Pupils' Classroom Environment Perceptions, Attitudes and Achievement in Science at the Upper Primary Level

Chin T.Y.

Xishan Primary School

8 Yishun Street 21

Singapore 768611

Rebublic of Singapore

Angela F.L. Wong

National Institute of Education

Nanyang Technological University

1 Nanyang Walk

Singapore 637616

Rebublic of Singapore

Abstract

This study in pupils' classroom environment perceptions, attitudes and achievement is significant as it was the first of such studies to focus on the learning environment of the primary school science in Singapore. The primary aim was to examine the relationship between pupils' perceptions of their science classroom environment and their achievement and attitudes in science. Another purpose was to explore the actual and preferred perceptions of pupils, as well as those of boys and girls. The sample consisted of 7 intact classes of Primary 5 pupils from one coeducational government primary school in Singapore.

The investigation of attitude-environment, achievement-environment and attitude-achievement associations involved using simple and multiple correlational analyses. A univariate one-way analysis of variance (ANOVA) for repeated measures was used to compare pupils' actual and preferred perceptions. Boys' and girls' perceptions were also compared in a similar manner. The instrument used in the study was analyzed for internal consistency, discriminant validity, ability to differentiate between classes and its factor structure.

The findings revealed the existence of positive associations between the nature of the primary science class environment and the pupils' attitudinal and achievement outcomes. In addition, it was found that girls held more favourable perceptions than boys. The study also adapted and reviewed an instrument in the Singapore context to assess both the primary science class and the science laboratory.

Key Words: Classroom environment, attitude, achievement, science education

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INTRODUCTION

Educational environment research was first built upon the ideas of K.Lewin (1936). Although classroom environment research has spanned more than 30 years (Fraser, 1998), the Science Laboratory Environment Inventory (*SLEI*) (Fraser et al., 1992) is the only instrument used in study of science laboratory classroom environment at the secondary level. The My Class Inventory (*MCI*) is one of the few designed for use at the primary level, not specifically designed for the study of science learning environment.

Since their development and validation, both instruments have been used in different types of environment research. These recent researches on classroom environment have indicated positive associations between the nature of the class environment and pupils' attitudinal and achievement outcomes (Fraser & O'Brien, 1985; McRobbie & Fraser, 1993; Goh, Young & Fraser, 1995, Wong & Fraser, 1997).

In the Singapore context, Toh et al. (1991) reviewed science education research and found a diversity of research done. It was noted that earlier studies reported were mainly in the field of science curriculum development, implementation and evaluation (Soh et al., 1983; Tan et al., 1983; Singham, 1987). Besides, science studies carried out at the primary level were few compared to those done at the higher levels.

Recently, a few environment studies involving the concept of learning environment have been reported in Singapore (Teh and Fraser, 1994; Wong and Fraser, 1996; Chionh and Fraser, 1998). All three studies were conducted with secondary school pupils. Goh and Fraser (1997) were one of the few who reported, at the primary level, consistent associations between classroom environment and pupil affective outcomes among mathematics pupils.

Despite the diversity of research reported for science education in Singapore, no study has been reported on science performance and its association with pupils' attitudes and perceptions on science classroom learning environment at the primary school level. A research in this area would thus be significant and form a basis to guide improvements in schools.

OBJECTIVES OF THE STUDY

The objectives of the study were

1. To review the instruments adapted for this study.
2. To find out significant differences, if any,

- between pupils' actual and preferred perceptions of their science classroom learning environment (science classroom and science laboratory)

- between boys' and girls' perceptions of their science classroom environment.

3. To examine the relationship, if any,

- between pupils' perceptions of their science classroom learning environment and their achievement and attitudes in science.

- between pupils' attitudes in science and their achievement in science.

SAMPLE

The sample consisted of 7 intact classes of Primary 5 pupils from a government primary school in Singapore. Science was taught as one of four core subjects in the Primary school syllabus. The other subjects were Mother Tongue, Mathematics and English.

INSTRUMENTS

Two instruments were used in this study. The science classroom environment perceptions of the pupils were measured using the My Science Class Inventory (MSCI). The pupils' attitudes towards science were assessed using the Science Attitude Questionnaire (SAQ).

