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Classroom Environment and Teachers' Cultural Background in Secondary Science Classes in an Asian Context

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Abstract

The purpose of this study was to investigate associations between students' perceptions of science classrooms learning environment, their attitudinal outcomes and the cultural backgrounds of their teachers. A sample of 1,188 students from 54 science classes in ten secondary schools in Brunei completed the *What Is Happening in This Class?* (WIHIC) questionnaire. Responses to two scales of the *Test of Science Related Attitudes* (TOSRA) were used as attitudinal measures. Statistical analysis supported the reliability of the instruments when used in this context. Associations between students' perceptions of classroom environment as assessed by the WIHIC and cultural background of teachers were also investigated. Significant associations were found between most of the scales and teachers' cultural background. The results showed that students perceived a more favourable learning environment in the classrooms of the Western teachers. Students perceived that the science classrooms of Western teachers were more cohesive, they received more teacher support and they were more involved in the work of the class. Students also perceived that in the science classes of Western teachers, there was more task orientation, cooperation among students and equity. The study also found that students in the classrooms of Western teachers enjoyed their science lessons more than those students in the other classes.

Introduction

The study of learning environment was rooted in the formula on the relationship of an individual and the environment proposed by Lewin (1936). He believed that all behaviour and experience are a function of the person and his/her environment. His mathematical formula B=f (P,E) indicates that a person's behaviour reflects the environment and the person within the environment. Since Lewin's time, international research efforts involving the conceptualisation, assessment, and investigation of perceptions of aspects of the classroom environment have firmly established classroom environment as a thriving field of study (Fraser, 1994, 1998; Fraser & Walberg, 1991). For example, recent classroom environment research has focused on constructivist classroom environments (Taylor, Fraser & Fisher, 1997), cross-national studies of science classroom environments (Fisher, Rickards, Goh, & Wong, 1997), science laboratory classroom environments (McRobbie & Fraser, 1993), computer laboratory classroom environment (Newby & Fisher, 2000) and computer-assisted instruction classrooms (Stolarchuk & Fisher, 1999; Teh & Fraser, 1995).

In the past three decades, much attention has been given to the development and use of instruments to assess the qualities of the classroom learning environment from the perspective of the student (Fraser, 1994; 1998; Fraser & Walberg, 1991), and the association between learning environment variables and student outcomes has provided a particular focus for the use of learning environment instruments. In a meta-analysis which examined 823 classes in eight subject areas and representing the perceptions of 17,805 students in four nations, Haertel, Walberg and Haertel (1981) found enhanced student achievement in classes which students felt had greater cohesiveness, satisfaction, and goal direction and less disorganization and friction. Other literature reviews since then have supported the existence of associations between classroom environment variables and student outcomes (Fraser, 1998).

The What Is Happening In This Class? (WIHIC) Questionnaire

While a number of learning environment research instruments have contributed to a better understanding of the socio-psychological climate of classrooms, some researchers felt that there was a need for a single instrument which incorporated some of the best features of the instruments previously developed. Based on the previous studies, Fraser, Fisher, and McRobbie (1996) developed a new learning environment instrument called *What Is Happening In This Class?* (WIHIC) which incorporates scales that have been used and proved to be significant predictors of learning outcomes. They also included additional scales which are designed to measure current concerns in the classrooms, such as cooperation and equity issues.

The What Is Happening In This Class? (WIHIC) consists of 7 scales and 56 items (Fraser, Fisher, & McRobbie, 1996; Aldridge & Fraser, 1997). The seven scales are Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity. Table 1 shows the scales in the WIHIC, along with a brief description of each scale and a sample item from each scale in the questionnaire.

Table 1

Scale Description for each Scale and Example of Items in the What Is Happening In This Class? [WIHIC] Questionnaire

Student	Extent to which students are	I make friendships among

Cohesiveness [SC]	friendly and supportive of each other.	students in this class.
Teacher Support [TS]	Extent to which the teacher helps, befriends, and is interested in students.	The teacher takes a personal interest in me.
Involvement [IV]	Extent to which students have attentive interest, participate in class and are involved with other students in assessing the viability of new ideas.	I discuss ideas in class.
Investigation [IN]	Extent to which there is emphasis on the skills and of inquiry and their use in problem-solving and investigation.	I carry out investigations to test my ideas.
Task Orientation [TO]	Extent to which it is important to complete planned activities and stay on the subject matter.	Getting a certain amount of work done is important.
Cooperation [CO]	Extent to which students cooperate with each other during activities.	I cooperate with other students when doing assignment work
Equity [EQ]	Extent to which the teacher treats students equally, including distributing praise, question distribution and opportunities to be included in discussions.	The teacher gives as much attention to my questions as to other students' questions.

