IDENTIFYING CULTURALLY SENSITIVE FACTORS OF SCIENCE LEARNING ENVIRONMENTS IN WESTERN AUSTRALIA

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ABSTRACT

The present study examines and investigates students' perception of their learning environment and its associations with their cultural background and attitude to class. A total of 560 students from years 7 and 8 from a multicultural Western Australian public school responded to the Cultural Learning Environment Questionnaire (CLEQ) and an Attitude Scale. Students' cultural background was established by ascertaining the language spoken at home and their parents' country of birth. This study provides further validation data for the already existing CLEQ and indicates changing trends in Western Australian schools with regard to cultural sensitivity. Gender differences in students' perception of cultural background were also established. Associations were drawn between students' perceptions of their cultural learning environment and attitude to science. These associations examine whether the students' cultural background affects their attitude.

INTRODUCTION

Western Australian classrooms are becoming increasingly multicultural and the way in which people communicate and perceive communication is culturally influenced (Giles & Franklyn-Strokes, 1989; Segall, Dasen, Berry, & Poortinga, 1990). Okebukola (1986) argued that the cultural background of the learner could have a greater effect on education than does the course content. Consequently, unless students can relate the application of what is taught to their own cultural backgrounds their learning is likely to be less than effective. Many students come from disparate cultural practices and at times the teaching and learning strategies adopted in science classrooms can be perceived as being in conflict with the natural learning strategies of the learner (Waldrip & Fisher, 1996). Since teachers can use practices that may inadvertently conflict with students' previous learning patterns, home environment, mores and values, there is an increasing need for teachers to be sensitive to the important cultural milieu into which teaching is placed (Thaman, 1993). Although there are a number of studies related to culture and science education generally described in literature (Atwater, 1993; Cobern, 1996; Evans, 1998; Koul & Fisher, 2006; Maddock, 1981) none have made an attempt to study primary science students' cultural background and their attitudes to science.

CLASSROOM ENVIRONMENT RESEARCH

A key advance in the thinking that contributed greatly to the study of learning environments was the Lewinian formula proposed by an exile from Nazi Germany, Kurt Lewin (1936). It is a key to the human interaction focus of this study in that it proposed that the environment and the personal characteristics of an individual determined human behaviour. This theory was expressed in the formula that human behaviour (B) is a function of both the personality of the individual (P) and the environment (E).

$$B = f(P, E)$$

This formula was to provide a motivating force for new research strategies (Fraser, 1994; Stern, 1970). Murray (1938) developed a theory to describe an individual's personal needs and environmental press. He defined needs as those specific, innate and personal requirements of an individual such as personal goals. An individual's need to achieve these goals or their drive to attain them is also a factor in an individual's personality. The environmental factors that were beyond an individual's control that either enhanced or retarded the individual's achievement of their personal goals and needs were defined as press. Murray used the term *alpha press* to refer to an external observer's perceptions of the learning environment and *beta press* to refer to observations by the constituent members of the environment under observation (Murray, 1938).

Stern, Stein, & Bloom (1956) built on Murray's discrimination between *alpha press* and *beta press.* They suggested that *beta press* could further be discriminated by the individual view and experience of the environment that each student, for example, has of the learning environment versus the shared view that the students have as a group of participants in the learning environment. They used *private beta press* to represent the idiosyncratic view a student may have of the classroom environment and *consensual beta press* for the shared view of the students' perceptions. This study utilises the student *consensual beta press* perspective for the

data collected through survey and observation methods and *private beta press* perspective for the interviews conducted with the students.

Classroom research methods about three decades ago were centred on observation techniques where trained observers would categorise classroom activities and interactions between members of the class. Along with an improvement in observation procedures and techniques (Brophy & Good, 1986) came a categorisation of observations as either high or low inference measures which were defined as the specific items that were recorded during classroom observations sessions. High-inference measures recorded during classroom observations required the observer to make an inference about the teacher's behaviour in terms of such aspects as warmth, clarity or overall effectiveness. Either a member of the classroom environment or an outside observer could make high-inference observations.

Murray's needs-press model was utilised and extended (Pace & Stern, 1958) to report on high inference measures in educational learning environments. A problem with outside observers is that they must make judgements on the observations that are based on experiences external to the learning environment. Further to this, Pace and Stern (1958) suggested that an assessment of the relationships between the environmental press and a student's needs might be useful in predicting personal achievement.

