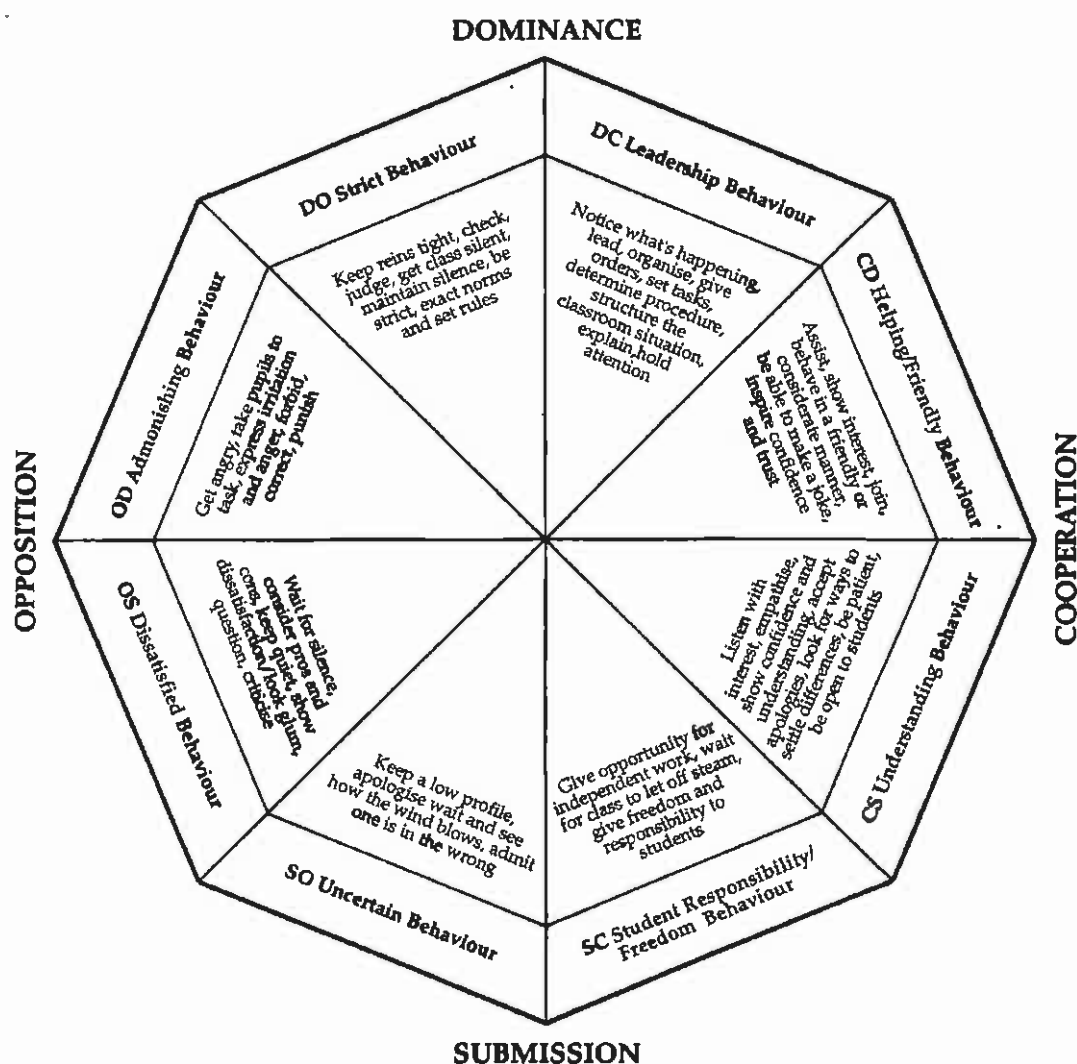


Figure 1. The model for Interpersonal Teacher Behaviour

### Place-based Learning and Constructivist Environment Survey (PLACES)

The *Place-based Learning And Constructivist Environment Survey* (PLACES) (Zandvliet, 2007) has been developed to gather information on students' perception of their learning about environment both in field-based as well as classroom-based activities. The scales for this instrument have been taken from already established learning environment questionnaires: the *Environmental Science Learning Environment Inventory* (ESLEI) (Henderson & Reid, 2000), the *What is Happening in this Class* (WIHC) (Aldridge, Fraser, & Huang, 1999) the *Science Learning Environment Inventory* (SLEI) (Fraser, Giddings, & McRobbie, 1995) the *Science Outdoor Learning Environment Instrument* (SOLEI) (Orien, Hofstein, Pinchas & Giddings, 1994) and the *Constructivist Learning Environment Survey* (CLES) (Taylor, Fraser, & Fisher, 1997). In all, the PLACES has 40 items spread across eight scales (Zandvliet, 2007) and has been administered and validated in Australia, Canada, India, and Mauritius. (Koul & Zandvliet, 2008). The description and example of each items in the PLACES is shown on Table 3.