Source: Aldridge & Fraser (1997)

Since its development, the WIHIC has been used to measure the psychosocial aspects of the classroom learning environment in various contexts. In some research, the questionnaire has been used without any modifications, and in others the questionnaire was adapted to suit the specific context. To date, the original questionnaire in English has been translated into Chinese for use in Taiwan (Aldridge & Fraser, 1997) and Singapore (Chionh & Fraser, 1998) and Korean for use in Korea (Kim, Fisher, & Fraser, 2000).

A study by Rawnsley and Fisher (1998) investigated associations between learning environments in mathematics classrooms and students' attitudes towards that subject in Australia using the WIHIC questionnaire. It was found that students developed more positive attitudes towards their mathematics in classes where the teacher was perceived to be highly supportive, equitable, and in which the teacher involved them in investigations.

Chionh and Fraser (1998) used actual and preferred forms of the WIHIC to further validate the instrument and to investigate associations between actual classroom environment and the outcomes. The associations between five different outcome measure namely, examination results, self-esteem, and three attitude scales and the seven actual classroom environment scales were investigated in geography and mathematics classrooms in Singapore and Australia. The study revealed that better examination scores were found in geography and mathematics classrooms where students perceived the environment as more cohesive. It was also found that self-esteem and attitudes were more favourable in classrooms perceived as having more teacher support, task orientation and equity.

Associations between perceptions of learning environment and attitudinal outcomes were reported by Hunus and Fraser (1997) when they used a modified version of the WIHIC with students in Brunei. In their study, simple and multiple

correlation analyses show that there was a significant relationship between the set of environment scales and students' attitudes towards chemistry theory classes. Using the individual students as the unit of analysis, the Student Cohesiveness, Teacher Support, Involvement, and Task Orientation scales were found to be positively associated with the students' attitudes. The results further suggested that students perceived moderately positive learning environments in chemistry theory classes in terms of Student Cohesiveness, Teacher Support, Involvement and Investigation. A highly positive environment on Task Orientation and Cooperation was also detected in the chemistry classrooms.

The study by Khoo and Fraser (1997) used a modified version of the WIHIC to measure classroom environment in evaluating adult computer courses. From the original questionnaire, six scales, Student Cohesiveness, Teacher Support, Involvement, Autonomy/Independence, Task Orientation and Equity were chosen to be included in a newly developed questionnaire. Out of these six scales, Student Cohesiveness and Teacher Support scales were collapsed into one named Trainer Support to suit the nature of the subject. After factor analysis, a set of 38 items were retained to assess the five scales of Trainer Support, Involvement, Autonomy/Independence, Task Orientation, and Equity. In investigating the differential effectiveness of computer courses for different gender, they found that males perceived significantly greater Involvement. At the same time, it was found that females perceived significantly higher levels of Equity in the computer classroom environment. In the Trainer Support dimension, sex and age interaction occurred in addition to a significant sex main effect. It was found that males perceived greater Trainer Support than females, but older females has more positive perceptions than younger females.

Gender-related differences in students' perceptions of their learning environments and teacher personal behaviour were explored by Kim, Fraser, and Fisher (2000) using the WIHIC. The study involved 543 grade 8 students in 12 different secondary schools in metropolitan and rural areas of Korea. Statistically significant differences were found that between boys' and girls' perceptions of the learning environment on all seven scales. It was reported that boys perceived more Teacher Support, Involvement, Investigation, Task Orientation, and Equity than did girls.

The above mentioned studies indicate that the WIHIC is useful in portraying the nature of a science classroom and investigating gender differences in specific classroom environments. The above research studies have indicated consistently that the WIHIC can be used to gather information from students for improving teaching and learning in different classroom contexts.

