Cultural Learning Environment of Non-Government Secondary Science Students in Brunei

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Abstract

The aims of this research were to cross-validate the Cultural Learning Environment Questionnaire (CLEQ) in the local context of Brunei and to evaluate culturally-sensitive factors (gender equity, collaboration, deference, competition, teacher authority, modelling and congruence) in secondary science students' learning environments. Data were collected from 1417 secondary science students enrolled at non-government schools in Brunei and their 49 science teachers by administering the CLEQ (Fisher & Waldrip, 1997). Factor, validity and reliability analyses supported the instrument's suitability to evaluate the culturally-sensitive factors associated with the cultural learning environment of these students. The students generally believed that both genders are treated equally and that they are independent learners, although, to some extent, they were reluctant to give their independent views in their classes. The perceived, predicted and observed mean values by students, teachers and researcher, respectively, were comparable for all these scales except for teacher authority and modelling scales, where differences were highly significant. The data revealed no gender, regional, or grade level differences in students' perceptions. However, perceptions of students from different race groups were different. Implications of the research are discussed.

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Introduction

Human cognition is shaped by the socio-cultural interactive processes (Vygotsky, 1978). All cultures have well developed theories about how the physical world operates without studying formal science (Bullivant, 1981; Ingle & Turner, 1981; Jordan 1985, & Quinn 1987). Science is therefore a cultural artifact and it is embedded in and influenced by society and culture (Aikenhead, 1997). Science teaching is also a cultural activity and cultures influence the teaching and learning process at large (Jegede, 1999; Santagata & Stigler, 2000).

The studies on the effects of cultures on educational systems suggest that classroom teaching and learning processes are influenced by the cultural values of both the teacher (Delpit, 1988; Santagata & Stingler, 2000) and the students (Fisher & Waldrip, 1997, 1999; Jegede & Okebukola, 1991). The research literature on science learning highlights that cultural background of a learner may have a greater effect on education than does the subject content, especially in relation to students making observations in science classes. (Jegede & Okebukola, 1991). Whenever the pupils enter the world of school science, they bring with them their existing cultures it soon becomes evident to them that science too is another culture with which they have to

interact. Moreover, students soon feel confused as a result of need for the border crossing not only from knowledge gained at home to school, but also between subjects (Aikenhead, 1996; Jegede, 1999). This problem is not only faced by students from non-western countries who are learning western science but also by students from western countries (Cobern & Aikenhead, 1998; Ogawa, 1995).

Research on the influence of teacher culture on classroom teaching suggest that Taiwanese teachers consider academic achievement (Aldridge, Fraser & Huang, 1999), Chinese teachers consider clarity in explaining and showing enthusiasm in their teaching (Steven & Stigler, 1992) and American teachers consider sensitivity and patience as the most important attributes of a good teacher and teaching. The research studies from USA reported that classroom management strategies (Grossman, 1995) and classroom communication techniques (Delpit, 1988) of white American teachers were inappropriate for children from other cultures, especially for black students. There are also studies that show that practising teachers from different cultures hold both scientific and traditional thoughts about scientific concepts. The traditional thoughts are often culturally oriented misconceptions about the scientific concepts. Many teachers were not aware that they are bringing cultural bias to their teaching by defining a concept using a non-scientific traditional knowledge (Lawrenz & Gray, 1995; Ogawa, 1995).

The sheer complexity and cultural variety that we often find in multicultural classrooms provide a stiff challenge for any teacher (Thomas, 2000). To deal with this challenge, it is apparent that today's teachers need to fully understand their own cultural beliefs, individual student's culture and the world view so that learning can be made more meaningful for all students (Lee, & Fradd, 1998). Moreover the complexity of the challenge is further heightened as a result of rapid human migration within and between countries as the world is progressing towards a borderless society. The schools are becoming increasingly culturally diverse in their scope and clientele. For example in 2001, there were about 80,000 (about 23% of the total population) temporary workers from many countries employed in Brunei. A considerable fraction of these workers are teachers and the children of these workers attend schools in Brunei. This population adds to the existing cultural diversity in the national population. According to the Government of Brunei Darussalama (GBD), the population (357,800 as estimated for 2004) of Brunei Darussalam consists of 52% male and 48% female. On the basis of race, there are 66.3% Malay, Kedayan, Tutong, Belait, Bisaya, Dusun, and Murut, 11.2% Chinese, 6% Iban, Dayak and Kelabit, and 11.8% other races (GBD, 2007). Moreover, there are also other subcultures within each culture such as rural, urban, water village, gender, language and socioeconomic status.

All these cultures and subcultures have dimensions that influence the teaching and learning processes differently. It is however, important to select some important dimensions that can be targeted to improve upon the overall classroom practices. The material, social, cognitive, affective, linguistic, and ecological dimensions of culture have also been highlighted in the literature (Leavitt, 1995; Stairs, 1995). The literature also reports three contrasting styles of learning: dependent–independent, competitive–collaborative and avoidant–participant that are influenced by cultural values of a learner (Grashna, 1972). Hofstede (1984) identified power-distance, uncertainty avoidance, individualism, and masculinity/femininity as the important cultural

dimensions of the unique environments of multicultural organisations. Moos (1979) reported relationship, personal development, system maintenance and system change as cultural dimensions. Schwartz (1992, 1994) reported that individualism and collectivism could supply valid explanations about cultural differences in cultural values in a society. Fisher and Waldrip (1997) proposed gender equity, collaboration, competition, deference, congruence, modelling, communication, and teacher authority as culturally sensitive factors. This study concentrated on these dimensions because they are widely accepted as significant and cover the dimensions, proposed by Moos (1979) and Hofstede (1984) (for details see Fisher and Waldrip, 1997). Moreover, these dimensions are important in a classroom setting and valuable information on these dimensions can be collected, which can guide the teachers to optimize their teaching in multicultural classes. Furthermore, these dimensions have been established to associate with classroom practices in the existing literature. For example association between these dimensions and students' (i) academic achievement (Waldrip, Fisher & Dorman, 2005), (ii) attitudes to science (Waldrip, Fisher & Dorman, 2005), and (iii) interaction with teachers (Fisher & Waldrip, 2002) has been reported in the literature. Fisher and Waldrip (2000) reported that the perceptions on these scales of metropolitan, provincial, rural and mining community students were statistically significantly different. Moreover, the availability of a well established valid and reliable instrument also to some extent guided the selection of these dimensions.

In addition to the above, these dimensions have been evaluated in the Bruneian context to investigate the cultural learning environments of (i) secondary science students in government schools (Dhindsa, 2005), and (ii) pre-service teachers (Dhindsa & Fraser, 2004). Additional research on these dimensions in the Bruneian context suggests (i) low level statistically significant gender differences in perceptions of these factors of students from government schools (Dhindsa, 2005), significant differences in perceptions of these dimensions of Bruneian students studying at international, private and public schools (Khadija-Mohd-Salleh & Dhindsa, 2005) and significant variations in means values of these factors in populations comprising of lower secondary, upper secondary and tertiary students (Dhindsa, 2008). Moreover, Khadija-Mohd-Salleh (2004) compared the perceptions of students from four race groups in Brunei and found significant differences in these groups of science students' perceptions of cultural learning environments. In Brunei, a father's race is considered as the race of the child and it is a common practice in this country to ask for an individual's race on government forms. However, the cultural learning environment of students studying at non-government schools has received very little attention. These students come from a subculture of the society which is to some extent economically better off than those members of society who cannot afford to pay high fees to send their children to non-government schools.

This study mainly concentrates on using CLEQ to study the cultural learning environment of secondary science students enrolled in non-government schools in Brunei. The authors have not come across research in the non-government schools representing a subculture based on the affordability to pay fees especially in Brunei. It is important and timely to investigate the cultural learning environment of science students in non-government schools. The study is extended to investigate if the teachers are able to predict their students' mean perception on the CLEQ scales. In order to predict students' behaviour on these dimensions, the teachers should (a)

know the make-up of the community, (b) select the important dimensions of culture that need to be addressed in a given curriculum, (c) know the existing influence of these dimensions on the classroom practices so that certain behaviours that can lead to successful teaching and learning can be targeted for modification and (d) be able to predict students' perceptions of the cultural learning environment in their classes (Brislin & Yoshida, 1994; Dhindsa, 2005).