**Table 3: Description and Example of Items for Each Scale in the PLACES**

Scale	Description	Item
Relevance/Integration [R/I]	Extent to which lessons are relevant and integrated with environment and field based activities.	Lessons are supported with field experiences and other field-based activities.
Critical Voice [CV]	Extent to which students have a voice in class.	It's all right for me to openly express my opinion.
Student Negotiation [SN]	Extent to which students can negotiate activities in their class.	Other students ask me to explain my ideas.
Group Cohesiveness [GC]	Extent to which the students know, help and are supportive of one another.	Members of this class help one another during classroom activities.
Student Involvement [SI]	Extent to which students have attentive interest, participate in discussions, perform additional work and enjoy the class.	I pay attention.
Shared Control [SC]	Extent to which teacher gives control to the students.	I help the teacher to decide which activities I do.
Open Endedness [OE]	Extent to which the teacher gives freedom to think and plan own learning.	I am encouraged to think for myself.
Environmental Interaction [EI]	Extent to which students are engaged in field trips.	Learning is very important for me during our field trips.

## RESEARCH METHODS

This study will involve the use of both qualitative and quantitative methods, which have been used successfully in various learning environment studies (Aldridge, Fraser, & Huang, 1999; Koul & Fisher, 2003; Tobin & Fraser, 1998). Fraser (2000) used a mixed methods approach in studying the classroom learning environment at different 'grain sizes' to show how not only individual students and teachers could be investigated at the smallest grain size, but also at the class, school and system level to clarify whether particular teachers or students were typical of larger groups. Therefore, in this study, quantitative and qualitative research methods (surveys and observations) and various grain sizes (student, gender group, year group, and class) used in this study.

Furthermore, the study is conducted to assess students' perceptions regarding environmental science education and how it influences students' interactions with the teacher, and students' awareness of their place in the environment. Combination of QTI and PLACES questionnaire and classroom observations is used in this first year of study to answer these questions:

1. How do students' perceptions on their interactions with the teachers and their awareness of their place in the environment?
2. To what extent are students' perceptions on their interactions with the teachers and their awareness of their place in the environment affected by gender and school?
3. To what extent is the each scale on QTI represented in the teachers' profile?
4. To what extent is the each scale on QTI and PLACES represented in the science teaching?

### Sample

The sample for this study is 2009-year eight students. A total of 265 students (51% male and 49% female) from 13 classes in three different West Australian High Schools were asked for their perceptions of their teachers' interpersonal behaviour using the Questionnaire on Teacher Interaction (QTI) and Place-based Learning And Constructivist Environment Survey (PLACES). There are two public schools and one private school with different culture and characteristics participated in this study. The same sample will be studied for the next two years or until these students finish year 10. In the second and third years, the co-teaching/co-generative dialogue approach will be employed in a larger sample of 20 classrooms.

## RESULTS

### Quantitative Analysis of Students' Perceptions of QTI and PLACES

Combination of two existing learning environment questionnaires (QTI and PLACES) was used in this study. The questionnaire was also administered in two different ways. In the first part, the students completed the PLACES questionnaire on a hard paper copy and then in second part, they completed the QTI questionnaire by an electronic program namely Keepad. Although, each method of data collection has strengths and weaknesses, it provided good experiences for the students on completing the surveys. The results from QTI and PLACES is analysed by SPSS with different types of analysis which are reliability, correlation, and differences between groups (gender and school). The analysis below shows the integrated quantitative analysis of the survey results.

**Table 4: Scale Internal Consistency (Cronbach Alpha Reliability, Means and Standard Deviations**

Scale	Alpha Reliability	Mean	Standard Deviation
Leadership	0.82	3.55	0.93
Understanding	0.88	3.39	1.05
Uncertain	0.81	2.33	0.95
Admonishing	0.85	2.68	1.10
Helping/Friendly	0.82	3.46	0.92
Student responsibility	0.61	2.70	0.68
Dissatisfied	0.74	2.23	0.79
Strict	0.68	2.83	0.77
Relevance/integration	0.70	3.08	0.70
Critical voice	0.80	3.55	0.88
Student negotiation	0.75	3.32	0.75
Group cohesiveness	0.86	3.72	0.82
Student involvement	0.72	3.27	0.76
Shared control	0.89	2.01	0.90
Open endedness	0.84	3.27	0.92

*N* = 265; female = 130; male = 135

### The Reliability of Instrument

The QTI and the PLACES are two pre validated learning environment questionnaire. However, the analysis of reliability instrument is further established in this study, since the combination of these two questionnaires is used in specific learning environment. Analysis of instrument reliability is estimated by internal consistency based on the correlation among the variables by using Cronbach's alpha reliability coefficient (Brown, 2007; Newby & Fisher, 1997). The table 4 shows that the instrument alpha reliability figures ranged from 0.61 to 0.89. Therefore, the results show that the instrument is reliable for the study with all alpha reliabilities above 0.50 (De Vellis, 1991).

In addition to the overview of mean of each scale shows that the scale of uncertain, admonishing, student responsibility, dissatisfied, strict, and shared control indicates the low usage in the classroom which is shown by the mean <3. The scale of leadership, understanding, helping friendly, relevance/integration, critical voice, student negotiation, student involvement, and open endedness is high usage which is implied by the mean score >3.