The MSCI

The MSCI was adapted from the Science Laboratory Environment Inventory (SLEI) and My Class Inventory (MCI). The new MSCI comprises 8 scales and 40 questions. The first 4 scales were adapted from the MCI and the latter 4 from the SLEI. The Friction scale of the MCI was not included in the study as the Satisfaction and Cohesiveness scales were good enough representations of the relationship dimensions which the researcher was interested in assessing. This also helped to minimize fatigue in the Primary 5 pupils. The Cohesiveness scale in the SLEI was left out in the present study because it was very similar to the Cohesiveness scale in the MCI.

In the present study, each question in the new MSCI was scored on a 5-point scale with the responses of Almost Always, Often, Sometimes, Seldom and Almost Never. Statements from both original instruments were personalized as primary school pupils would be better able to assess his or her own perceptions compared to perceiving the class as a whole. Item and factor analyses from other studies confirmed that personal forms of these questionnaires had similar factor structures and comparable statistical characteristics to the class forms when either individual or class mean was used as the unit of analysis (Fraser, Giddings & McRobbie, 1995). The personal form also allowed for more meaningful and sensitive investigations of the sub-environment existing within a class for different subgroups of pupils (eg. between boys and girls) which was undertaken in the present study; as well as for constructing more meaningful case studies of individual pupils (Fraser, 1994).

MSCI was administered in two forms, namely actual and preferred. Both forms were similar in item wording but differed slightly in instructions for answering the questionnaires. The preferred forms were concerned with goals and value orientations and measured perceptions of the classroom environment ideally liked or preferred. Comparison findings based on both actual and preferred MSCI will serve as a basis for improving science class environment.

7 out of 8 scales in the MSCI originally planned were eventually used in the actual study. Academics in the field felt that the Satisfaction scale contained questions which were too similar in nature to questions in the Science Attitude Questionnaire (SAQ). Based on pupils' feedback in the pilot study, each question from the MSCI was scored on a 3-point instead of

a 5-point scale to simplify responding. A description of the remaining 7 scales for the MSCI and an example of an item in each scale are given in Table 1.

The SAQ

Students' attitudes towards science were assessed using the SAQ, which is a shortened and modified version of the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981). The original TOSRA questionnaire consisted of 70 items designed to measure seven distinct science-related attitudes among secondary school pupils. However, for the purposes of this study, only one of these scales, the 'Enjoyment of Science' was considered. Like the MSCI, a three-point response scale was also used for the SAQ. The response alternatives are Agree, Not Sure and Disagree.

Achievement Test

Pupils' achievement scores were obtained from the school's first combined assessment. The first combined assessment constituted 40% of the science score for the academic year and reflected pupils' performance in science for the first half of the academic year. Pupils were tested on knowledge application and process skill topics.

PROCEDURES

The researcher administered the instruments to 7 intact classes in a coeducational government primary school in Singapore. The pupils completed three questionnaires, namely, the actual and preferred versions of the MSCI, and the SAQ. Approximately 45 minutes were required to administer all questionnaires to each class.

Table 1 Description and Sample Item for each MSCI Scale in the Actual Form

Scale Name	**Moos Category**	**Description**	**Sample Item**
1 Competitiveness	Relationship	Emphasis on pupils	I want to be first all the
		competing with each other	time. (+)
2 Difficulty	Personal	Extent to which pupils	I know how to do my
	Development	find difficulty with the science	science work. (-)

		work	
3 Cohesiveness	Relationship	Extent to which pupils	Everybody is my friend
		know, help and are friendly	in my science class. (+)
		towards each other	
4 Open-Endedness	Personal	Extent to which the laboratory	I have to design my
	Development	activities emphasize an open	own experiment to
		ended divergent approach	solve a given problem
		to experiment	in the science
			laboratory. (+)
5 Integration	Personal	Extent to which the laboratory	What I do in the
	Development	activities are integrated with	science laboratory
		non-laboratory and theory	helps me to understand
		classes	what is taught in my
			science class. (+)
6 Rule Clarity	System	Extent to which behaviour in	I have to follow certain
	Maintenance &	the laboratory is guided by	rules in the science
	System Change	formal rules	laboratory. (+)

7 Material Environment	System	Extent to which the laboratory	The things which I use
	Maintenance &	equipment & materials are	in the science laboratory
	System Change	adequate	are working poorly. (-)
Adapted from MCI (Fraser & O'Brien, 1985) and SLEI (Fraser, Giddings & McRobbie, 1995)			
Items designated (+) were scored 1,2 and 3 respectively for the responses never, sometimes and			
very often. Items designated (-) were scored in the reverse manner. Missing or invalid responses were scored 2.			