Educational context and rationale

According to the Brunei Ministry of Education (MOE) statistics there are 31 government, 16 non-government, and 3 international secondary schools in Brunei. Education in Brunei Darussalam government schools is free, non-government and international schools charge moderate to high fees (MOE, 2005). The non-government schools follow the Bruneian curriculum. Nine of these schools are situated in Brunei–Muara district and seven schools in Belait District, there are no non-government schools in the Tutong and Temburong districts of Brunei. Brunei though small in size with only four districts, the cultures of residents in these districts are clearly distinct. The total number of students enrolled in the non-government schools increased by 10.5 % from 4881 to 5453 in the year 2004 (MOE, 2005). An increase in the number of students in the schools is the result of an expected increase in the total populations in Brunei Darussalam.

The parents select schools for their children. Those who can afford to pay moderate to high school fees are likely to choose a non-government school because the students in non- government schools get better grades in national examinations as compared to students in government schools. During 2003, the Pass rates for government and non-government schools for a national lower secondary examination (Penilaian Menengah Bawah – PMB) were 77.3% and 95.5% respectively and for GCE O-level examination were 70.4 % and 91.8% respectively (MOE, 2005). The higher percentage of passes in both these national examinations could influence parents' decisions to send their children to non-government schools. Moreover admission to and the selection of, A-level subjects is based on the GCE-O level results. The student population in these schools represents children of expatriate workers who came from various cultural backgrounds from many countries and also from various local cultures especially from families that can afford to pay the school fees. The population feeding these schools represents a subculture based on the ability of families to pay school fees (economic factor). Furnham (1992) identified several powerful sub-groups that influence student's understanding about science: the family, peers, the school and the mass media, as well as groups associated with various physical, social, and economic environments. Furnham further stated that each subgroup has a culture, which we designated as a "subculture" to convey an identity of a subgroup.

It is important that teachers are able to predict the students' behaviour in a classroom situation to avoid students completing the questionnaires which may require students' learning and teachers' teaching time. Moreover, the processing of these data takes time and teachers have to wait for some to react to the survey results. Furthermore this process adds to the teachers' responsibility. These issues can be tackled by training teachers to predict students' related desired variables to a fair degree of accuracy. An alternative to this could be that teachers are able to observe and record students' behaviours accurately so that they can help each other without

losing classroom teaching and learning time. Therefore this study decided to compare associations between students' perceived, teachers' predicted, and researchers' observed data on the scales CLEQ.

Aim

The aim of this study was to evaluate the cultural learning environment of secondary science students in non-government schools in Brunei. More specifically the study concentrated on the following research questions.

a. How suitable was the CLEQ instrument in collecting the data on cultural factors of the learning environment of students in non-government schools?
b. What were the magnitudes of the cultural learning environment factors, covered in the instrument, in the science students' classes in non-government schools?
c. Were the teachers able to predict their students' perception of these factors?
d. How did the observation data compare with students' perception and teachers' prediction data?
e. How were these cultural factors influenced by respondents' gender, district, grade level and race?

Methodology

Student Participants

The participant*s* of this study consisted of 1417 [753 in Form 3 (Grade 9) and 664 in Form 4; (Grade 10)] students enrolled at non-government schools. There were 963 respondents from Brunei-Muara district and the remaining 454 were from Belait district. When the sample was grouped on the basis of respondents' race, it was found that there were 443 Malays, 685 Chinese, 65 Indigenous and 131 Others. The respondents under Others were mainly from India and Pakistan. There were 673 males and 673 females in the sample. Of the participants 93 and 71 did not disclose their race and gender respectively. The age range of the respondents was between 13 and 17 years with the median ages for Form 3 (Grade 9) as 14 years and Form 4 (Grade 10) as 16 years.

Teachers Participants

The study also included 49 teachers whose students participated in the research. These included 22 male and 20 female teachers (7 teachers did not disclose their gender). Twenty eight teachers were from Brunei-Muara district and 21 from Belait district. Sixteen teachers taught Form 3 (Grade 9) and the remaining 33 taught Form 4 (Grade 10). There were 4 Malay, 6 Chinese and 33 Others and 6 teachers did not disclose their race in this sample.

Instrument

The instrument (CLEQ) used in this study was empirically developed by Fisher and Waldrip (1997). The selection of CLEQ instrument for the present study

was based on its successful use (reliability and validity in collecting data) in previous learning environment research (Dhindsa, 2005, 2008; Dhindsa & Fraser, 2004; Fisher & Waldrip, 1997, 1999). Moreover the development of this instrument was guided by the anthropology, sociology, psychology, management, and cultural factors research (Hofstede, 1984, Moos 1979; Stull & von Till, 1994). Furthermore, the instrument is considered salient by teachers and students as well as it is economical in time and money as it contains a relatively small number of reliable scales, each containing a small number of items i.e. 5 items per scale. The overall 35 item instrument contains seven scales: Gender Equity, Collaboration, Deference, Competition, Teacher Authority, Modelling, and Congruence. Each item written in simple English was responded to on a five-point scale with the extreme alternatives varying from Strongly Disagree to Strongly Agree. The respondents were asked to indicate to what extent they agreed to that each item described their classroom. The higher the score for a given scale the more prominent is the behaviour. The instrument is easy to modify. The items were modified to get prediction and observation data from the teachers and a researcher respectively without changing the theme of the scale and the content of the item. These changes are reported in Table I along with the description of the scales. In this way three instruments for students (CLEQ-S), teachers (CLEQ-T) and researcher (CLEQ-R) were designed.

Table I
Descriptive Information for Each Scale of the Cultural Learning Environment Instrument

Scales	Description	Sample item
Gequity	The extent to which students perceive males and females are treated equally.	S. I feel that comments in class by male and female students are equally important. (+) T. I think that my students feel that comments in class by male and female students are equally important. (+) R. Students feel that comments in class by male and female students are equally important. (+)
Collabo-ration	The extent to which students perceive they collaborate with other students rather than act individually.	S. I feel it is important for the class to work together as a team. (+) T. I think that my students feel that it is important for the class to work together as a team.(+) R. These students feel that it is important for the class to work together as a team. (+)
Deference	The extent to which the students feel they defer to the opinions of others.	S. I try to say what I think the teacher wants rather than give my own opinion. (+) T. I think that my students try to say what they think the teacher wants rather than give their own opinions. (+) R. These students try to say what their teacher wants rather than giving their own opinions. (+)

Compe-tition	The extent to which the students are competitive with each other.	S.	I like to compete against the other students. (+)
		T.	I think that my students like to compete against other students. (+)
		R.	These students like to compete against the other students. (+)
Teacher Authority	The extent to which the students perceive the teacher has authority in the classroom.	S.	It is OK for me to disagree with the teacher. (-)
		T.	I think that my students think it is OK for them to disagree with teachers. (-)
		R.	These students feel that it is OK for them to disagree with their teacher. (-)
Modelling	The extent to which the students expect to learn by a process of modelling.	S.	I like teachers to show me what to do. (+)
		T.	I think that my students like teachers to show them what to do. (+)
		R.	These students like their teacher to show them what to do. (+)
Congru-ence	The extent to which the students perceive learning at the school matches their learning/ application at home.	S.	What I learn at school helps me at home. (+)
		T.	I think that my students feel that what students learn at schools help them to do things at home. (+)
		R.	These students feel that what they learn at school helps them to do things at home. (+)

Gequity=Gender equity; Collabo=Collaboration; Defer=Deference; Compet=Competition; Teacheraut=Teacher Authority; Modell=Modelling; Congrue=Congruence

Procedure

The Cultural Learning Environment Questionnaire-Students (CLEQ-S) was administered to the students in their classes. The instructions written on the instruments were repeated verbally and students' questions were answered before they started to answer the CLEQ-S. The teachers' questionnaire (CLEQ-T) was administered to all the Form 3 and Form 4 science teachers who were currently teaching the targeted classes. The items in the CLEQ-T evaluated teachers' awareness of their students' mean perceptions of the culturally sensitive factors in their classes. Teachers were also asked to respond to each question on a 5 pointed scale. One of the researchers observed 10 classes of participant teachers and graded the CLEQ-R items. All the respondents marked each item on a 5 pointed scale. The completed response sheets were collected, and, data were then coded and processed using the SPSS program. The significant differences were further evaluated by computing effect size for each comparison. The effect size data was scaled as low (0.2), medium (0.5) and high (0.8) based on Cohen's classification (Cohen, 1969).