CULTURAL LEARNING ENVIRONMENT QUESTIONNAIRE (CLEQ)

The Cultural Learning Environment Questionnaire (CLEQ) was developed by Waldrip and Fisher (1996) to assess the culturally-sensitive factors of the classroom learning environment. The research on dimensions of culture (Hofstede, 1984) and Moos' dimensions served as the main guide in the development of CLEQ. The other main criteria adhered to when developing the CLEQ were: consistency with previous learning environment research and literature, salience for teachers and students in target audience and economy of operational requirements The questionnaire has eight scales with five items in each scale giving a total of 40 items. Waldrip and Fisher (1996) used it with the individual student as the unit of analysis and its factor analyses resulted in retaining all the 40 items in eight scales. This study used the CLEQ in primary science classes for one of the first time to measure students' perceptions on the basis of their cultural backgrounds.

Table 1 illustrates the nature of the CLEQ by providing a sample item for each of the eight scales. Student responses were taken on a four point Likert scale ranging from Almost Always (4) to Almost Never (1).

Table 1
Description and Example of Items for Each Scale in the PLACES

Scale	Sample Item
Equity	I feel that female teachers should be shown the same amount of respect as male teachers.
Collaboration	I would rather decide what to do as a group than to make decision by myself
Deference	I try to say what the class thinks rather than give my own opinion
Competition	I worry if I don't perform as well as other students.
Teacher Authority	I feel that I can challenge or question what teachers say.
Modeling	I like to watch how my classmates tackle a problem before I start.
Congruence	What I learn in this class agrees with what I learn at home.
Communication	I like to be able to see as well as hear what is happening in class

STUDENT ATTITUDES TOWARDS SCIENCE

Because of the national importance given to the teaching of science and inculcation of positive attitudes towards science in students, it is both timely and opportune to examine associations between students' perceptions of cultural factors that affect the learning environment and their attitude towards science. Attitudes towards science were assessed in this study using an Attitude Scale based on the *Test of Science Related Attitudes* (Fraser, 1981).

METHOD

The overall aim of the study was to investigate associations between students' cultural backgrounds and their attitude to science. This led to the following objectives which were:

to further validate the Cultural Learning Environment Questionnaire (CLEQ) instrument for use in multicultural primary science classrooms;

to investigate whether their were differences in students' perceptions on the basis of their cultural background;

to determine whether there were associations between students' perceptions of their cultural background and attitude to science; and

to inform teachers about the perceptual differences due to the culture of the students as this can be used as a guide to improve teaching, thereby leading to improved learning.

The research involved administering the CLEQ and the Attitude Scale to a total of 560 students in 20 primary science classrooms (years 7 and 8) in Perth metropolitan schools. Care was taken to include a school where students came from a wide range of cultural backgrounds which was established by including a question 'Language spoken at home'. Students in this study spoke 45 different languages at home. These 45 languages were grouped into six sets keeping in mind the cultural practices and geographical locations as shown in Table 2.

Table 2
Description of the Groups Created on the Basis of Language Spoken at Home and Number and Percentage of Sample from Each Group

Group	Language Spoken at home	N	Percentage
1	English	446	79%
2	Vietnamese	43	7.6%
3	Mandarin, Cantonese, Chinese, Hokkien & Thai	11	1.96%
4	Arabic, Bosnian, Kurdish, Malay, Persian, Indonesian, Urdu, Croatians, Serbian, Dari	24	4.28%
5	African, Burmese, Maori, Tagalog, Punjabi, Tamil, Amharic	11	1.96%
6	Macedonia, Polish, German, French, Italian, Spanish, Hungarian, Romanian, Russian, Yugoslavian	25	4.46%

The validity of the instrument was further confirmed in terms of reliability and ability to differentiate between perceptions of students in different classes and students coming from different cultural backgrounds.

RESULTS

Table 3
Scale Mean, Standard Deviation, Internal Consistency (Cronbach Alpha Reliability) and Ability to Differentiate Between Classrooms (ANOVA Results) for the CLEQ

Scale	**Mean**	**St. Dev**	**Alpha Reliability**	**ANOVA (eta^2)**
Equity	3.47	.51	.71	.08*
Collaboration	3.36	.5	.67	.05*
Deference	2.78	.61	.66	.14*
Competition	2.26	.73	.77	.04
Teacher Authority	2.27	.66	.65	.07*
Modeling	2.55	.65	.69	.04
Congruence	2.89	.67	.81	.09*
Communication	2.92	.62	.76	.06*
n= 560 students in 23 classes	*p<0.01			