In examining education systems in different contexts and cultures, there is a suggestion that there are some fundamental differences in approaches. Schools in Asia are more examination-oriented and teachers are seen as authority figures. As such, students from an Asian background seem to perceive their teachers significantly more positively in the classroom compared with students from other cultural backgrounds (Fisher & Rickards, 1998).

In an attempt to explore the potential of cross-cultural studies, Fraser and Aldridge (1998) examined classrooms in Australia and Taiwan using English and Chinese versions of the WIHIC. The results show that students in Australia consistently viewed their classroom environment more positively then students in Taiwan. Significant differences were detected on the WIHIC scales of Involvement, Investigation, Task Orientation, Cooperation, and Equity. This means that students in Australia perceived they are given more opportunity to get involved in the experiments and investigate scientific phenomena. They also have an opinion that teachers are cooperative and give an equal chance of participation to both genders.

Again in this study, cultural differences were highlighted and it appears that the education system in Taiwan is examination-driven and teaching styles are adopted to suit the particular situation. It was found that in Taiwan the most important element of being a good teacher was perceived as having good content knowledge, but in Australia, having a good interpersonal relation between teacher and students is considered the most important element in the education process. Taiwanese classrooms offer a teacher-centered lesson in which students appear to play a passive role and there are only a few opportunities to discuss or question.

These studies indicate that the WIHIC is useful for differentiating between cultural differences in the classroom environment and therefore is suitable for cross-cultural studies. Thus, the purpose of this study was to investigate associations between students' perceptions of science classrooms learning environment, their attitudinal outcomes and the cultural backgrounds of their teachers.

Context and Methodology

The objectives of this study were to:

provide validation data for the use of the WIHIC in Brunei;

examine associations between the learning environment and students' attitudes to science; and

investigate whether there are any differences in the classroom learning environment of Western science teachers and the Asian science teachers.

This investigation was carried out in secondary schools in Brunei, a country situated on the north-west coast of the island of Borneo. Due to the shortage of local science teachers in the secondary schools expatriate teachers from Australia, New Zealand, and the United Kingdom are recruited to fill the gap. Sharifah (1997) noted that recruitment of science teachers from other countries has been a feature of the schools in Brunei.

The attitudes of the students towards science were measured using two scales from the *Test of Science Related Attitudes* (TOSRA) (Fraser 1981). The instrument has been extensively field tested in Australia and other countries and has shown high reliability (Fraser, 1981). The two scales deemed appropriate for this study were the 'Attitude to Scientific Inquiry' and the 'Enjoyment of Science Lessons' scales.

The WIHIC and the attitude scales were administered to students in science classes from 10 government secondary schools. A total of 1,188 (543 male and 645 female) students from 54 science classes participated in this study. This sample represented 50% of the total population of Form 5 (Grade 11) students in government secondary schools. The class size varied from 11 to 32 students in each class with an average class size of 27 students. The mean age of the student is 17.1 years.

Results

Reliability and Validity of the WIHIC

In the statistical analyses both the individual student score and the class mean were used as the unit of analysis to determine the internal consistency (Cronbach alpha reliability) and discriminant validity (mean correlation of a scale with the other six scales of the instrument). The results are reported in Table 2. The reliability coefficients for different WIHIC scales ranged from 0.78 to 0.87 when using the individual student as the unit of analysis and from 0.81 to 0.94 when using the class mean as the unit of statistical analysis. Typically higher reliabilities were obtained when the class mean was used as the unit of statistical analysis.

Table 2

Scale Internal Consistency (Cronbach Alpha Reliability), Discriminant Validity (Mean Correlation with other Scales) and Ability to Differentiate Between Classrooms (ANOVA results) for the WIHIC

Scale	Units of Analysis	Alpha Reliability	Discriminant Validity	ANOVA Eta^2
Student Cohesiveness	Individual Class	0.78 0.88	0.38	0.08 **
Teacher Support	Individual Class	0.80 0.91	0.39	0.13 **

Involvement	Individual Class	0.80 0.87	0.45	0.10 **
Investigation	Individual Class	0.87 0.88	0.37	0.08 **
Task Orientation	Individual Class	0.79 0.81	0.39	0.08 **
Cooperation	Individual Class	0.85 0.90	0.41	0.09 **
Equity	Individual Class	0.85 0.94	0.40	0.17 **