### Correlations between Scales

Pearson's correlation was used to analyse correlation between the scales. This test is applied to find a correlation between at least two continuous variables (Brown, 2007). The interpretation of correlation could be done by examining the significant value (*p*) which less than 0.05 (Coakes & Steed, 2007). Furthermore, the correlation coefficient can range from -1.00 to +1.00, the value of negative shows the negative correlation while the positive value shows the positive correlation.

**Table 5: Inter-scale Correlations**

	LEA	UND	UNC	ADM	HELP	SRES	DISS	STRT	RELV	CRICL	STNE	STIN	SHCO	OPEN
LEA	1	.707**	-.713**	-.588**	.658**	.063	-.489**	.010	.151*	.169**	.279**	.293**	.269**	.199**
UND		1	-.480**	-.801**	.710**	.374**	-.603**	-.342**	.132*	.329**	.418**	.337**	.312**	.297**
UNC			1	.465**	-.511**	.141*	.481**	-.144*	-.002	-.078	-.110	-.201**	-.105	-.037
ADM				1	-.636**	-.325**	.586**	.405**	-.074	-.202**	-.226**	-.155*	-.143*	-.209**
HELP					1	.449**	-.537**	-.227**	.217**	.363**	.344**	.367**	.269**	.311**
SRES						1	-.186**	-.430**	.164**	.329**	.258**	.246**	.105	.265**
DISS							1	.460**	-.176**	-.244**	-.205**	-.261**	-.130*	-.107
STRT								1	-.094	-.197**	-.117	-.087	.007	-.058
RELV									1	.297**	.270**	.250**	.269**	.308**
CRICL										1	.536**	.422**	.359**	.329**
STNE											1	.483**	.586**	.341**
STIN												1	.465**	.318**
SHCO													1	.511**
OPEN														1

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

The result shows that most the inter-scale correlations are not significantly correlated, except for the scale of strict, relevance, open endedness, shared control which have the value of  $p < 0.05$ .

### Comparison of the Students' Perceptions of QTI and PLACES by Gender

The result of mean differences between the female and the male students responses, together with the results of F-tests and effect size ( $r$ ) for each scale show in the table 6. According to Coakes and Steed (2007), F-tests and effect size ( $r$ ) of the sample could be determined the degree of significant differences between different groups.

The results from the Table 6 show that there are no statistically significant differences between the female and male students on scales of QTI and PLACES which is confirmed by the means and standard deviation scores which have only slight differences. Then, the values of F also show that there are no significant differences between groups except for student responsibility, strict, and group cohesiveness. According to Cohen (1996) the effect size ( $r$ ) for social study has different range: small effect size,  $r = 0.1 - 0.23$ ; medium,  $r = 0.24 - 0.36$ ; large,  $r = 0.37$  or larger (Wikipedia, 2010). Therefore, the results show that almost all scales have the small effect size in the groups, except for strict which has large effect size with value of  $r > 0.37$ . Therefore, all data indicates there are no significant differences between male and female students' perceptions on their environment.

