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Is My Project Work Classroom Environment Conducive for Student Collaboration?

Quek Choon Lang & Angela Wong Foong Lin

Abstract

In the primary school classrooms, students spend almost three terms (20–25 hours) doing project work in groups of 4–5. In order for any learning task to be conducted effectively, the students need to know how to work collaboratively in their groups, and teachers need to find out how their students perceive one another while working in their groups. This will in turn help teachers help their students build the interdependence and team spirit needed to develop the correct attitude towards project work. The objectives of this study are to assist teachers to better understand how their students collaborate with one another in their groups, and to suggest strategies to enhance students' collaboration in the classroom. Using one of the standard learning environment instruments, the My Class Inventory (MCI), this study assesses students' perceptions of their actual and preferred learning environments. This paper reports the results and gives suggestions on how the results can be used to assist in developing appropriate strategies to enhance collaboration in project work classrooms.

Introduction

Over the last five years, several new initiatives have been implemented in the Singapore education system. These include National Education, Information Technology (IT), Thinking Programme (TP) and Project Work (PW). These initiatives aim to prepare our students for the challenges of the 21st century and to achieve our vision of Thinking Schools Learning Nation. In particular, the PW initiative aims to provide students with opportunities to explore the inter-relationships and inter-connectedness of subject-specific knowledge (Jacobs, 1989). By introducing PW into the curriculum, students will be better equipped with creative and critical thinking skills, have their communication skills (both oral and written) improved, their collaborative learning skills fostered, and their self-directed inquiry and life-long learning skills developed (Ministry of Education, 1999). While PW had been implemented in the school curriculum in the last three years, we maintain that it is timely to evaluate the teaching and learning of PW in schools. With teachers as facilitators, students work collaboratively in groups of 4–5 over a period of about 25 hours of curriculum time to complete the interdisciplinary

project. Since students spend much of their curriculum time in completing their group project, it is therefore important to examine and evaluate how students and teachers perceive the project work classroom learning environment. Results from such evaluations will shed light as to whether the present classroom learning environment is conducive for encouraging the collaboration which is so vital to promoting Project Work (PW).

Theoretical Background

The field of learning environments has undergone remarkable development and growth in the last 30 years. Past research (Fraser, 1986, 1994; 1998a,b; Fraser & Walberg, 1991) show that learning environments have been used as a source of dependent and independent variables in a rich variety of research applications, spanning many countries. Qualitative and quantitative research methods have been used in the assessment of learning environments and in research applications (Tobin & Fraser, 1998). The field of learning environment research has made available a variety of economical, valid and widely-applicable questionnaires and instruments for assessing students' perceptions of their classroom. The major questionnaires for assessing these student perceptions are: the *Learning Environment Inventory* (LEI), *Classroom Environment Scale* (CES), *College and University Classroom Environment Inventory* (CUCEI), *Questionnaire on Teacher Interaction* (QTI), *Science Laboratory Environment Inventory* (SLEI), *Constructivist Learning Environment Survey* (CLES) and *What Is Happening In This Class* (WIHIC).

Over the years, the original research instruments were gradually refined to suit specific environments. Two types of specialisation are worth noting. First, instruments were made more subject-specific. This allowed researchers to select instruments most suitable for their chosen fields of study. The *Science Laboratory Environment Inventory* (SLEI), for instance, was designed for studying science laboratories at senior high schools and universities (Fraser, Giddings & McRobbie, 1995). Second, many grade-specific instruments were developed. These included the *My Class Inventory* (MCI) for primary education (Fisher & Fraser, 198l; Fraser, Anderson & Walberg, 1982; Fraser & O'Brien, 1985); the *Individualised Classroom Environment Inventory* (ICEQ) (Fraser, 1990) for secondary education (Rentoul & Fraser, 1979); and the *College and University Classroom Environment Inventory* (CUCEI) (Fraser & Treagust, 1986; Fraser, Treagust & Dennis, 1986) for post-secondary classrooms. The MCI is a good example of how earlier instruments were modified to suit special needs. It is actually a simplified version of the LEI, designed for use with younger children (aged 8–12 years) to assess their primary school classroom. The 15 scales in the LEI were cut down to a more manageable five in the MCI. Questions require only a Yes-No answer compared to the four-point response in the LEI (Fraser & O'Brien, 1985).

Research on student and teacher perceptions of the classroom learning environment has provided useful information for teachers, parents and administrators

in the teaching-learning setting. By using the perceptual information provided by students, the schools would then be able to address the gaps, such as knowledge and skills that exist in the learning environment. PW is a new initiative and the processes of teaching and learning in the PW classroom would be of concern to teachers, students and school administrators. In this study, the *My Classroom Inventory* (MCI) was chosen to assess how students perceived the PW classroom learning environment as they worked collaboratively in small groups.

Objectives

(i) To assess the PW classroom learning environment of a primary school using a modified version of the classroom environment questionnaire, *My Classroom Inventory* (MCI),

(ii) To identify differences in perceptions of the PW classroom environment between

  (a) the actual and preferred forms of MCI,
  (b) the teacher and students, and

(iii) To suggest strategies to address the teacher-student perceptual differences that exist in the PW classroom.