** p <0.01 n = 1188 students and 54 classes

The highest alpha reliability for individual means (0.87) was obtained for the Investigation scale and class means (0.94) was obtained for the Equity scale. The lowest reliability for individual means (0.78) was found for the Student Cohesiveness scale, and for class means (0.87) was found in the Involvement scale. The mean correlations of one scale with the other scales ranged from 0.37 to 0.45. These values can be regarded as small enough to suggest that each scale of the WIHIC has adequate discriminant validity, even though the scales assess slightly overlapping aspects of classroom environment. The eta^2 statistic was calculated to provide an indication of the degree to which each scale could differentiate between the perceptions of students in different classes. The eta^2 statistic, which is the ratio of 'between' to 'total' sums of squares and represents the proportion of variance in scale scores accounted for by class membership, ranged from 0.10 to 0.17. This indicates that each scale of the WIHIC is capable of differentiating significantly between classes (p<0.01).

In general, the results are similar to the previous cross-validations of the instrument in Australia (Fraser, Fisher, & McRobbie, 1996), Taiwan (Aldridge, Huang, & Fraser, 1998), Singapore (Chionh & Fraser, 1998), and Korea (Kim, Fisher, & Fraser, 2000). The results confirmed that the Australian version of the WIHIC could be used with confidence in this context.

Associations between learning environment and attitudinal measures

Associations between science classroom environment as measured by the WIHIC scales and students' enjoyment of science lessons and attitudes towards scientific inquiry were explored by simple and multiple correlation analyses. As shown in Table 3, the results of the simple correlation analysis revealed that all of the seven scales were significantly correlated to the Enjoyment of Science Lesson (p<0.01). It was found that there were positive and significant associations between the classroom environment scales and enjoyment of science lessons, ranging from 0.15 to 0.34.

The multiple correlation, (R) was 0.44, which is statistically significant (p<0.001). This clearly confirmed that the nature of the classroom environment is strongly influencing the students' enjoyment of their science lessons. In order to interpret this relationship, the standardised regression coefficient (b) was also examined. It was found that out of the seven scales, four scales retained their significance (p<0.01 and p<0.001). This means that the scales, Teacher Support, Investigation, Task Orientation, and Equity are independent predictors of individual students' enjoyment of science lesson. The R^2 value which indicates the proportion of variance in enjoyment of science lessons that can be attributed to students' perception of classroom environment was 19%.

Associations between science classroom environment and the students' attitudes toward scientific inquiry are also

reported in terms of simple and multiple correlation analysis in the last two columns of the Table 3. The simple correlation analysis revealed that all seven scales in the WIHIC questionnaire were found to be significantly and positively correlated ($p<0.01$) with attitude to inquiry. This indicates that there is a positive and significant associations between the nature of the classroom environment and the students' attitude to inquiry.

An examination of the standardised multiple regression showed that none of the scales were found to be the independent predictors of students' attitudes towards scientific inquiry. The R^2 value which indicates the proportion of variance in attitude to inquiry that can be attributed to students' perception of classroom environment was only 3%.

Table 3

*Associations between WIHIC Scales and Enjoyment of Science Lessons and Attitude to Scientific Inquiry in Terms of Simple Correlations (r), Multiple Correlations (R) and Standardised Regression Coefficient (*b*)*

Scale	Enjoyment of Science		Attitude to Inquiry	
	r	b	*r*	b
Student Cohesiveness	0.16 **	-0.01	0.12 **	0.05
Teacher Support	0.31 **	0.14 ***	0.09 **	0.01
Involvement	0.27 **	0.04	0.11 **	0.03
Investigation	0.29 **	0.12 ***	0.19 **	0.02
Task Orientation	0.34 **	0.19 ***	0.12 **	0.05
Cooperation	0.15 **	-0.08	0.19 **	0.03
Equity	0.33 **	0.16 ***	0.11 **	0.04

Multiple correlations *R* 0.44 *** 0.16 ***

R^2 0.19 0.03

**$p<0.01$, ***$p<0.001$ n = 1188

Cultural Differences of teachers and Students' Perceptions of Learning Environments

One of the objectives of this study was to find out whether there are any differences in the classroom learning environment of the Asian science teachers and Western science teachers. Cultural differences of teachers in the perceptions of teacher interpersonal interaction and the science learning environments were examined using the WIHIC. This study was conducted in 54 science classrooms which involved 47 teachers. Out of the total number of teachers, 24 teachers came from Asia and had an Asian cultural background and 23 teachers came from Australia, New Zealand and the UK and had a Western cultural background.