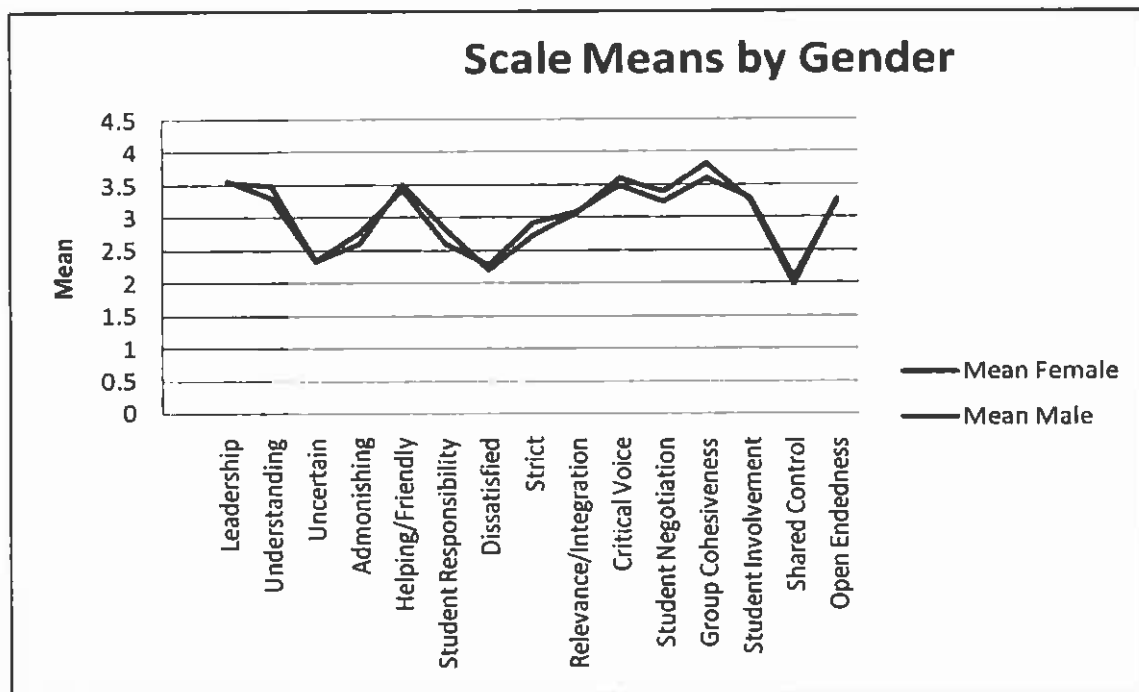


**Table 6: Item Mean and Standard Deviation for Gender Differences in Students' Perceptions**

Scale	Mean		SD		F	Effect size (r)
	Female	Male	Female	Male		
Leadership	3.55	3.56	0.92	0.95	0.001	0.005
Understanding	3.49	3.29	0.98	1.11	1.499	0.095
Uncertain	2.34	2.32	0.97	0.94	1.594	0.010
Admonishing	2.6	2.77	1.03	1.16	1.888	0.077
Helping/Friendly	3.51	3.42	0.86	0.98	1.293	0.049
Student Responsibility	2.82	2.59	0.68	0.66	0.041*	0.169
Dissatisfied	2.2	2.26	0.77	0.81	0.583	0.038
Strict	2.73	2.92	0.78	0.76	0.167**	1.224
Relevance/Integration	3.07	3.08	0.68	0.71	0.039	0.007
Critical Voice	3.62	3.48	0.9	0.86	0.429	0.079
Student Negotiation	3.41	3.24	0.67	0.81	3.600	0.114
Group Cohesiveness	3.84	3.6	0.85	0.78	2.045**	0.146
Student Involvement	3.26	3.29	0.74	0.79	1.403	0.019
Shared Control	1.97	2.06	0.82	0.98	2.352	0.049
Open Endedness	3.29	3.24	0.92	0.92	0.037	0.027

*n* = 265; female = 130; male = 135

\**p* < 0.01, \*\**p* < 0.05

**Figure 2. Scale Means of QTI and PLACES by Gender**

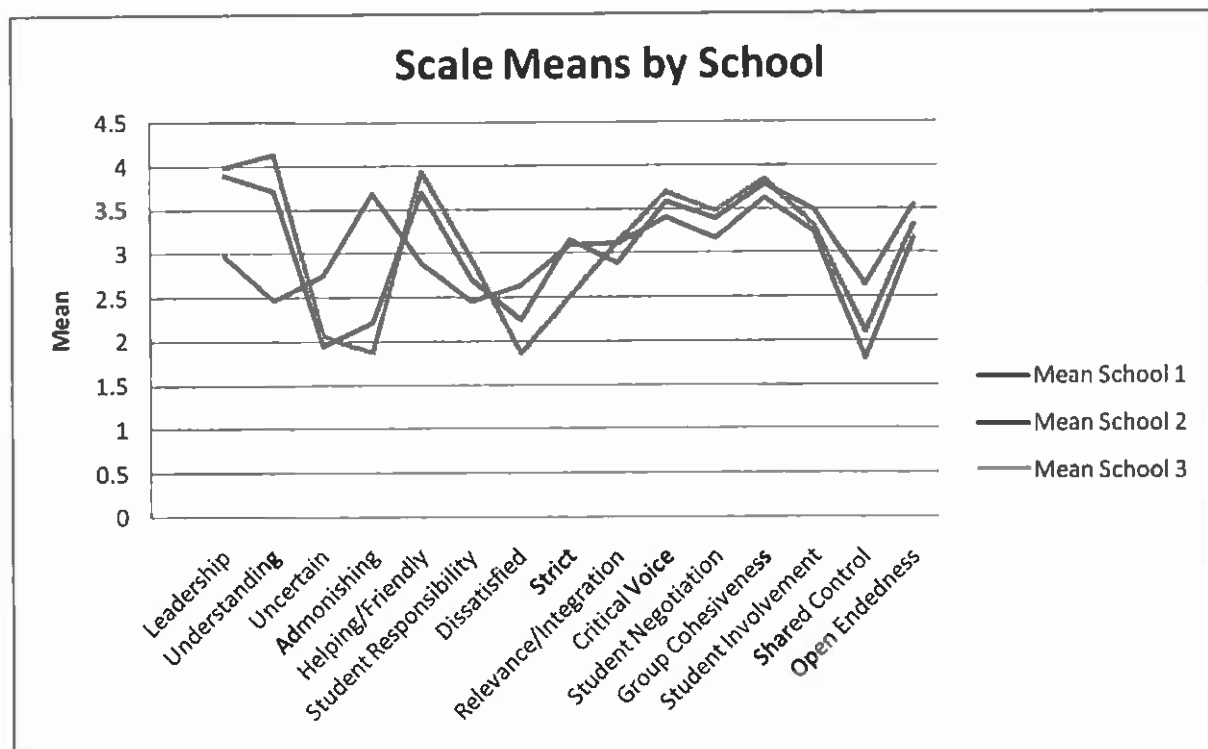
## Comparison of the Students' Perceptions of QTI and PLACES by School