METHODS & RESULTS

Review of the instrument adapted for this study

The MSCI was analyzed for internal consistency, discriminant validity, ability to differentiate between classes and its factor structure. It was observed in the factor structure that some items did not load with the *a priori* scales. These items had low itemscale intercorrelation compared to the other items in their respective scales. This finding suggested the removal of these problematic MSCI items in the present study. Fraser (1977) encountered low reliability of several of the original MCI's scales and tried improving scale reliability through application of item analysis techniques. He identified 7 items whose item-remainder correlation were unsatisfactorily low and removed them from the battery, resulting in considerably higher scale reliability than those obtained for the original version of the MCI by Anderson in 1971 (0.54 to 0.77) and Perkins in 1976 (0.41 to 0.73). Thus, to improve the reliability of the scales in this study, 8 questions from 5 scales were removed.

The internal consistency, discriminant validity and ability to differentiate between classes were re-evaluated again for the MSCI actual and preferred forms (Table 2). The 35-item MSCI (7 scales, 35 items) was compared with the 27-item MSCI (7 scales, 27 items) in terms of internal consistency, discriminant validity and ability to differentiate between classes. As seen in Table 2, reliability of some of the scales improved after the problematic items were removed from the respective scales.

The low reliability, the poor factor validity and the low item scale intercorrelation of both Open-Endedness and Rule Clarity surfaced during the validation of the MSCI. Since these 2 scales showed low reliability, they were left out in subsequent analyses as they would affect the credibility of the analysis results if kept. Hence, the modified instrument (22 items) comprising the Competitiveness (4 items), Difficulty (4 items), Cohesiveness (5 items), Integration (4 items) and Material Environment (5 items) scales will be used in the rest of the analyses for this study. A total of 22 items from 5 scales was used. A diagrammatic representation of adaptation and improvement of the MSCI is summarized in Fig 1.

Comparison of actual and preferred science classroom environment perceptions of pupils

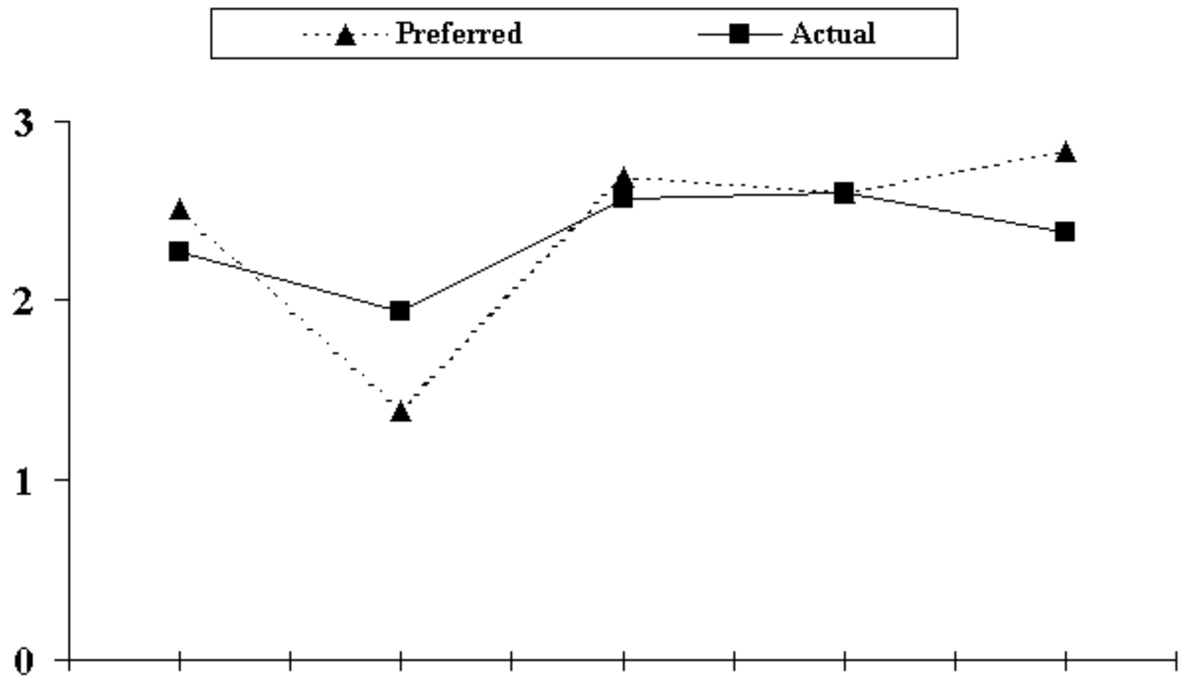
Part of the second objective of the study was to compare pupils' actual and preferred perceptions of their science classroom learning environment. The scale means, standard deviations and item means for the actual and preferred perception scores calculated across the 6 classes for each of the 5 MSCI scales are tabulated in Table 3. A univariate one-way analysis of variance (ANOVA) for repeated measures was examined for each of the five scales individually.