Students perceived that there were more student cohesiveness and teacher support in the classrooms of the Western teachers. Students also perceived that there were more task orientation, cooperation and equity in the classrooms of the Western teachers. These differences are significant at $p<0.001$ level. In the area of involvement, students perceived that Western teachers provided more opportunity for their involvement in the science learning. The difference is

significant at $p<0.05$ level. In general it was found that there were significant differences in the students' perceptions of learning environments according to the cultural background of the teachers.

Table 4

Differences in Students' Perceptions of Leaning Environments of Asian and Western Teachers as Measured by the WIHIC Scales

Scale	Culture	Item Mean	SD	Item Mean Difference	t
Student Cohesiveness	Asian	3.71	0.59	-0.12	3.63 ***
	Western	3.83	0.61		
Teacher Support	Asian	2.97	0.65	-0.17	4.27 ***
	Western	3.14	0.73		
Involvement	Asian	2.90	0.65	-0.08	2.29 *
	Western	2.98	0.66		
Investigation	Asian	2.75	0.77	-0.06	1.34
	Western	2.81	0.80		
Task Orientation	Asian	3.72	0.63	-0.11	3.14 ***
	Western	3.83	0.59		
Cooperation	Asian	3.49	0.76	-0.13	3.11 ***
	Western	3.63	0.70		
Equity	Asian	3.33	0.75	-0.29	6.82 ***
	Western	3.63	0.74		

*p <0.05, ***p<0.001 n = 24 Asian and 23 Western teachers

Table 5 presents the cultural differences in students' enjoyment of science lessons and attitude to scientific inquiry of students in the classes of Asian and Western teachers. In terms of enjoyment of science lesson, students in the classes of Western teachers indicated that they enjoyed science lessons more than those students in the classes of Asian teachers. This was reflected in the mean score difference of 0.15 in favour of Western teachers and the difference was statistically significant at $p<0.001$. No significant difference was perceived on the Attitudes towards Scientific Inquiry scale.

Table 5

Cultural differences in Students' Enjoyment of Science Lessons and Attitude to Scientific Inquiry Measured by TOSRA

Sub- scales

Scale	Culture	Scale Item Mean	SD	Mean Difference	t
Enjoyment of Science Lessons	Asian	3.75	0.68	-0.15	4.06 ***
	Western	3.90	0.60		
Attitude to Scientific Inquiry	Asian	3.53	0.54	0.04	1.30
	Western	3.49	0.54		

***$p<0.001$

Conclusion

Fisher and Waldrip (1999) noted that science can be viewed as a cultural artifact and it is embedded in and influences by society and culture. Many research studies have been carried out in education concerning cultural diversity in the classroom (Atwater, 1994; Cobern & Aikenhead, 1998), however, only a few studies consider the teachers' cultural backgrounds.

When investigating classroom environments in Taiwan and Australia, Aldridge, Fraser and Huang (1999) found that education in Taiwan focused predominantly on the development of the academic ability of students and social and emotional aspects of a student's development were generally considered to be more the responsibility of the family. But in Australia, teachers considered academic advancement to be one of a number of aspects to be developed in students. It is also known that most of the education systems in Asian context are syllabus bound and examination oriented.

Steven and Stigler (1992) pointed out the importance of cultural differences in learning interactions between teachers and students in different cultures and how different cultures perceive the role of a teacher. In their study, they found that teachers in China stress clarity in explaining and showing enthusiasm in their teaching as the highest priority, but teachers in America felt that sensitivity and patience are the most import attributes of a good teacher.

This study investigated the associations between student perceptions of learning environment and cultural background of the teachers. The study found that teachers from different cultural backgrounds created different types of learning environment. It also indicates that the WIHIC is a useful instrument to measure the cultural background differences and can be used as a basis for identification and development of desirable teacher behaviours that will lead to a conducive learning environment. The comparative nature of the present study reveals the differing approaches made by the Asian and Western science teachers.

The ultimate aim of education is to foster positive attitudes toward learning and to create an enjoyable and productive learning environment. Each culture has much to learn from the other with regard to the approaches to education in general and teaching and classroom management in particular.

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