Results and Discussion

In this section, the results are discussed under three headings: (a) instrumental variables (b) culturally sensitive factors of students' learning environment, and (c) the effects of gender, grade level, race, and region on culturally sensitive factors of students' learning environment.

Table II
Factor Loading for Items in the 35 Item Version of the Personal Form for Individual Students as the Unit of Analysis (n= 1417)

Item	Gequity	Collabo	Defer	Competition	Teacheraut	Modell	Congrue
1	0.70						
2	0.74						
3	0.70						
4	0.74						
5	0.74						
6		0.58					
7		0.72					
8		0.72					
9		0.76					
10		0.74					
11			0.63				
12			0.73				
13			0.61				
14			0.67				
15			0.74				
16				0.78			
17				0.69			
18				0.68			
19				0.48			
20				0.76			
21					0.64		
22					0.63		
23					0.54		
24					0.67		
25					0.61		
26						0.69	
27						0.75	
28						0.68	
29						0.62	
30						0.48	
31							0.44
32							0.49
33							0.55
34							0.59
35							0.60
% variance	7.16	4.54	7.14	7.85	6.56	9.71	7.19
Eigen value	2.50	1.59	2.50	2.75	2.30	3.40	2.52

Gequity = Gender Equity, Collabo = Collaboration, Teacheraut = Teacher Authority, Modell = Modelling. Cut off point = 0.3. Note: See the text of these items in Fisher & Waldrip, (1997).

Instrumental variables

The suitability of the instrument for collection of data was evaluated by analyzing the students' data using factor analysis, internal consistency and discriminated validity. The teachers' and researcher's data were only processed for some of these coefficients due to small sample sizes.

Factor Analysis. The purpose of factor analysis was to examine the internal consistency of scales within the 35 items instrument. The determinant value of 1.275E-04, Bartlett's test: p =0.000 and KMO value of 0.813 suggested that data were suitable for factor analysis. Principal components analysis with varimax rotation was used to generate orthogonal factors with eigenvalue of one or more by omitting the factors loading less than 0.3. In this way 9 factors were obtained that explained 56.2% of the variance in students' data explained by 35 items if they were not grouped into factors. This produced two factors each with two items and some other items contributed to more than one factor. Since the instrument was conceptually designed for seven factors, therefore it was decided to reanalyze the data to get a seven factor solution. Table II shows the factor loadings for seven factors obtained from this analysis using the individual students as the unit of the analysis. Scree plot test also justified these seven factors. The percentage variance extracted and eigenvalue (rotation sum of squared loading) associated with each factor are also recorded at the bottom of each scale. The 35 items when extracted into seven factors accounted for 50.0% of the variance in students' responses explained by these items if all were kept independent. The percent variance explained in this study was comparable to the variance 52.7 % and 51.1% for seven and six factors reported by Fisher and Waldrip (1997) and Dhindsa, (2005) respectively.

Table III
Cronbach Alpha Reliability Coefficient and Discriminant Validity for Student Data for CLEQ Scales

Scales	No. of items	Alpha Reliability	Discriminant Validity
		Students (n=1417)	
Gender Equity	5	0.65	0.08
Collaboration	5	0.74	0.10
Deference	5	0.58	0.17
Competition	5	0.82	0.13
Teacher Authority	5	0.72	0.06
Modelling	5	0.68	0.11
Congruence	5	0.77	0.11
Instrument	35	0.81	-

Reliability. Cronbach alpha coefficient was used as a measure of the reliability of the CLEQ. It was computed for the seven factors as well as for the 35 items scale (whole instrument). Table III shows the alpha coefficient for the whole instrument was 0.81 for students' and 0.86 for teachers' responses. The students' data in the table also shows that the alpha coefficients ranged from 0.58 to 0.82 for different scales. These data suggested that CLEQ scales have acceptable reliability, especially for scales containing a small number of items except for deference data. The range of alpha reliability values for the seven scales were comparable to range (0.69 to 0.86) reported by Fisher and Waldrip (1997). Dhindsa (2005) using the same instrument reported the alpha reliability values in the range of 0.68-0.81 for the six scales for data from secondary science students in government schools in Brunei Darussalam.

Discriminant validity. The discriminant validity was measured as the mean absolute partial correlation of a scale with other scales. This procedure was used as a convenient measure of independence of the CLEQ scales. The mean correlation of a scale with other scales (discriminant validity) ranged from 0.06 to 0.17 for students' data and from 0.12 to 0.24 for teachers data for CLEQ scales (Table III). These low values of discriminant validity suggest that the raw scores obtained in CLEQ scales measured relatively distinct aspects of the cultural learning environment. Moreover, the independence of CLEQ-S scales is attested by the factor analysis results. The range of correlation coefficient values (discriminant validity) for seven constructs in the present study was consistent with the ranges: 0.04 to 0.23; 0.09 to 0.18, (Fisher and Waldrip, 1997, 1999) and, 0.11 to 0.18, (Dhindsa, 2005) reported in literature.

Table IV
Scales, Scale Item Mean, Standard Deviation, ANOVA, and Effect Size Data for Students, Teachers and Researcher

Scales	Students (S)	Teachers (T)	Researcher (R)	Comparisons		
	(n=1417)	*(n=49)*	*(n=10)*	SvsT	SvsR	TvsR
	Mean ± SD	Mean ± SD	Mean ± SD	p-value/ES*	p-value/ES	p-value/ES
Gender Equity	4.11 ± 0.62	4.21 ± 0.46	3.92 ± 0.29	0.26	0.33	0.06
Collaboration	4.13 ± 0.67	4.11 ± 0.55	3.76 ± 0.65	0.84	0.08	0.08
Competition	3.69 ± 0.86	3.70 ± 0.80	3.62 ± 0.29	0.94	0.80	0.76
Deference	3.46 ± 0.66	3.24 ± 0.83	3.70 ± 0.47	0.02/0.33	0.25	0.10
Teacher Authority	3.01 ± 0.82	2.62 ± 0.67	2.10 ± 0.83	0.00/0.48	0.04/0.74	0.00/1.11
Modelling	3.51 ± 0.71	3.74 ± 0.58	4.26 ± 0.42	0.03/0.33	0.00/1.06	0.01/0.92
Congruence	3.55 ± 0.73	3.78 ± 0.71	3.42 ± 0.67	0.03/0.32	0.57	0.15

*Effect Size (ES) data for significant differences only

Culturally Sensitive Factors of Students' Learning Environment

Scale item mean, standard deviation, ANOVA and effect size data for students, teachers and researcher are reported in Table IV. ANOVA analysis revealed that mean data for students, teachers and researcher for gender equity, collaboration and competition scales were statistically non-significantly different. Whereas for deference and congruence scales the researcher's data when compared to that for teachers as well as for students, the differences were statistically non-significant. These results suggest that students' and teachers' perceptions and the researcher observation were in agreement with each other for these five scales except for students' and teachers' perception data on deference and congruence scales. The comparison of students' and teachers' data for deference and congruence scales revealed that students perceived statistically significantly higher level deference and lower level congruence than that what their teachers predicted. The effect size values close to 0.3 suggest that the differences are marginal and are of little educational importance. These differences may be the result of large variations in sample sizes for two groups of data. However, p-values less than 0.05 for all the comparisons for the remaining two scales (Teacher authority and Modelling) suggest that the mean values for the three groups were statistically significantly different. The researcher observed significantly higher teacher authority and modelling compared to what students and teachers perceived. Moreover, students perceived significantly lower modelling and lower teacher authority than that what their teachers predicted. The effect size values

in the range of low to high for all these comparisons suggest that these differences are of educational importance. While considering all these comparisons reported in Table IV it was concluded that the three sets of data were comparable for all the scales except for Teacher authority and Modelling. For these scales perceived, predicted and observed mean data for students, teachers and researcher respectively were different. Additional details for each scale are discussed below.