Table 3 Scale Means, Standard Deviations and Item Means for the Actual and Preferred Versions of MSCI

		Scale Mean			Standard Deviation		Item Mean	
Scales	No. of Items	Actual	Preferred	Difference	Actual	Preferred	Actual	Preferred
CM	4	9.11	10.07	0.96**	0.46	0.42	2.28	2.52
DI	4	7.73	5.50	2.23**	0.35	0.39	1.93	1.38
CH	5	12.87	13.44	0.57**	0.39	0.42	2.57	2.69
IN	4	10.31	10.45	0.14	0.37	0.44	2.58	2.61
ME	5	11.93	14.21	2.28**	0.41	0.27	2.39	2.84

*$p<0.05$; **$p<0.01$

To provide a parsimonious picture of the differences between the actual and preferred perceptions of pupils, only the score differences which were significantly different ($p<0.05$) were plotted. Figure 2 is a simplified plot of the results in Table 3. The response alternatives of the MSCI instrument corresponding to the value intervals on the item mean axis in the figure are as follows: 1=Never, 2=Sometimes and 3=Very Often. An examination of Table 3 and Figure 2 showed that pupils preferred more Competitiveness, Cohesiveness and Material Environment but less Difficulty in their science classroom learning environment. Another interesting feature illustrated in Figure 2 was that the two areas in which pupils would like to see the greatest amount of change were Difficulty and Material Environment. Pupils' preference for more competitiveness could be due to their inherent competitive nature. Healthy competition was encouraged in school through science quizzes, science day and science corner competitions. They were rewarded with little tokens for good performance. Pupils were hence accustomed and positive to competitive activities. A preference for greater cohesiveness was not surprising as pupils were often engaged in cooperative learning activities. Pupils probably saw cooperation as essential for good working relationships.



They wished to see a lower level of difficulty in science. As pupils' performance in science had implications in pupils' ranking in class and level, as well as placement in secondary schools, it was not surprising that pupils wanted science to be a lot less difficult so that they could obtain better grades in the subject. Pupils also indicated that they wanted a much better Material Environment. As learning of science was often enhanced through hands-on experiments and experience, a conducive and well-equipped environment was likely to have influence in the learning of science. The strong positive correlation found, between pupils' perception of the material environment with attitude also reiterated the importance of the material environment in the learning of science.

Comparison of science classroom environment perceptions of boys and girls

The scale means, standard deviations and item means for the actual and preferred perception scores for boys and girls calculated across the 6 classes for each of the 5 MSCI scales are tabulated in Table 4. The perceptions of the science class and laboratory environment of boys and girls were also compared using a univariate one-way analysis of variance (ANOVA). The pupils' perception scores (actual and preferred) were the dependent variable while the independent variable was sex. Figures 3, 4 and 5 show simplified plots of the results in Table 4. The score differences which were significantly different ($p<0.05$) were plotted to provide parsimonious pictures of the differences between the sexes. The response alternatives of the MSCI instrument corresponding to the value intervals on the item mean axis in the figure are as follows: 1 = 'Never', 2 = 'Sometimes', 3 = 'Very Often'.