Table 3 presents the means and standard deviations for each of the scales of the CLEQ indicating that the students perceive a high degree of equity and collaboration in their classroom environments. The deference, competition, authority, modelling, congruence and communication aspects are less noticeable. However, all the

scales have a high mean, the lowest being 2.26 on a four point Likert scale for the scale of Competition. The students perceived equity most favourably with a score of 3.47. The standard deviation for all the scales ranged from 0.5 to 0.73, suggesting that there was not a large diversity in the students' perceptions

The validity and reliability information for the CLEQ when used with this primary school Australian sample are also presented in Table 2. To determine the degree to which items in the same scale measure the same aspect of culture, a measure of internal consistency, the Cronbach alpha reliability coefficient (Cronbach, 1951), was used. The highest alpha reliability was obtained for the scale of Congruence and the lowest for Teacher Authority. The reliability results for the scales of the CLEQ were consistently above 0.50 suggesting that it can be considered a reliable tool (De Vellis, 1991) with primary school Australian students**.**

The ability of a learning environment questionnaire to differentiate between classes is important. The CLEQ's ability to differentiate in this way was measured using one-way analysis of variance (ANOVA). The eta^2 statistic was calculated to provide an estimate of the strength of the association between class membership and the dependent variables as shown in Table 2. The eta^2 statistic for the CLEQ, indicates that the amount of variance in scores accounted for by class membership ranged from 0.14 to 0.04 and was statistically significant (p<0.01) for the scales of Equity, Collaboration, Deference, Teacher Authority, Congruence and Communication It appears that most of the scales of the CLEQ are able to differentiate clearly between the perceptions of students in different classrooms.

Gender differences

The associations between the students' perceptions of cultural aspects and the gender of the students were analysed. The gender differences in students' perceptions of classroom learning environment were examined by splitting the total number into male (294) and female (256) students involved in the study.

To examine the gender differences in students' perceptions of culture aspects of the science classes, the within-class gender subgroup mean was chosen as the unit of analysis which aims to eliminate the effect of class differences due to males and females being unevenly distributed in the sample. In the data analysis, male and female students' mean scores for each class were computed, and the significance of gender differences in students' perceptions of science classroom culture were analysed using an independent t-test. Table 4 shows the scale item means, male and female differences, standard deviations, and t-values. The purpose of this analysis was to establish whether there are significant differences in perceptions of students according to their gender.

As can be seen in the Table 4, out of eight scales of the CLEQ, the gender differences in the perceptions of males and females were found to be statistically significantly different on only two scales. According to the results, female students perceived more positively the equity and communication displayed by their teachers.

Table 4
Item Mean and Standard Deviation for Gender Differences in Students' Perceptions as Measured by the CLEQ.

Scale	Gender	Item Mean	Mean Difference (F-M)	Std. Deviation	t
Equity	Females	3.52	.08	.45	7.22*
	Males	3.44		.53	
Collaboration	Females	3.38	.04	.47	2.25
	Males	3.34		.52	
Deference	Females	2.73	-.08	.62	.88
	Males	2.81		.59	
Competition	Females	2.27	.02	.71	.99
	Males	2.25		.75	
Teacher Authority	Females	2.16	-.21	.64	.29
	Males	2.37		.65	
Modeling	Females	2.47	-.13	.64	.04
	Males	2.6		.65	
Congruence	Females	2.88	0	.63	3.67*
	Males	2.88		.7	
Communication	Females	3.01	.17	.59	.5
	Males	2.84		.63	
Attitude to Class	Females	2.39	.05	.41	.96
	Males	2.34		.43	

* p=0.01 females (n=256); males (n=294)

Cultural differences

Associations between scales of the CLEQ and students, on the basis of the cultural group they come from, were examined. The cultural group of the students was determined by the question 'language spoken at home'. To examine the cultural differences in the science classes, the within-class cultural subgroup mean was chosen as the unit of analysis which aims to eliminate the effect of class differences due to the strength of various groups being unevenly distributed in the sample. In the data analysis, mean scores for each of the six cultural groups were computed. Table 5 shows the scale item means and F values of the scales of the CLEQ with the perceptions of students from the six cultural groups created. The purpose of this analysis is to establish whether there are significant differences in the perceptions of students according to their cultural backgrounds.