Gender equity. Table IV shows that the average scale item mean for gender equity was 4.11, which suggests that students believed both male and female students were treated equally in their classes. They also believed contributions from both genders in the classes were equally valuable. Researcher's classroom observation value (3.92 ± 0.29) also supports high gender equity in these classes. Moreover, the mean values of 4.21 reported by teachers suggest they also perceived a high value and were able to predict students' perception of gender equity in their classes. Average scale item mean values of 4.13 and 4.53 for gender equity were reported for secondary science students in government schools in Brunei Darussalam (Dhindsa, 2005) and Australia (Fisher & Waldrip, 1997) respectively. The comparable mean and standard deviation values for Bruneian government (4.13±0.63) and non-government (4.11±0.62) school students support the previously published data on government schools on this dimension of the local culture. Since the same instrument was used in Brunei and Australia, therefore the differences in mean student data for gender equity in these countries suggest that the instrument was able to pick up the cultural differences in the two countries. Brunei is a country where Malay culture, Islam religion and Islamic values are highly respected, whereas Australia represents a multicultural society with western culture as the majority culture. The results obtained in this study on gender equity suggest that the Bruneian society value women education. At present there are more female than male students enrolled at the institutions of higher education (Dhindsa, 2008). The gender equity in the classroom situation in the non-government schools in Brunei was comparable to that found in some developing and developed countries (Shumba, 1999), but different from the reports which indicated that in some cultures even in the classroom setting, genders were treated differently (Barber, Chadwick & Oerter, 1992).

Tobin and Gallagaher (1987) reported that unfair engagement opportunities provided to male and female students as well as the selection procedures used by teachers encourage inequity in a classroom situation. Teachers can play a vital role to maintain or improve gender equity by providing equal opportunities to both male and female students in their classes. Tobin and Gallagher (1987) also reported that gender inequity is also enhanced by the students' seating orientation in a the classroom. It can put them in a position to be involved more or less in classroom interaction that might contribute towards gender inequity. In Bruneian schools, male and female students sit in different rows. This certainly affects the seating orientation in a classroom. However, there is no research in the Bruneian context on the effects on gender equity of separate seating arrangements for male and female students in classroom, which is recommended. Fisher and Waldrip (1999) reported that the gender equity is enhanced by teachers who were helping/friendly, but retarded by too much freedom. Nurdiyanah (2006) reported that Bruneian lower secondary students perceived their teachers to be highly helping/friendly (mean value 2.5 out of 3). A high mean value on this factor suggests that science teachers' personal behaviour could have helped the lower secondary students perceive higher gender equity in their classes despite

students sitting in different rows with limited freedom to mix with the opposite sex. Teacher educators can target to improve upon these behaviours of teacher trainees with a view to improve gender equity in science classes. The curriculum department can contribute towards increasing gender equity by improving upon the teaching materials. Elgar (2001) reported unfair representation of gender in favour of males in the lower secondary science textbooks recently published by MOE. Curriculum materials influence students' perceptions in general. The unequal representation of the two genders in the Bruniean science textbooks could also have contributed to the lower mean score on gender equity scale at lower secondary level.

Collaboration and Competition. The *collaboration* scale item mean value of 4.13 suggested that the students perceived a high degree of collaborative learning occurring in their classes (Table IV). Teachers reported an almost matching value of 4.11 for students' perception, whereas the researcher reported a relatively lower value of 3.76 ± 0.65. The non-significantly lower mean value for researcher might be due to the small number of classes observed where differences in schools' culture and teachers' practices have occurred. The scale item mean value of 4.13 is comparable with the mean values of 4.24 and 4.08 obtained using the same instrument in Bruneian (Dhindsa, 2005) and Australian (Fisher & Waldrip, 1997) secondary science classes.

The *competition* scale item mean value of 3.69 in Table IV shows that the students to some extent liked to compete with each other in their classes. The teachers' predicted value of 3.70 for their students' perception of competitive learning in their classes matched almost exactly. The researcher's observation mean value (3.62 ± 0.29) also supports the students' perception in this regard. The mean value of 4.16 for Bruneian students in government secondary schools suggest that students in non-government compared to those in government schools perceived their classes to be less competitive. Fisher and Waldrip (1997) using the same instrument reported the mean scale item score of 3.03 for Australian students. The differences in the mean values could be due to the difference in cultural make up of students and teachers' teaching styles in these two types of schools, as well as in the two countries.

A comparison of collaboration and competition data revealed that students in non-government schools perceived science learning in their classes to be more collaborative than competitive. These results are different from what was observed in government schools. In government schools, the students perceived equal extent of collaborative (4.24) and competitive (4.16) learning occurring in their classes (Dhindsa, 2005). However, the results of this study are in line with (i) trend reported by Fisher and Waldrip (1997) in Australian data and (ii) the general practices observed in most western countries. According to the observed practices, collaboration and competitiveness are inversely related to each other. Bruneian students come from a collectivist society in which collaboration is highly valued, therefore this factor appears to elevate the mean score for them (Thomas, 2000). According to Thomas (2000), although collaboration is a key element in a collectivist society and constructivist learning, however, schools are designed for competition. This inherent characteristic of the school system might have contributed towards the relatively high value on the competition scale.

Since the mean scores for the competition and collaboration scales were less than the maximum possible values, there is scope for optimisation of these culturally sensitive factors. Fisher and Waldrip (1999) reported that collaboration is more likely

to occur when teachers showed leadership, were admonishing or strict. They also stated that when teachers showed leadership, were strict or uncertain or gave students' responsibility, competition was enhanced. Teachers from developing countries including Asia have been reported to be directive and strict (Coll, et al., 2002; Gidding & Waldrip 1993). Bruneian teachers, as reported by Nurdiyanah (2006), showed leadership (mean value 2.8 out of 3) and were also strict (mean value 2.2 of 3). This behaviour of teachers might have contributed to the higher mean values on collaboration and competition scales. However, further improvements to these factors can be achieved by modifying the teachers' specific behaviours. Teacher educators during pre-service and in-service training should emphasize these behavioural aspects of teacher trainees to optimize competition and collaboration in science classes.

Deference. The scale item mean of 3.46 for deference in Table IV, which is greater than 3, suggest that the Bruneian students in non-government schools, to some extent, were unwilling to give their opinions in their classes. Teachers predicted a similar value (3.24) however the researcher observed a higher value of 3.70 ± 0.47. The researcher's data are based on observation of 10 classes only. It could have been a chance factor that the researcher observed classes where teachers provided very little opportunity for students to air their opinion. Dhindsa (2005) reported slightly higher mean value (3.63) for Bruneian secondary science students in government schools and Fisher and Waldrip (1997) reported a lower value (2.98) for Australian secondary science students.

The results of this study are in line with previous classroom observation studies (Monaliza, 2001; Norlina, 2002) which reported that in actual classroom situations, students are generally reluctant to air their views. The results of this study appear to be consistent with the Bruneian culture. People of Bruneian society highly respect hierarchical order. This means that the teacher occupies a higher place in hierarchical series than the students and the students are expected to agree with their teachers and thus not to air their contradictory views.

Moreover, language appears to be another barrier that may hinder students from expressing their own views. English is students' second or third language and their proficiency in it is low. According to Heppner, Heppner, and Leong (1997), less than 15% of Bruneian Form 6 (USA 12^{th} grade) students could read independently at USA 9^{th} grade level, and more than half were reading at the frustration level on the USA 7^{th} grade material. The English text reading level of Bruneian students is about six years lower than their counterparts in English-speaking countries. However, in schools the lessons are conducted in English. Those students who are unable to communicate effectively often fear a loss of identity (Beebe, 1983). The university students' risk-taking behaviour (Ely, 1986) and sensitivity to rejection (Naiman, Frohlich, Stren, & Todesco, 1978) were positive predictors of students' voluntary classroom participation. Dhindsa (2005), based on government schools students' data, concluded that Bruneian students feel that they are confident in their ability to embrace risk-taking even if it might cost them stress in relationship however, their actions appear to be limited by language deficiency and by the superior hierarchical status of the teacher. The results of this study also reflect a very similar situation.