**Table 7: Item Mean and Standard Deviation for Schools Differences in Students' Perceptions**

Scale	School 1		School 2		School 3		F
	Mean	SD	Mean	SD	Mean	SD	
Leadership	2.97	0.93	3.89	0.75	3.99	0.67	0.266
Understanding	2.47	0.71	3.71	0.82	4.13	0.65	3.050**
Uncertain	2.75	0.95	1.95	0.68	2.06	0.87	0.840
Admonishing	3.68	0.69	2.22	0.66	1.87	0.68	2.801
Helping/Friendly	2.89	0.79	3.69	0.49	3.93	0.79	0.205
Student Responsibility	2.45	0.70	2.70	0.65	2.94	0.61	1.665
Dissatisfied	2.63	0.75	2.25	0.76	1.86	0.66	2.720
Strict	3.09	0.68	3.15	0.66	2.50	0.75	5.849**
Relevance/Integration	3.11	0.64	2.89	0.90	3.12	0.71	0.533
Critical Voice	3.40	0.88	3.58	1.03	3.70	0.86	0.291
Student Negotiation	3.17	0.73	3.39	0.80	3.47	0.75	0.058
Group Cohesiveness	3.63	0.68	3.78	1.03	3.83	0.90	0.023
Student Involvement	3.23	0.72	3.49	.67	3.30	0.83	0.747
Shared Control	1.80	0.76	2.63	1.09	2.10	0.96	2.868
Open Endedness	3.17	0.80	3.54	.89	3.32	1.02	0.656

*n* = 265; School 1 = 112; School 2 = 19; School 3 = 123

\**p* < 0.01, \*\**p* < 0.05



**Figure 3. Scale Means of QTI and PLACES by School**

The analysis of comparison between schools is investigated by mean, standard deviation, and F-test (Table 7). The analyses of mean values show that the school one has different pattern from other two schools. For example,

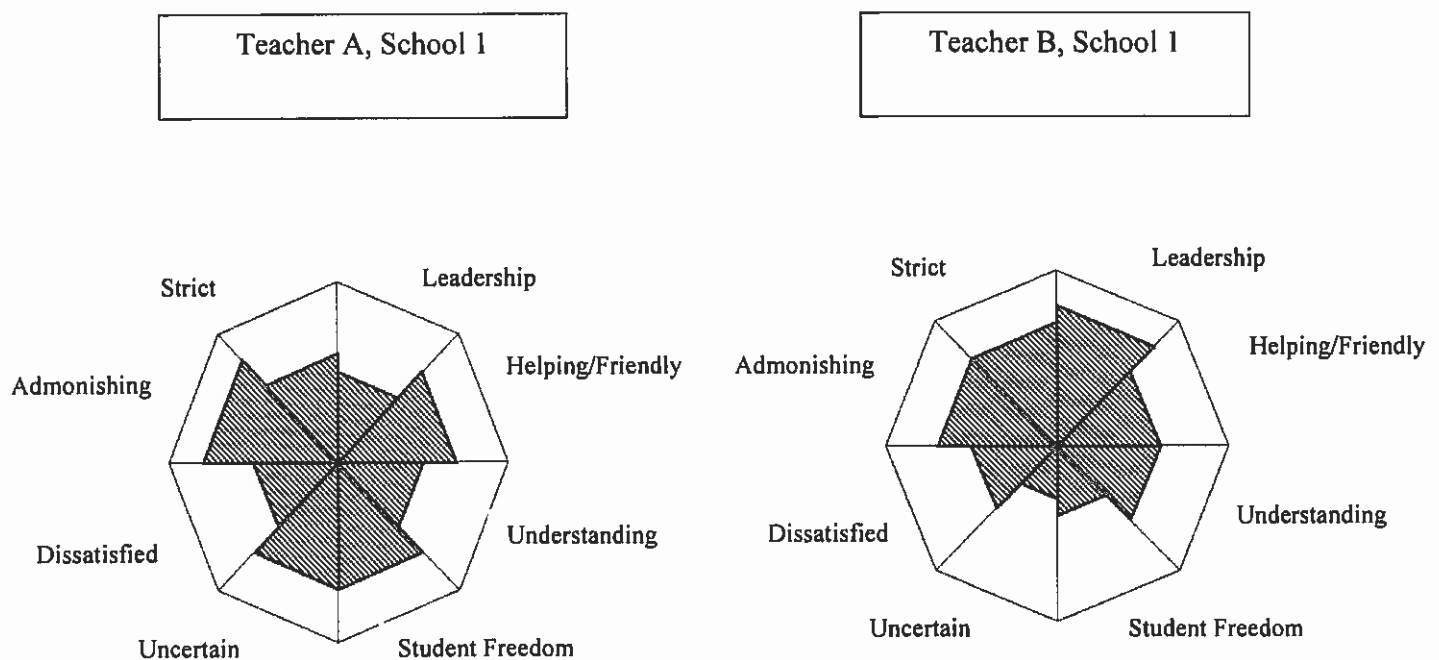
the negative scales of uncertain, admonishing, and dissatisfied have high mean values. On the other hand the positive scales of leadership, understanding, helping friendly, student responsibility, and shared control have the low mean values. Compared to other two schools, the school two mean value of strict is quite high and the mean value of relevance/integration is quite low. In addition to F-test between schools show that only the scale of understanding and strict have statistically significant differences.