Table 4 Scale Means, Standard Deviations and Item Means for the Actual and Preferred Versions of MSCI for Boys and Girls

Scale Mean Standard Deviation Item Mean

Scales No of Items Form Boy Girl Difference Boy Girl Boy Girl

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CM 4 Actual 8.33 9.33 -0.45 1.78 1.84 2.08 2.33

Preferred 0.07 10.06 0.01 1.65 1.74 2.52 2.52

Difference 1.74** 0.73**

DI 4 Actual 7.68 7.77 -0.09 1.39 1.39 1.92 1.94

Preferred 5.67 5.35 0.32 1.58 1.57 1.42 1.34

Difference -2.01** -2.42**

CH 5 Actual 12.64 13.06 -0.42 2.09 1.82 2.53 2.61

Preferred 13.09 13.78 -0.69* 2.27 1.83 2.62 2.76

Difference 0.45 0.72**

IN 4 Actual 10.09 10.56 -0.47* 1.42 1.48 2.52 2.64

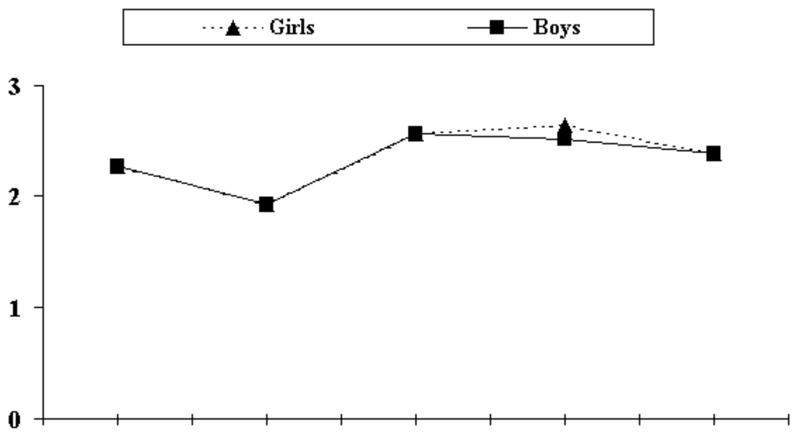
Preferred 10.18 10.71 -0.53* 1.89 1.60 2.55 2.68