A lower average scale item mean value for students at non-government (3.46) compared to government (3.63) schools suggests that these students were more open to air their views in their science classes. This difference in mean scores was expected

because the command of the English language of students in non-government schools is relatively better as reflected by O-level English results. According to these results the pass percentage ranges of students from 2004 to 2006 were 14-15.6 % and 52.2-59.5% for government and non-government school students respectively (unpublished statistics, Ministry of Education, Brunei)

Teacher Authority. For this scale a higher average scale item mean value reflects lower teacher authority. The scale item mean value of 3.01 for teacher authority suggests that the students at this level were undecided on whether they like to follow what the teacher says or do things by themselves. Teachers predicted (2.62) that their students will perceive a higher level of teacher authority in their classes as has been observed by the researcher (2.10 ± 0.83). The average scale item mean value of 3.01 for Bruneian students in non-government schools was close to Australian data (3.02) reported by Fisher and Waldrip (1997).

The results of this study suggest that the students did not see their teachers as highly authoritarian as has been observed by the researcher and felt by the teachers. Dhindsa (2005) highlighted that there are items on the scales that start with "I feel..." and require students to reflect on their feelings not actions. Based on their feelings the students appear to have scored high on this item, thus increasing the scale mean score. However, teachers and the researcher concentrated on the actions and did not appear to have seen the actions in the classes.

According to Thomas (2000), mostly high power/distance (a dimension of culture that is associated with emotional distance between teacher and students) and collectivist culture go hand in hand, and the strong hierarchical feature of high power/distance dimension will mitigate against the group decision. In most developing countries cultural systems are still typified by a top-to-bottom approach, which favours high power/distance including between teachers and students. Thomas's view supports the authoritarian nature of teachers in Asian cultures, especially where teaching involves traditional approach, is well known. This factor might have prompted the students to record teachers as more authoritarian. In Brunei, the hierarchical superiority of teachers in the social set up gives them authority. Since the data were collected in the presence of class teachers, the presence of a teacher might have helped to increase the average score for the students. Moreover, the Bruneian culture is very considerate and does not encourage speaking against others. This inherent cultural characteristic might also have elevated the students' mean data to some extent. Thomas (2000) also stressed that where there are strong goals, in this case teaching and learning in a classroom setting, participative practices are likely to become part of system. The students and teachers are part of a common system and have strong common goals therefore this factor could have helped students to see teachers as less authoritarian.

Modelling. The scale item mean value of 3.51 for modelling suggests that the students perceived that modelled learning was occurring in their classes and hence they were, to some extent, dependent learners. The traditional teaching styles and examination oriented teaching in Bruneian secondary schools appear to have contribute towards this factor. Teachers predicted a comparable mean value of 3.74, however, the researcher reported the observed value to be 4.26 ± 0.42. According to the researcher's data, learning in the students classes was highly modelled, which might be the result of observing a small number of classes and selected teachers'

teaching style. However, this value is slightly lower than 3.76, the value reported by Dhindsa (2005) for students in government schools but higher than 3.10 reported for Australian students (Fisher & Waldrip, 1997). These results suggest that the students in the non-government schools perceived that they were marginally more independent learners in their classes during science lessons than students in the government schools. Since many of the science teachers teaching in non-government schools are expatriate teachers from developing countries, their teaching styles might have contributed towards the mean value for this factor. Some of the teachers in non-government schools are not trained and also their teaching is results oriented. Their survival in the job is based on the percent pass rate in the examination. Furthermore, the mean value might also have been influenced by educational backgrounds of high achieving foreign students especially from India and Pakistan as well as the local Chinese students attending the non-government schools in Brunei. Most of these students attend extra classes outside school (take tuition) in science subjects and their exposure to different teaching and learning styles at school and tuition can influence this value.

In a collectivist society with a high power/distance dimension, like the Bruneian society, students like to be told what to do (Thomas, 2000), hence, teachers are more directive and students follow the directives. The research studies from developing countries, including from Asia, also show that the teachers in these countries are directive with high values for helping/friendly behaviour, admonishing behaviour, and low values for freedom and responsibility (Coll, Taylor & Fisher, 2002; Gidding & Waldrip 1993). Examination oriented educational systems, and, students' pass rates in traditional examinations taken as a measure of teacher efficiency, often forces many teachers to exhibit the above stated behaviours. These characteristics of teachers encourage modelling (Fisher & Waldrip, 1999). These authors reported that modelling tended to occur when the teacher was admonishing and strict. Moreover, with helping and friendly teachers, students favoured modelled learning.

Congruence. The scale item mean value of 3.55 for the congruence scale suggested that the students perceived that what they learn at school, to varying extents, was associated with the environment at home. Teachers predicted higher (3.78) and the researcher observed lower (3.42 ± 0.67) mean values which are nevertheless close to the mean value for students. However, the average scale mean item value of 3.55 was lower when compared to government schools (3.85) reported by Dhindsa (2005) but higher than 3.43 reported for Australian students by Fisher & Waldrip (1997).

Congruence is a key element in teaching and learning as the students are motivated to learn the topics that are useful and relevant to their lives (Jegede & Okebukola, 1991; Waldrip & Taylor, 1994). For many children around the world the educative experience in schools is clearly not consonant with their home experience and the schools do not emphasise what students' homes do (Bishop, 1999). In non-government schools, teaching is result oriented as teachers are preparing students for GCSE–O level external examinations that are set and conducted by UK authorites. Excellence in this examination helps these schools to attract good students. The overall teaching is examination oriented with less emphasis on the aspect of congruence. Therefore, students appeared to have scored a low value on this scale.

Since some teachers in these schools are untrained, they lack ability in making science learning at school consonant with home experience. Most of the teachers in these schools are relatively low-paid expatriates. Their limited knowledge of local culture and environment could have been a limitation of their teaching that is picked up by the students while they were responding to this scale. The origin and nature of their teachers' training as well as long successful teaching experience with students from a wide range of cultural backgrounds appears to play a vital role in helping to improve congruence in the secondary science classes. For example, leadership in teachers helps to improve congruence (Fisher & Waldrip, 1999). These authors also reported that students who were more likely to see congruence between what they learn at school and home tend to have teachers who displayed leadership, were friendly and helpful or strict. Moreover, the congruence between what is learned at school and its usefulness in a social setting can be enhanced by relating classroom teaching to students' daily life.

Comparison of Culturally Sensitive Factors of Various Groups of Students.

Under this heading, comparisons of culturally sensitive factors of students grouped on the basis of gender, location (district), grade level and race are reported. Teachers' predicted and researcher's observation data were not processed due to small sample sizes.

Table V
Scale Item Mean Values, Standard Deviation Data and Significance Levels for Male and Female Subjects on Seven CLEQ-S Factors

Scale	Items	Male	Female	Male vs. Female	
		N = 673	N= 673	p-values	Effect size
Gender Equity	5	4.10± 0.64	4.12±0.58	0.522	
Collaboration	5	4.12±0.71	4.16±0.61	0.317	
Deference	5	3.42±0.69	3.51±0.63	0.015	0.14
Competition	5	3.62±0.86	3.78±0.85	0.001	0.19
Teacher Authority	5	3.04±0.83	2.96±0.80	0.088	
Modelling	5	3.49±0.74	3.53±0.68	0.282	
Congruence	5	3.53±0.77	3.57±0.69	0.274	

N = number of respondents; 71 respondents didn't disclose their gender; Effect size data for significant differences only.