The Figure 3 also shows that the first school has quite different profile compared to other two schools, especially in the five scales (understanding, uncertain, admonishing, student responsibility, dissatisfied, and strict). The mean of understanding and student responsibility is quite low. On the other hand, the mean of uncertain, admonishing, and dissatisfied is quite high.

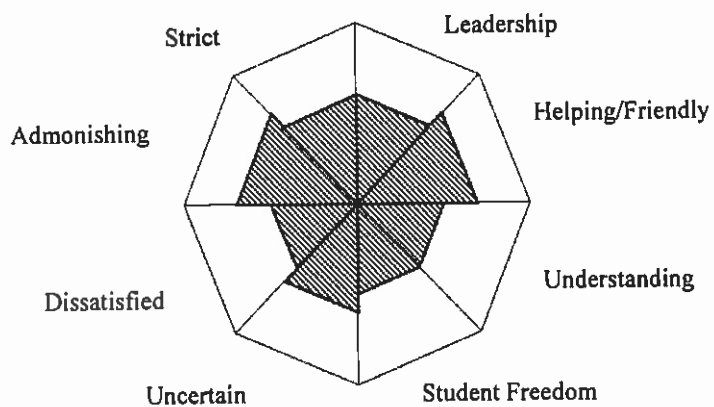
### Teacher Profile

A summary of these 48 scores in QTI results is presented in teacher profile that describes how a teacher interacts with his/her students. The figure uses two dimensions to map teacher behaviour: Dominance-Submission and Cooperation-Opposition. The dimensions are represented in a pie chart divided into eight sectors. The figures below show the teachers' profile from different schools. A profile was drawn based on their students' perceptions.

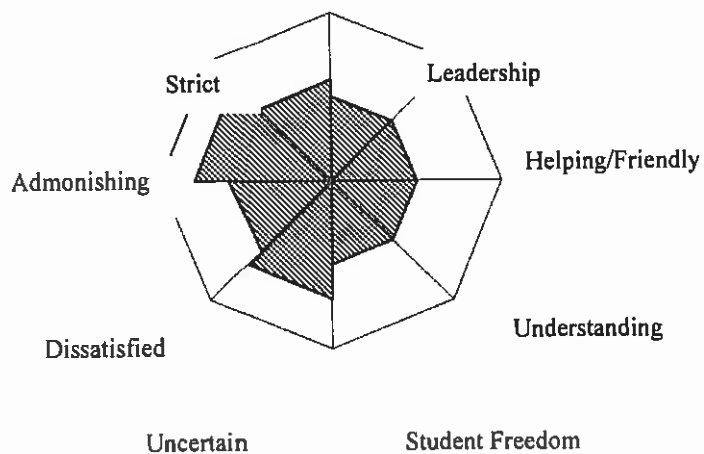
Figure 4. Teacher profile's results from participating schools