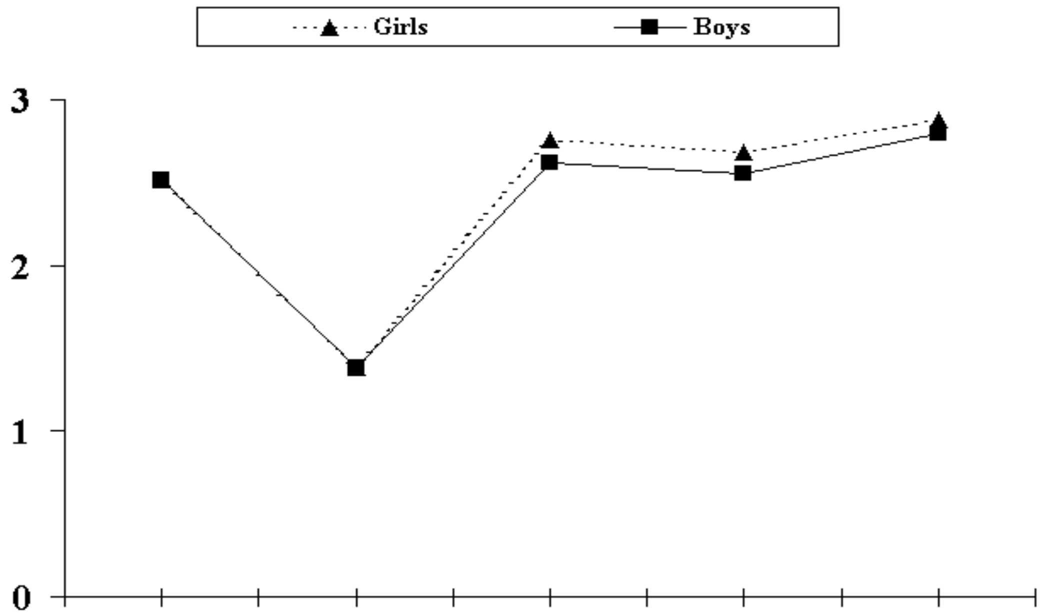
Difference 0.09 0.15

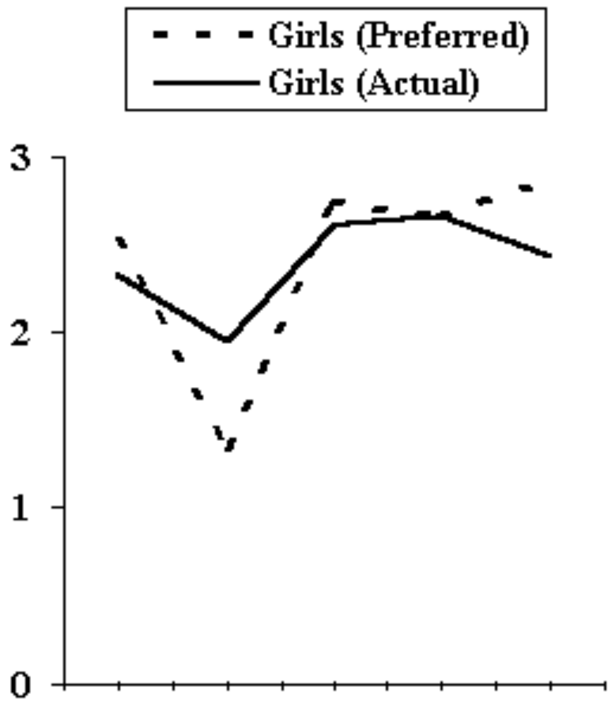
ME 5 Actual 11.67 12.20 -0.53 1.97 2.13 2.33 2.44

Preferred 13.98 14.42 -0.44* 1.66 1.00 2.80 2.88

Difference 2.31** 2.22**







An examination of Figure 3 and Table 4 showed that boys and girls differed significantly ($p<0.05$) in actual perceptions for one out of the five MSCI scales, namely, Integration. Both boys and girls agreed that Integration was practised. However, girls perceived their classes to have greater integration between theory and practical work than the boys did. For the remaining 4 scales, Competitiveness, Difficulty, Cohesiveness and Material Environment, there was no significant difference between the perceptions of boys and girls. Figure 4 and

Table 4 showed that the differences in preferred perception scores between boys and girls differed significantly ($p<0.05$) for three out of five MSCI scales, namely Cohesiveness, Integration and Material Environment. On comparing the actual and preferred perceptions of the science classroom learning environment for boys and girls separately in Figure 5 and Table 4, it was found that preferred perceptions were either more positive or similar to the actual perceptions, except for the Difficulty scale. With regards to the preferred perceptions, girls would prefer an environment with greater levels of Competitiveness, Cohesiveness and Material Environment but lower levels of Difficulty. Boys were also quite similar in their preferences. They would also like an environment with more Competitiveness and Material Environment but less Difficulty.

A general comparison of mean scores obtained by males and females on the preferred scale of the MSCI showed that females scored significantly higher. This suggested that the females generally had higher expectations of their science classroom learning environment than their male counterparts. This finding was in line with that reported in previous research on gender differences in classroom environment perceptions (Lawrence, 1987; Wong & Fraser, 1995).

Relationship between pupils' environment perceptions, attitudes and achievement

Simple correlations were performed to find out if there were significant associations or strong correlates between each environment scale with Attitude and Achievement. Multiple regression analysis was also conducted to identify possible predictors of attitude and achievement. The results from both simple correlation and multiple regression analyses were compared.

Simple correlations between each environment scale with Attitude and Achievement were analyzed. The simple correlation values, *r*, are reported in Table 5.

Results showed that four environment dimensions (Difficulty, Cohesiveness, Integration, Material Environment) had significant associations ($p<0.05$) with the Attitude and Achievement scores. There was no significant association with the Competitiveness scale. Attitude also correlated significantly with Achievement ($p<0.05$).

All the significant associations showed positive relationships between nature of the science classroom environment and attitude and achievement except for the Difficulty scale. In particular, Difficulty, Integration and Material Environment were strong correlates of both attitude and achievement. Attitude also correlated positively with achievement ($p<0.05$). Hence, teachers should not neglect pupils' attitude while pursuing academic excellence. They should make conscious efforts in planning and improving science lessons in order to improve pupils' attitude to science.

The negative correlation between the Difficulty scale of the science classroom environment, attitude and achievement was understandable. Pupils probably felt threatened by difficult questions in science and this might cause them to develop less favourable attitudes towards science. This was highly likely as Singapore has a highly examination-oriented school system and pupils probably see difficult questions as a threat to securing good passes or higher grades.