Cultural Learning Environment: Male and Female Students

Table V shows that the scale item mean values for all the seven scales for male students ranged from 3.04 to 4.12 and for the female students from 2.96 to 4.16. The male and female students' perceptions on gender equity, collaboration, modelling, teacher authority and congruence were statistically non-significantly different. However, on deference and competition scales the differences were statistically significantly in favour of females. The low effect size values of 0.14 (deference) and 0.19 (competition) show that these significant differences are of little educational importance. These differences might have been due to large sample sizes. It was therefore concluded that there were no gender differences in male and female

students' perceptions on deference and competition scales. Based on the overall analysis of the data on gender differences it was concluded that there were no gender differences in students' perceptions of the cultural learning environments of secondary science classes at non-government schools in Brunei. Dhindsa (2005) reported no gender differences in culturally sensitive factors data for government school students. Openness in Bruneian culture and emphasis on female education may have contributed to these results. The Bruneian results are different from the ones reported by Parker, Rennie & Harding, (1995). According to them (a) females prefer a science classroom that is cooperative rather than competitive in nature and (b) females receive less attention than boys from their teachers in the classroom and that would foster gender inequity.

Cultural Learning Environment: Brunei-Muara and Belait Students

Table VI shows that the scale item mean values on seven scales ranged from 2.97 to 4.14 for Brunei-Muara district, and 3.05 to 4.17 for Belait district students. The analysis of students' data from the two districts revealed that the scale item mean values on the collaboration, deference, modelling, teacher authority and congruence scales were statistically non-significant different and hence comparable in both districts except for gender equity (p=.004) and competition (p=.024). However, the low effect size values for gender equity (0.07) and competition (0.13), suggested that these differences are of little educational importance. Based on the above data, it was concluded that there were no differences in students' perceptions on seven cultural factors of learning environment evaluated using CLEQ-S in the Brunei-Muara and Belait districts.

Table VI
Scale Item Mean Values, Standard Deviation and Significance Levels for CLEQ Scores for Subjects from Brunei-Muara (BM) and Belait (B) Districts

Scales	Items	Districts		Comparisons	
		Brunei-Muara.	Belait	BM vs B	
		N=825	N=592	p-values	Effect Size
Gender Equity	5	4.07 ± 0.65	4.17 ± 0.64	0.004	0.07
Collaboration	5	4.14 ± 0.68	4.12 ± 0.64	0.536	
Deference	5	3.45 ± 0.90	3.48 ± 0.65	0.430	
Competition	5	3.64 ± 0.90	3.75 ± 0.80	0.024	0.13
Teacher Authority	5	2.97 ± 0.83	3.05 ± 0.81	0.083	
Modelling	5	3.50 ± 0.72	3.51 ± 0.70	0.724	
Congruence	5	3.53 ± 0.75	3.58 ± 0.71	0.204	

N = number of respondents; Effect size data for significant differences only.

These results are in line with those reported by Dhindsa, (2005) for government schools in four districts of Brunei. His data for Brunei-Muara and Beliat suggest that mean data for all the culturally sensitive scales were comparable despite a

wider range in students' ability and parents' economic status in government schools than in non-government schools. Brunei though small in size, the development of its four districts varies at large. Based on regional developmental status of four districts, Brunei-Muara and Beliat, where non-government schools are located, rank first and second respectively. Moreover, the expatriate population is high in these districts. These two factors appear to have contributed towards minimising the regional variations in the students' perceptions in these districts. However, these results are different from those reported by Waldrip and Fisher (2002). They have reported variations in some culturally sensitive factors between urban, rural and mining populations. Their study covered a large regional area in Westren Australia, where variations in regional developmental and economic status of parents appeared to be significant, which could have influenced their results.

Table VII
Scale Item Mean Values, Standard Deviation and Significance Levels for CLEQ-S Scores for Form 3 and Form 4 Subjects

Scales	Items	Form		Form 3 vs Form 4	
		Form 3 N=779	Form 4 N=638	Significance p-values	Effect Size
Gender Equity	5	4.15 ± 0.60	4.07 ± 0.63	0.013	0.13
Collaboration	5	4.18 ± 0.64	4.06 ± 0.69	0.001	0.18
Deference	5	3.50 ± 0.67	3.41 ± 0.65	0.009	0.14
Competition	5	3.75 ± 0.84	3.61 ± 0.88	0.003	0.16
Teacher Authority	5	2.93 ± 0.82	3.09 ± 0.81	0.000	0.20
Modelling	5	3.52 ± 0.72	3.49 ± 0.71	0.491	-
Congruence	5	3.64 ± 0.73	3.44 ± 0.72	0.000	0.28

N = number of respondents; Effect size data for significant differences only

Cultural Learning Environment: Form 3 and Form 4 Students

Table VII shows the ranges of average scale items mean values are 2.93 - 4.18, and 3.09 - 4.07 for Form 3 and Form 4 respectively. For these two groups of students, all these differences were statistically significant except for modelling.

However, the effect size values for these differences (0.13 - 0.28) were low and of little educational importance. It was therefore concluded that Form 3 and Form 4 students' perceptions on these factors of cultural learning environments were comparable. The scale item mean values for Form 3 on all the scales were higher than for Form 4 students except for teacher authority which was lower. These significant differences might have been contributed by the large sample sizes. Moreover, it was observed that Form 3 students were more serious with their studies because they were preparing to sit for a national examination, whereas Form 4 students are evaluated by the class teachers. Students' achievement at the national level examination is important for them to select the area of their choice to study at upper secondary level. Dhindsa (2005) compared Form 4 and Form 5 data on the culturally sensitive factors and reported that mean values for all the scales except for collaboration and deference were comparable. The differences in means for these two scales were also at marginal for deference and moderate for collaboration.

Cultural Learning Environment: Malay, Chinese, Indigenous and Other Students

Table VIII shows the range of scale item mean values from 3.05 to 4.23 for Malay, 2.96 to 4.08 for Chinese, 3.03 to 4.35 for Indigenous and 2.98 to 4.29 for Others. The analysis of students' data using ANOVA analysis on the seven scales for the four race groups revealed that all the average scale item mean values were statistically significantly different except for teacher authority (see p-values for overall). These results indicated that at least one of the race based comparisons should be statistically significantly different for six factors other than teacher authority. The post-hoc analysis revealed one comparison each on gender equity scale involving Malays and Chinese (ES= 0.36), and deference scale involving Others and Chinese (ES=0.26) were statistically significantly different. Since the differences in these two comparisons were at a low level as indicated by effect size data, these differences are considered to be of little educational importance. Hence, it was concluded that students from the four race groups perceived the extent of gender equity, modelling and deference to equal extent in their science classes.

Table VIII also shows that the average scale item mean values on collaboration scale for Chinese (4.08) students was statistically significantly lower than for Malay (4.23) and Indigenous (4.35) students. Similarly the scale item mean value for students categorized as Others (4.02) was also statistically significantly lower than for Malay (4.23) and Indigenous (4.35) students. The effect size values for these comparisons (0.23 to 0.51) ranged from low to moderate level. These results suggest that the perceptions of students from different races on collaborative learning in their classes were different. Post-hoc analysis suggested that the perceptions of Chinese and students classified as Others were comparable. Similarly the perceptions of Malays and Indigenous students were also comparable. A similar trend was observed for modelling data. The perceptions of Chinese (3.42) students as well as of students categorized as Others (3.27) were statistically significantly lower than for Malay (3.71) and Indigenous (3.78) students. The effect size values for these comparisons were (0.46 – 0.69) of moderate level. The Chinese (3.46) students also perceived learning in their classes to be statistically significantly and moderately less modelled as compared to the perceptions of Malay (Mean 4.01; ES=0.66), Indigenous (Mean 3.89; ES=0.48) and Others (Mean 3.79; ES=0.36). Based on these results it was concluded that there were valuable differences in perceptions of students from

different races on the competitiveness of teaching and the learning process in their classes. The perceptions of Malay students were comparable to those of indigenous students and of Chinese to Other students.

The post-hoc analysis of the congruence scale data revealed that the Chinese (3.41) group perceived congruence in their class to be moderately statistically significantly lower than for the other groups: Malay (Mean 3.67; ES=0.36), Indigenous (Mean 3.71; ES=0.40) and Others (Mean 3.74; ES=0.45). These results suggested that the students grouped as Malay, Indigenous and Others perceived that learning in their classes, to some extent, was associated with the environment at home and helped in their daily life to resolve day to day problems, whereas the Chinese students perceived a relatively low level of congruence between learning at school and its use at home. The overall analysis of race based data on congruence scale revealed three out of six comparisons to be statistically significantly different. These results guided the conclusion that students grouped in four race groups perceived congruence in their classes to be at a different level.