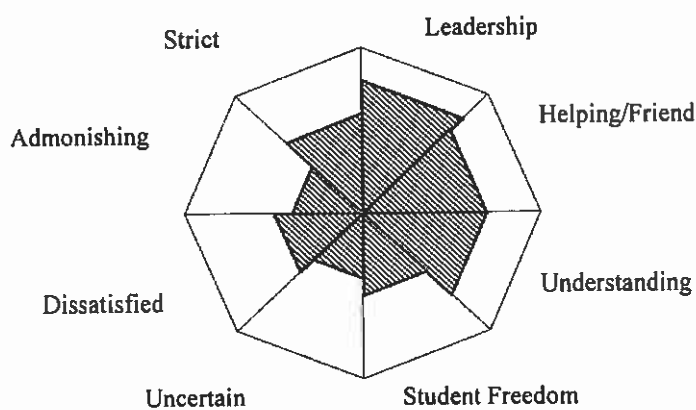
Teacher C, School 1



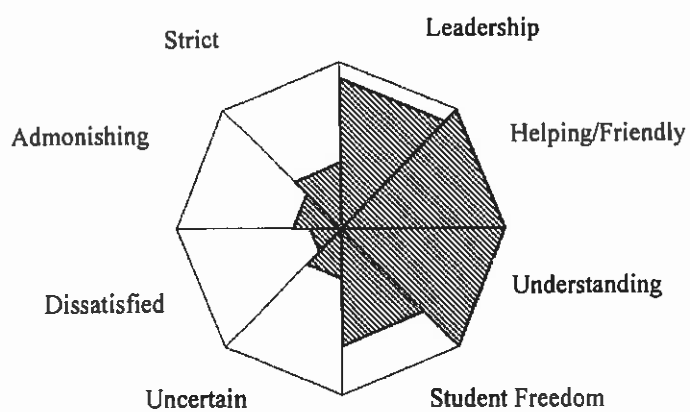
Teacher D, School 1



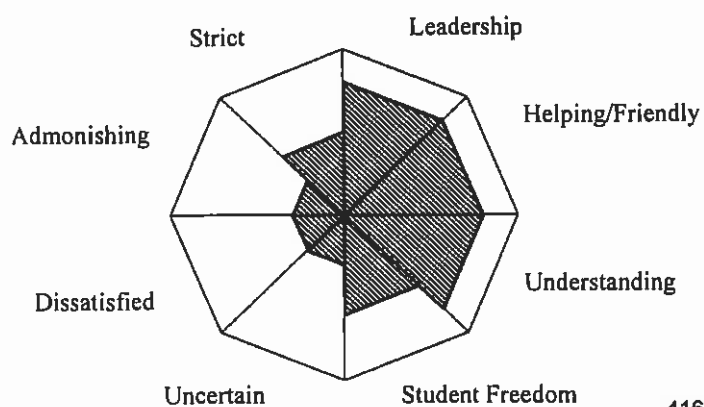
Teacher A, School 2



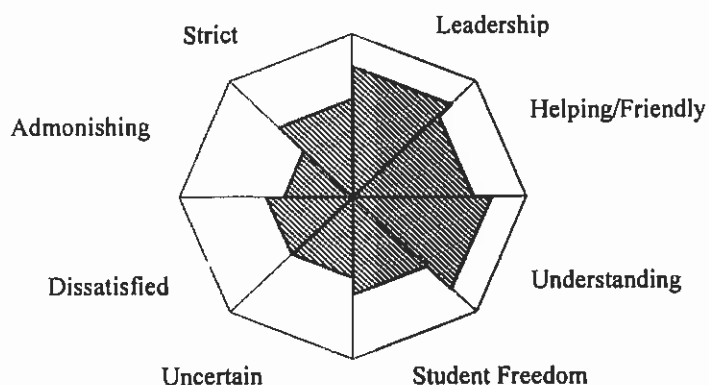
Teacher A, School 3



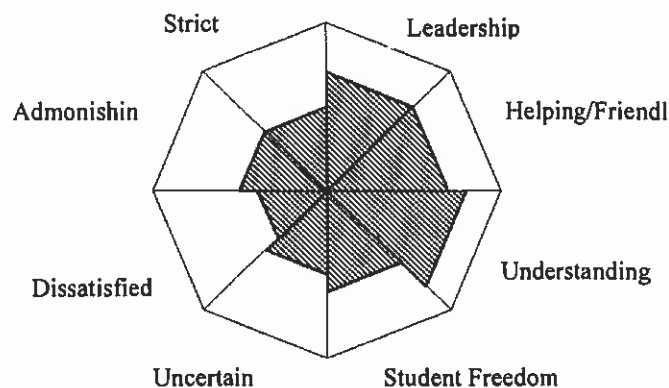
Teacher B, School 3



Teacher C, School 3



Teacher D, School 4



All the teacher profiles are different in appearance suggesting that each teacher interacted differently with their students. The picture on the left side of the profile shows the negative scales on the questionnaire and vice versa. Therefore, from the picture profile, students who have most positive perceptions on their teacher can be seen on teacher A at school 3. The researcher also observed in the classroom how this teacher interacted with the students. This teacher has positive attitude, such as understanding, good leadership, and helping/friendly behaviours. Most teachers are considered as a good leader by students' perceptions which can be seen on the first part on the right side, especially at the school 2 and school 3. At the school 1, the results are also quite similar; the left side of the profile is quite similar with the right side. The large part of negative scale on admonishing is shown from the teachers' profile at school 1. However, it needs to be observed in-depth into classroom observations and several interviews to get integrated information of the teacher profiles. Based on students' perception, most the teachers are also considered as helping/friendly teachers. The teacher profile helps the researcher and the teachers to obtain feedback about students' perceptions on their teachers. The next step in this study was to conduct observations of student-teacher interaction in selected classes to improve its interaction.

### Qualitative Analysis of Students' Perceptions of QTI and PLACES

The qualitative data was collected from the classroom observations in three science classrooms in three schools. The observation was focused in the QTI and PLACES which are student-teacher interaction, teacher profile, and student place in the environments. Throughout the observation process, the findings provide meaningful insights into the features of learning environment which is also having positive significant correlation with scale of QTI and PLACES. Further data collections in the second year, such as interview with students and teachers will provide the detailed information of their perceptions.

### Classroom Observations

Fourteen classroom sessions were observed in the three participating schools, seven sessions in school one, four sessions in school two and three sessions in school three. The first school and the second school are the public schools; meanwhile the third school is the private school. All the three school are located in different suburbs in Western Australia. Observations were conducted in science classrooms in school one and three and Environmental Education class in school two.