The strong positive correlations found between both pupils' perception of Integration and the Material Environment, with Attitude and Achievement reiterated the importance of the appropriate integration of laboratory activities with theory and the availability of adequate equipment and resources in helping pupils in the learning of science. Science laboratory classes that integrate knowledge learnt from science lessons and provide conducive material environment may ultimately have a positive impact on how pupils learn, pupils' attitude towards science and their achievement in science.

Multiple regression analysis was performed separately for attitude and achievement with respect to the whole set of five environment scales (Competitiveness, Difficulty, Cohesiveness, Integration and Material Environment). The multiple correlation (*R*) found between Attitude and the set of environment scales was 0.60. The *R* between achievement and the set of environment scales was 0.50.

In order to determine which individual MSCI scales contributed most to explaining the variance in the Attitude and Achievement outcomes, the standardized regression coefficient (b) was also studied (Table 5). The number of significant regression weights for the multiple regression is 3 for both Attitude and Achievement. From the signs of the significant bweights in Table 5, it could be seen that the regression weight is positive in most cases, with the exception of the Difficulty scale's negative association with Attitude and Achievement.

Difficulty and Integration were the strongest predictors of Attitude and Achievement. Findings indicated that pupils' achievements in their continual or semestral assessments probably had a profound impact on their attitude towards science and their perceptions of how difficult science was. Pupils with low achievement scores probably indicated that science was difficult. The multiple regression analysis findings also confirmed that science laboratory classes, which integrated knowledge learnt from science lessons, had a positive effect on the pupils' science-related attitudes and achievement.

These multiple regression analysis findings are consistent with those obtained in the simple correlational analysis, except for the Competitiveness, Cohesiveness and Material Environment scales. The Competitiveness scale did not correlate significantly with Achievement while the Material Environment scale was not a significant contributor to the Achievement outcome. Cohesiveness correlated significantly with Attitude and Achievement in the simple correlation analysis but did not contribute significantly to Attitude and Achievement outcomes in the multiple regression analysis.

CONCLUSION

The primary objective of the present study was to find out pupils' perceptions of their science learning environment. 5 out of the 7 scales in the MSCI displayed adequate internal consistency reliability, discriminant validity, factorial validity and could differentiate significantly between the perceptions of primary pupils in different classrooms. However, as only pupils from one level in one coeducational government school were used in this study, findings cannot be generalized to all Primary 5 classes or other grade levels in Singapore.

Another major objective of this study was to compare pupils' actual and preferred perceptions of their science classroom learning environment, as well as boys' and girls' perceptions of that same learning environment. An analysis of the item means showed that preferred perceptions of pupils were more favourable than their actual perceptions for some scales except for the Difficulty scale. These findings were consistent with those previously reported for other classroom environment instruments, which included the Difficulty scale (Moos, 1979; Fraser, 1982). The differences between actual and preferred perceptions of pupils signal a need to look into the possible areas where science learning can be improved. Chang (1974) and Lam-Kan (1985) studied the values of enrichment activities such as science projects for improving science achievement and developing science interest. Findings from both studies showed that interest in science was strongly related to science achievement. Such activities may lower pupils' perception of difficulty in science and promote more favourable attitudes towards it and better achievement in it. In view of the Education Ministry's recent move to include 20-25 hours of project work for Primary 3 to Primary 6 pupils from year 2001, teachers in Singapore will be playing a more significant role in guiding pupils through the process of learning. Hopefully, the new initiative will foster greater interest, better attitude and achievement in science.

When the perception scores of boys and girls were compared, girls scored either similarly or significantly higher. This finding concurs with previous research, which has also shown girls in having more positive perceptions of their classroom environments (Lawrenz, 1987; Wong & Fraser, 1995). Teachers may like to take note of the perception differences among the sexes so as to maximize learning of each individual in class.

The other objective of this study was to investigate the relationships between pupils' attitudes towards science, achievement in science and their perceptions of their science classroom learning environment. The significant environment-attitude association for the Integration scale concurred with past research (Wong & Fraser, 1996). Data analyses in the present and past studies have revealed relationships between the science classroom learning environment and the attitudinal and achievement outcomes of pupils. However, it cannot be concluded in absolute terms that the nature of the environment caused the observed student attitudinal or student achievement outcomes. In order for such a conclusion to be reached, classroom intervention studies would have to be conducted. Such studies will add meaning to the currently reported associations.