Table VIII shows 16 of the 42 possible comparisons to be statistically significantly different. Chinese students were involved in 12 of these 16 comparisons and perceived significantly lower values for all these comparisons than their counterparts. For the remaining 4 comparisons, students categorised as Others perceived significantly lower mean values on collaboration and modelling scales than their Malay and Indigenous counterparts. Malaysian society is classified as a collectivist society that values more collaboration than individualism (Thomas, 2000). Brunei Malay cultural values overlap with the Malaysian culture to a great extent. This is reflected in results where Malay and Indigenous students perceived their classes to be more collaborative than others. Moreover, in the Kingdom of Brunei, the society is very hierarchical and directive. These effects are reflected in the Malay and Indigenous students' data for Modelling where their mean values are significantly higher than that of Others.

Chinese students in the country follow Confucian ethics. According to Thomas (2000), the diligence and positive attitudes of these students towards education coupled with a high level of achievement motivation, are consonant with the fundamental Confucian concept of learning. These conceptions include a striving for perfection and education for all, and the application of effort to fuel a high level of achievement. This philosophy seems to explain the Chinese students' data in Brunei. These students are generally high achievers and are less satisfied in their classes as they expect more in their classes. They also seem to enjoy more cultural freedom than their Malay counterparts. Moreover, being a minority in the country, Chinese parents are highly concerned about the education of their children and they are heavily involved in helping children with homework and paying for tutors to improve their children's achievement. Chinese parents' pressure on the children to achieve high grades is also associated with their cultural values. The students in the Other category are mostly from India and Pakistan. These students are also high achieving students and experience high parental pressure for high achievement. These cultural variations in the backgrounds of the students seem to be associated with significant differences in the perceptions of these four groups of students.

Table VIII

Scale Item Mean Values, Standard Deviation data and Significance Levels for Malay, Chinese, Indigenous and Others on Students' Races on CLEQ-S Seven Factors

Scale	M	C	I	O	p-values	p-values *(ES)*					
	N=443	N=695	N=65	N=131	for overall	M vs. C	M vs. I	M vs. O	C vs. I	C vs. O	I vs. O
Gender equity	4.12# (0.59)	4.08 (0.65)	4.08 (0.48)	4.29 (0.54)	0.005	0.757	0.976	0.057	1.000	0.005 (0.33)	0.184
Collaboration	4.23 (0.60)	4.08 (0.69)	4.35 (0.47)	4.02 (0.71)	0.000	0.003 (0.23)	0.590	0.012 (0.34)	0.017 (0.40)	0.775	0.010 (0.51)
Deference	3.57 (0.62)	3.40 (0.66)	3.59 (0.55)	3.41 (0.76)	0.000	0.000 *(0.26)*	0.998	0.090	0.170	1.000	0.333
Competition	4.01 (0.66)	3.46 (0.92)	3.89 (0.61)	3.79 (0.84)	0.000	0.000 *(0.66)*	0.759	0.062	0.001 *(0.48)*	0.001 *(0.36)*	0.877
Teacheraut	3.05 (0.77)	2.96 (0.84)	3.03 (0.66)	2.98 (0.90)	0.306	0.328	0.999	0.833	0.916	0.990	0.984
Modelling	3.71 (0.63)	3.42 (0.71)	3.78 (0.68)	3.27 (0.76)	0.000	0.000 *(0.43)*	0.873	0.000 *(0.66)*	0.001 *(0.51)*	0.163	0.000 *(0.69)*
Congruence	3.67 (0.67)	3.41 (0.75)	3.71 (0.72)	3.74 (0.73)	0.000	0.000 *(0.36)*	0.984	0.806	0.018 *(0.40)*	0.000 *(0.45)*	0.993

M, C, I and O are codes given for students from Malay, Chinese, Indigenous and Others races respectively.* Significance levels (p-values and effect size (ES) values in italicizes). Teacheraut=Teacher authority. #Mean and (SD); N = number of respondents. Ninety three students didn't disclose their race.

Conclusions

Under this section responses to research question are summarized.

How suitable was the CLEQ instrument in collecting the data on cultural factors of learning environment of students in non-government schools?

The determinant value of 1.275E-04, Bartlett's test: p =0.000 and KMO value of 0.813 suggested that data were suitable for factor analysis. The excellent grouping of 35 items into 7 factors during factor analysis and low values (0.06 – 0.17) for discriminate validity justify the conceptual distinctions among the scales. The high internal consistency (Cronbach alpha reliability coefficient) values for all the scales (0.58 – 0.82) suggested that each scale has an acceptable reliability. The reliability coefficient of 0.81 for the overall instrument also supports the reliability of the instrument. Moreover, the values are comparable with the data on these coefficients reported in literature (Dhindsa, 2005; Fisher & Waldrip, 1997). Based on these results it was concluded that the instrument was internally consistent, valid, and reliable for collecting quality data on cultural factors pertaining to the learning environment of students in non-government schools. However, the readers should take note that the reliability coefficient for deference scale was low (0.58), and this scale appears to need some revisions.

What are the magnitudes of the cultural learning environment factors, covered in the instrument, in the science students' classes in non-government schools?

The scale item mean values for gender equity (4.11) and collaboration (4.13) are high and for teacher authority (3.01) is low. The mean values for competition (3.69), congruence (3.55), modelling (3.51) and deference (3.46) are at moderate level. The high values for gender equity and collaboration scales in science classes are good indicators of effective science teaching especially using constructivist philosophy. These indicators get relatively less support from teacher authority, competition, congruence, modelling, and deference factors for effective classroom practices. The mean values in the positive range for five scales and teacher authority values at median indicate no serious conflict between these cultural factors in the Bruneian school classroom. Hence these factors are supportive for classroom learning however, the teacher authority, deference and modelling needs attention. Moreover, there is scope for all these factors to be optimized for effective learning.

Were the teachers able to predict their students' perception of these factors?

Statistically non-significantly different mean values for teachers and students for gender equity, collaboration and competition scales suggest that the teachers were able to predict the students' mean response data for these scales. However, low to medium (Effect size range 0.32 – 0.48) level significant differences in prediction of mean data on deference, modelling, congruence and teacher authority suggest that the teachers were unable to predict students' mean perceived data for these scales. These results suggest that teachers were partly able to predict their students' perceptions of cultural factors in their classroom learning environment.

How did the researcher's observation data compare with students' perception and teachers' prediction data?

ANOVA analysis of the three sets of data revealed the mean observed values for gender equity, collaboration, competition, deference and congruence scales were non-significantly different than students' perceived and teachers' predicted values for these scales. However, for teacher authority and modelling scales the differences were statistically highly significant. These results suggest that observation data were comparable with students' perception and teachers' prediction data for all the scales except for teacher authority and modelling. For these two scales as suggested by high effect size data, the researcher observed a statistically significantly higher level of deference and teacher authority than what the students perceived and the teachers predicted. These results suggest that the researcher's observation data partly matched with the other two forms of data.

How are the cultural factors influenced by the subcultures (based on the gender, region, grade level, and race) of this population?

While comparing data for gender, it was observed that mean values for all the scales were statistically non-significantly different except for deference ($p= 0.015$, ES= 0.14) and competition ($p= 0.001$, ES= 0.19) scales. Similarly for regional variations, mean differences for gender equity ($p= 0.004$, ES= 0.07) and competition ($p= 0.024$, ES= 0.13) were statistically significantly different. However for grade level differences mean values for all the scales except for Modelling ($p= 0.49$) were statistically significantly different with a range of p-values from 0.000 to 0.013 and effect size values from 0.13 to 0.28. A low level effect size data suggests these differences to be of little educational importance. Based on the effect size data it was concluded that the cultural factors of non-government school students' learning environment were not influenced by their gender, region and grade level.