### School One

The observations in this public school were conducted while the researcher administered the questionnaire. Even though it was not in-depth classroom observations, the science classrooms' culture in this school can be captured from 7 classrooms which participated in the survey. Each class had approximately 25 students. However, only 6 to 23 students consented to participate in the study. Some teachers asked students to come to the class who were prepared to conduct the survey. The other teachers divided the students into two groups based on the willingness to participate in the research. In these classes, the teachers gave some activities to students who were not participating in the research. Some teachers had good leadership skills and managed the classes while other students completed the questionnaire. In other classrooms, the teachers taught the subject first before the students

completed the questionnaire. The teacher-centred style was observed generally observed in these classes. After conducting the survey, the science coordinator in this school selected the class that was the focus of the case study in this research. The selected class is the academic extension class which was composed of students who have good academic achievement and motivation in the science subject.

### **School Two**

School two provides another picture of science classrooms in the research. This public school is considered as one of the top schools in academic achievement in Western Australia. The observations were conducted in one environmental education class after the researcher conducted the survey in five classes. In particular, this school differed from other two participating schools, as this school has an environmental education class. As a result, in this school, students can learn more specific issues and activities in environmental education. In this class, the students learn about environmental topics and issues on Tuesdays morning. Then they do the practical work on Fridays afternoon. On Fridays, the students do practical work such as gardening and worm farming. The students work towards keeping the environment green. The researcher conducted four classroom observations. During the observations, the researcher was not only a passive observer, but also helped the teacher with environmental activities. The researcher observed the teacher's passion about environmental sustainability in the way he conducted himself in the classroom. For example he always kept the light off during teaching if the light from sun was appropriate for teaching and gave double-sided worksheets to students' to save paper. His enthusiasm was captured during his teaching by motivated students who were actively working towards saving the environment. Even though, the class was teacher-centred and still dominated the learning activities, the teacher tried to provide different learning activities for students which related to the environment. The teacher would give homework and group work which was related to students' daily lives such as the percentage of students' carbon consumption each day, the daily activities of students to save the environments, and making environment posters. Most students were excited during the practical work; they told the researcher that they enjoyed the subject. The activities in this classroom contributed towards greener environment in the school, such as planting the plants and managing the organic rubbish from the canteen for the worm farm. As a result, both theoretic and practical work in the environment provided the integrated learning activities for the students.

### **School Three**

School three was a private school which had a different environment as compared to other two schools. The students are international students with different cultural and ethnic backgrounds and cultures. Most of students are using English as their second language which sometimes was a challenge for the teacher. The teacher told the researcher that, some students have difficulties in using English as an instructional language. This school has only one science class in each level. Therefore, the survey and observations were conducted in the one class. Three classroom sessions were observed in this science class. Even though, the class was dominantly teacher-centred, the teacher was performing different learning activities to engage the students in science, such as practical and group work. In the learning activities, some students participated actively by asking questions or working in groups. One day, the teacher set practical work about investigation of fish anatomy. Some students were serious about working on this activity; while as others were observed playing around with the fish and equipment. In this class teacher leadership plays important role, because the students were less disciplined. Based on the classroom observations and the result of the questionnaire, the teacher has a good leadership, especially in class management. In addition to student freedom, the researcher found that the teacher is the only one who decides the learning activities for the students. As a result, students have less contribution to their learning.

### **Summary on Classroom Observations**

Even though the most classes were teacher-centred, the teachers tried to engage students by providing varied learning activities. The students also had less opportunity to contribute and make decision about their learning. Thus the teachers were the decision makers for students' learning. Combination data collection of questionnaire results and classroom observations found that they had strong characteristics in relation to leadership and helping/friendly behaviours. This is further supported by teachers' profiles (Figure 4). In addition to relevance/integration with environment, the teachers prepared the topics on the environment which were effectively integrated in science classroom.

## CONCLUSION

In conclusion, this is the first time the QTI and PLACES has been administered to provide the information of students' perceptions on the interaction with their teacher and their awareness of their place in the environment. Throughout this study, it was found that the instrument is reliable with all alpha reliabilities above 0.50. The scale of uncertain, admonishing, student responsibility, dissatisfied, strict, and shared control indicates of the low usage in the classroom which is shown by the mean less than 3. The scale of leadership, understanding, helping friendly, relevance/integration, critical voice, student negotiation, student involvement, and open endedness is of high usage which is implied by the mean score less than 3. The study found that students' perceptions on their learning environment are not affected by gender. The analysis of differences between three schools shows that the first school has quite a different profile compared to other two schools, especially in the five scales (understanding, uncertain, admonishing, student responsibility, dissatisfied, and strict). The combination of QTI and PLACES is appropriate to assess the students' perception on their learning environment. The result of these questionnaires could be used by the teachers as survey feedback for their perusal. It also can be used for the students to think reflectively into their learning and interactions with their teachers. Furthermore, the data collection from the questionnaires is supported with the classroom observations which are found that students make little contribution in deciding about their learning. The observed teachers have good leadership and helping/friendly characteristics. The teachers also always tried to create different learning activities to engage the students. Finally, this first year of study provides an overall understanding about how science classes were conducted in participating schools. The next study will be focus on selected class for case study in implementing co-teaching and co-generative dialogue.

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