Two previously validated scales, Open-Endedness and Rule Clarity, were found to have low reliability and item scale intercorrelation in the present study. Other researchers, who are keen on using the Open-Endedness and Rule Clarity scales in MSCI, are encouraged to do so because the targeted populations in future studies may have different experiences and are able to perceive these environment scales with better accuracy. They may want to reword the items to suit different countries and contexts. However, many past studies have reported low level of Open-Endedness (Fraser, 1986; Fraser, Giddings & McRobbie, 1992; Waldrip & Giddings, 1993). This study, together with past studies, seems to suggest that pupils may still be exposed to limited open-ended practical activities in the science laboratory classroom. In fact, some researchers argue that in spite of the supposed inroads by constructivists into teaching pedagogy and teacher training, constructivism has made very little difference in the teaching practices of science teachers (Waldrip & Wong, 1995). It may thus be worthwhile to look into the perceptions of teachers in the area of Open-Endedness. Perhaps, schools in Singapore can look into exposing teachers to and training them in the use of easy hand scoring learning environment instruments. Teachers can then be more involved in using such assessments to guide improvements in science learning environments. Fraser (1993) reported some case studies of how classroom and school environment has been used within preservice and inservice teacher education to sensitize teachers to important aspects of classroom life.

In addition, the MSCI variables could provide a valuable source of criteria in science curriculum evaluation studies. With an intended new science syllabus and textbooks in 2001, the MSCI may prove to be a useful tool in assessing and improving science learning environment in my school and in Singapore.

Researchers and teachers might also want to use qualitative methods to complement and substantiate findings from the use of quantitative methods like those in the present study of science class and laboratory environment. Fraser and Tobin (1991) reported three case studies of investigations which involved the use of qualitative ethnographic methods in conjunction with quantitative information obtained from the administration of classroom environment questionnaires.

One important contribution of the present study was that the MSCI was adapted and reviewed in the Singapore context to assess both the primary science class and the science laboratory. It is hoped that the findings, the first in Singapore to focus on the learning environment of the primary science, will prove useful to teachers and science educators.

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Author's email: Chinty@moe.edu.sg

Table 2 Comparing Internal Consistency Reliability (Cronbach Alpha Coefficient), Discriminant Validity (Mean Correlation with Other Scales) and Ability to Differentiate Between Classrooms For Actual and Preferred Forms of the 35-item & 27-item versions of the MSCI

Unit **Alpha Reliability Mean Correlation ANOVA (eta^2)**

Scale of No. of No. of No. of No. of No. of No. of

Analysis Items Actual Preferred Items Actual Preferred Items Actual Preferred Items Actual Preferred Items Actual Items Actual

(35) (27) (35) (27) (35) (27)

CM Individual 5 0.60 0.56 4 0.63 0.56 5 0.08 0.11 4 0.09 0.11 5 0.05 4 0.05

DI Individual 5 0.47 0.56 4 0.65 0.67 5 0.16 0.16 4 0.20 0.18 5 0.08** 4 0.08**

CH Individual 5 0.71 0.78 5 0.71 0.78 5 0.19 0.20 5 0.20 0.18 5 0.07* 5 0.07*

OE Individual 5 0.34 0.67 2 0.36 0.57 5 0.05 0.08 2 0.13 0.08 5 0.18* 2 0.16**

IN Individual 5 0.57 0.65 4 0.58 0.65 5 0.19 0.20 4 0.19 0.21 5 0.26** 4 0.32**

RC Individual 5 0.49 0.70 3 0.44 0.57 5 0.22 0.19 3 0.21 0.18 5 0.14** 3 0.16**

ME Individual 5 0.63 0.63 5 0.63 0.63 5 0.25 0.20 5 0.24 0.19 5 0.08** 5 0.08**

Table 5 Simple Correlations (*r*), Multiple Correlations (*R*), Standardized Regression Coefficients (b) between MSCI, Attitude and Achievement

Outcomes Unit Outcome-environment associations

Of CM DI CH IN ME

Analysis *r* b *r* b *r* b *r* b *r* b *R*

Attitude Individual -0.10 -0.03 -0.49** -0.38** 0.23** 0.04 0.32** 0.14* 0.43** 0.28** 0.6

Achievement Individual 0.13 0.15* -0.31** -0.22** 0.16* 0.03 0.42** 0.34** 0.18** 0.04 0.5

Attitude- 0.15*

Achievement

(*r*)

*$p<0.05$; **$p<0.01$