However, when race based comparisons were considered, it was found that 16 out of 42 possible comparisons were statistically significantly different with low to moderate effect size values. Further analysis revealed that all the mean values on teacher authority scale for four race groups were statistically non-significantly different. The means values on deference scale for the four groups of students were comparable except that Malay students perceived significantly ($p= 0.003$) but marginally (ES = 0.26) higher deference in their classes than the Chinese students. Similarly for gender equity scale only one comparison where students classified as Others perceived a significantly ($p = 0.005$) but marginally (ES = 0.33) higher mean value than Chinese students. Based on effect size data representing low level statistically significant differences, which are of little educational importance, it was concluded that the perceptions of students from the four race groups on gender equity and deference were similar in their science classes. However for collaboration, competition, modelling and congruence scales, statistically significant differences for 14 (3 to 4 per scale) out of 24 possible race based comparisons with low to moderate level effect size were obtained. These data guided the authors to conclude that the students from four race groups perceived collaboration, competition, congruence and modelling in their classes differently. The overall results show that the

perceptions of cultural factors of the four race based groups of students were comparable on gender equity, deference and teacher authority, but different on collaboration, competition, modelling and congruence scales.

Implications and suggestions

The results of this study supported the suitability of using the Cultural Learning Environment Questionnaire (CLEQ-S) for the evaluation of socio-cultural factors of the learning environment of Form 3 and From 4 science students in non-government schools. Dhindsa (2005) reported that the CLEQ-S was valid and reliable for assessing these factors in a similar setting at government schools. These studies also supported the validity and reliability of the instrument for evaluating the cultural learning environment of science students at various stages of the curriculum in Brunei educational institutions. However, its suitability for other subjects needs to be evaluated. Teachers should modify the items of the instrument to improve its suitability in other contexts.

This instrument includes seven dimensions of culture that influence the learning environment. However, there are more cultural dimensions that influence classroom practices and need attention. Hence there is a need either to extend this instrument to include additional scales or to develop new instruments to cover additional scales. Salwana (2006) developed an instrument to evaluate cultural communication in science classes and the instrument has been reported to be valid and reliable. However, researchers can think on these lines to develop similar instruments that teachers can use to understand better the cultural dynamics in a classroom.

The results of this study revealed that the magnitude of these cultural factors supports the learning process. However, the scale item mean values for the scales are less than 5, the optimum value. There is scope for improvement in these factors. An improvement in scale item mean values and also minimization of differences in scale item mean values for various groups based on gender, race, region and educational standard can be achieved through modifications to the curriculum. A fair representation of examples from various subcultures in the curriculum can help improve the magnitude of these scales. For example an unfair gender representation in favour of males in lower secondary science books used in Brunei has been reported (Elgar, 2001). The mean values for deference (3.46) and teacher authority (3.01) scales as perceived by students suggest that they were willing to air their views only to some extent in the presence of their authoritarian teachers. The curriculum should allow opportunities for students from all subcultures to express their views about scientific knowledge based on their cultural backgrounds. Teachers should use these differences in students' cultural perceptions to develop their lessons. It is important that teachers use cultural values of students to adopt an inclusive teaching approach in their classes. Since, teachers' cultures also influence the teaching and learning process, they should also express their personal views during the development of their lessons, rather than teaching the views of the authors of the book. The curriculum should also encourage teachers' role as a guide than authoritarian. Teacher communication behaviour has been reported to influence the cultural learning environment in science classes. It is important for teachers to be careful while communicating in the class. The Bruneian being a collectivist majority culture and high

mean value for collaboration (4.13) can provide support for constructivist teaching. Constructivist teaching encourages group work. Group work encourages students to air and defend their views. Teachers can help the optimization of the cultural learning environment in their classes by grouping students from majority and minority cultures together. This will encourage interactions between students from various cultural backgrounds. Certain actions such as adjusting the curriculum content, changing the methodology of teaching or even bringing up some examples from different cultures in teaching might help to improve the cultural learning environment in science classes.

The results of the present and previous studies have shown a high level of gender equity in science classes. In recent years the dynamics of the classes at institutions of higher education have changed in terms of gender enrolment. At the university level there are about 40 males for every 100 females (Dhindsa, 2008). Similar data has been reported for enrolment at other tertiary institutions and even at the elite schools of the country. This difference has emerged because at school level the number of high achieving girls is higher than that of boys. It is highly desirable for the Brunei Ministry of Education to be vigilant on the effects of this shift in enrolment balance on the various dimensions of the teaching and learning processes in the national education system.

This research is focused on non-government schools where most of the teachers are expatriates and some of them are even untrained. There is a need for these teachers to improve their qualifications as well as to be up to date with the latest developments in the educational field. Teacher training institutions and these schools should concentrate on staff development programmes to improve these teachers' classroom practices especially for teaching multicultural classes. The Brunei government is trying to replace the expatriate teachers with locally trained teachers. Keeping in view how the future teachers should teach the multicultural classes, the teacher training institutes can benefit from this research to train teachers to be culturally sensitive. This can be achieved by designing a culturally sensitive curriculum. Moreover, the teacher trainers should also concentrate on training science teachers on how to teach effectively in culturally diverse classes. Furthermore teacher training should focus on how to use cultural diversity for enhancing the effectiveness of teaching and learning process. According to Thomas (2000), multicultural classrooms help to concentrate the minds of teachers on how to manage their teaching and learning strategies in class. The teachers could be given workshops to get them exposed to activities which concern the cultural learning environment. The need for the development of culture sensitive teacher education and training programmes is highly desirable so that in the long run it is likely to provide a teaching force which would be better prepared for meeting the challenges of the cultural diversity in the multicultural classroom. Thomas (2000) reported that the case for culture-sensitive teacher education is not only viable and clear but it is also long overdue. The local pre-service teachers complete their teaching practice in one semester at one school only. By doing so, they get only limited experience of teaching students from different cultural backgrounds. The distribution of ethnic populations is distinct and specific in four districts of Brunei. The teacher trainees can improve their ability to teach in multicultural classes if they are given an opportunity to teach in more than one school located in culturally diverse districts of Brunei.

In this study, it was found that the teachers were able to partly predict culturally sensitive factors of their students' learning environment. However, improvements are desirable to minimize teachers' reliance on the use of instruments because it requires time and money. Teacher training programmes often put little emphasis on association between cultures and science teaching. It is therefore, important that the teacher training curriculum should include topics on predicting human behaviour with special reference to cultural variables associated with science teaching. Moreover, there is a need to further research the differences between data reported by the students, teachers and observer.

Some significant differences in perceptions of different race groups on certain cultural factors of the learning environments have been reported in this study. It poses a challenge for teachers in non-government schools to optimize their teaching practices to minimse these differences and also to use the cultural diversity in their classes to create a more conducive learning environment for all the students.

In this study, some of the statistically significant differences were treated as of little importance because the effect size values for these differences were low. However, the readers, more specifically teachers, should consider the importance of these small differences. These differences could be of some importance, because teaching and learning are complex processes involving a large number of variables. A complex interaction between large variables involving small significant differences could give rise to useful gains. Therefore, teachers when considering the applications of this research should keep in mind the existence of these differences. Rennie (1998) reported that the small non-significant differences in p-values and low effect size may be of some importance especially when these differences are repeated.

In summary, a major implication of this research is that if we can identify the culturally sensitive factors of the learning environment of multicultural classes, then we can make use of the multicultural make up of science classes to (a) optimize the teaching and learning processes, (b) optimize the curriculum to train culturally sensitive teachers and to develop curriculum materials that should cater to the needs of the multicultural classroom, (c) organize workshops for teachers to get them exposed to activities which concern the cultural learning environment, (d) to improve the culturally sensitive factors of the learning environment in multicultural classes, (e) make use of the multicultural make up of science classes for the optimization of the teaching and learning processes and (f) prepare teachers to meet the challenges posed by students from diverse cultural backgrounds. Teachers could make use of this information to prepare them to meet the challenges of teaching students from culturally diverse backgrounds. Research on how to train teachers so that they are able to predict students' perceptions on these factors is also desirable.

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