As can be seen in Table 5, the differences in the perceptions of students about their science teachers on only two scales out of the eight CLEQ scales are statistically significant. The scales in which there were significant differences were Deference and Competition where the students from Group IV had a higher score. Further analyses will be done on these preliminary measures.

Table 5
Item Mean for Cultural Differences (Language Spoken at Home) in Students' Perceptions of CLEQ Scales

Scale		Group I	Group II	Group III	Group IV	Group V	Group VI	F Value
Equity	Mean	3.5	3.38	3.57	3.46	3.13	3.43	1.39
	St Dev	.49	.54	.79	.49	.37	.51	
Collaboration	Mean	3.37	3.4	3.25	3.43	3.26	3.21	.86
	St Dev	.49	.57	.49	.55	.44	.53	
Deference	Mean	2.74	2.89	2.58	3.11	2.77	2.88	2.52*
	St Dev	.62	.5	.51	.52	.52	.55	
Competition	Mean	2.19	2.54	2.14	2.7	2.62	2.58	5.55*
	St Dev	.69	.8	.93	.8	.25	.82	
Teacher Authority	Mean	2.27	2.28	1.97	2.37	2.4	2.33	.81
	St Dev	.66	.68	.42	.74	.63	.58	
Modeling	Mean	2.55	2.65	2.28	2.39	2.48	2.65	1.05
	St Dev	.66	.36	.45	.74	.78	.71	
Congruence	Mean	2.87	3.05	3.28	2.76	3.06	2.73	2.04
	St Dev	.69	.57	.51	.69	.4	.66	
Communication	Mean	2.93	3	3.04	2.83	2.91	2.8	.54
	St Dev	.62	.61	.56	.66	.45	.74	
Attitude to Class	Mean	2.36	2.46	2.34	2.34	2.69	2.32	.1.58
	St Dev	.43	.44	.37	.47	.24	.38	
		n=437	n=40	n=14	n=26	n=9	n=25	

*p=0.01 Total n = 551

Associations between attitude towards science class and the scales of CLEQ

One of the aims of the study was to investigate whether the students' cultural background affects his/her attitude towards science classes. Associations between the perceptions of the scales of CLEQ and students' attitudes were explored using simple and multiple correlation analyses. The results of the analyses are shown in Table 6. For all the scales of CLEQ except Equity associations are positive and statistically significant.

The multiple correlation (R) between the set of CLEQ scales and attitude to science class was 0.39. The R^2 value which indicates the proportion of variance in attitude to science class that can be attributed to students' perceptions of the cultural environment was 16%. To determine which of the CLEQ scales contributed most to this association, the standardized regression coefficient (beta) was examined for each scale. It was found that only the scales of Collaboration, Competition, Modeling and Communication retained their significance and were positively and significantly associated with attitude to science classes.

Table 6
Associations between CLEQ Scales and Attitude to Science Class in terms of Simple Correlations (R)*, Multiple Correlations and Standardized Regression Coefficient ( )*

Scale	Attitude to Science Class	
	r	*Beta*
Equity	0.01	-0.07
Collaboration	0.16**	0.09*
Deference	0.12**	-0.06
Competition	0.25**	0.17*
Teacher Authority	0.12**	0.06
Modeling	0.28**	0.19*
Congruence	0.17**	0.06
Communication	0.23**	0.14*
Multiple Correlation	R = 0.39**	$R^2 = 0.16$

*$p<0.05$,**$p<0.01$ n=551

CONCLUSIONS

The results of this study provide further evidence that the CLEQ is a valid instrument for use with Australian students in middle school. Students generally have very positive perception of cultural aspects of their learning environment. This finding does not contradict with earlier studies conducted by Evans (1998) and Waldrip & Fisher (1996)

In this study, there is little statistically significant evidence of differences in students' perceptions of their learning environment based on their cultural background. This finding is contrary to other research studies in this field. Although data were collected from a multicultural school, significant number of respondents belonged to one group. It is probable that teachers in this selected school are culturally sensitive or students have been living in Australia for a long time and accept an Australian way of life. These factors could have impacted the results obtained in this study. However, further qualitative study is needed to provide more insight into the research questions under investigation.

This study is significant, as it identified the students' perceptions of cultural factors that affect their classroom-learning environment. Thus, it accepts that students should be active participants in learning process. It further investigates links between students' perceptions of cultural factors and their attitudes towards science, which affects student outcomes. Through this research study increased understanding of effective teaching of science in primary schools was gained, which can benefit the community through the application of research results to school and education system.

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