Methodology

Sample

One class of 39 upper primary students from an all-girl school took part in the study. These were the high ability students who studied either English and Mother Tongue as first languages (called EM1 stream) or English as first language and Mother Tongue as second language (called EM2 stream). These students were briefed about the requirements of an interdisciplinary project task and taught Just-in-Time skills (JITs) during PW lessons. These students worked in groups of 4 and spent about 20–25 hours carrying out the interdisciplinary project task entitled "Asean Countries". In this project, the students were expected to find out a unique aspect of one of the Asean countries e.g. Philipines, Thailand, Malaysia etc. that they would visit. As a collaborative group, they were expected to plan, brainstorm, gather information and produce a written product. At the end of the project, the students presented their project to the class. The teacher and peers posed questions to the groups at the end of each oral presentation. During the 20–25 hours of PW lessons, the teacher taught "Just-in-Time" lessons, and facilitated and evaluated the students' learning. In the study, the form teacher was the supervising and resource teacher during the entire PW implementation in this upper primary class. The form teacher and the 39 students participated in the survey.

Table 1.
Description for each scale of the My Class Inventory (MCI).

Scale Name	Items Per Scale	Description of Scale	Moos' Scheme
Satisfaction (SA)	5	Degree to which students enjoy learning and their class.	Relationship
Friction (FR)	5	Degree to which students do not get along and are unfriendly to one another.	Relationship
Competitiveness (CM)	5	Degree to which the students compete with classmates.	Personal Development
Difficulty (DI)	5	Degree to which students experience difficulty in their learning tasks.	Personal Development
Cohesiveness (CH)	5	Degree to which students feel a sense of belonging.	Relationship

Instrument

The original version of the MCI contained 9 items per scale. Due to the low reliability of several of the original MCI scales, the item analysis technique was applied to improve scale reliability (Fraser, 1977). With further refinement, a new *38-item version* of the MCI evolved to contained 5 of the LEI's original 15 scales. It comprises *6 items in the Cohesiveness scale, 8 items each in the Friction* and Difficulty scales, 9 items in the Satisfaction scale and 7 items in the Competitiveness scale (Fraser, Anderson & Walberg, 1982).

With young children in mind, the MCI offers several advantages in terms of simple language and direct response to the questionnaire. The MCI was further modified to include a two-point (YES-NO) response format instead of the original four-point response format. Subsequently, a short version of the 25-item MCI with 5 scales was developed with the intention of minimizing cost and technology accessibility (Fisher & Fraser, 1981).

The short 25-item *My Class Inventory* (MCI) (Fisher & Fraser, 1981; Fraser, Anderson & Walberg, 1982) was used in this study. Table 1 shows a brief description of the scales and Moos' scheme (Moos, 1974a,b) of five scales. The MCI was simplified from the 105-item *Learning Environment Inventory* (LEI) which was developed and validated in conjunction with evaluation and research related to the Harvard Projects Physics in the 1960s (Fraser, Anderson & Walberg, 1982).

Recently, Goh, Young and Fraser (1995) successfully used a three-point response format (Seldom, Sometimes and Most of the time) with a modified version of the MCI which included a Task Orientation scale. In the same study conducted by Goh and Fraser (1996), it was reported that achievement was related

Table 2.
Description for each scale of the modified My Class Inventory (MCI)

Scale Name	Items Per Scale	Item Number	Sample Item
Satisfaction (SA)	5	1,6,11,16,21	The students enjoy their project work in my class.
Friction (FR)	5	2,7,12,17,22	Certain students always want to have their own way.
Competitiveness (CM)	5	3,8,13,18,23	Students often race to see who can finish first.
Difficulty (DI)	5	4,9,14,19,24	In my class the project work is hard to do.
Cohesiveness (CH)	5	5,10,15,20,25	In my class everybody is my friend.

$^{*}p < 0.05$ $^{**}p < 0.01$ $N = 39$

to the climate dimensions (MCI) and student attitudes for primary school mathematics. In terms of gender differences, boys achieved better results than girls. On the other hand, the girls generally viewed their classroom environment more favourably than the boys did.

The distinctive features of the 25-item MCI included:

(i) five scales,
(ii) simple language,
(iii) two-point response scale,
(iv) direct answer on the question paper, and
(v) completion within 10–15 mins.

These features have warranted the MCI to be chosen for use in this study. A total of 25 items are arranged in cyclic order and in blocks of five to enable easy calculation. In each block the first item assesses Satisfaction (SA); the second item assesses Friction (FR); the third item assesses Competitiveness (CM); the fourth item assesses Difficulty (DI); and the last item assesses Cohesiveness (CH).

The 25-item short form MCI (Table 2) was modified and adapted for use in the project-based classroom learning environment. By examining the Satisfaction and Difficulty scales, only minor modifications were made by changing words such as "schoolwork" to "project work". The word "project" was used in most of the items except in scales such as Friction. The modified MCI (Table 2) was used to gauge the students' and teachers' perceptions of the existing project-based classroom learning environment.

The scoring procedure was straight forward for 20 items of the MCI in that a "3" was given for the "Yes" response and a "1" was given for the "No" response. However, the reverse scoring procedure was used for the remaining five reverse items in that a "1" was given for the "Yes" response and a "3" was given for the "No" response. Missing items or vague responses scored a "2".

Procedures

Two sets of questionnaire (actual and preferred versions) were administered to 39 students and one teacher. They took about one period (30 mins) to complete the questionnaire. Instructions were read to all students and the teacher before they responded to the items in the questionnaire.

Data Analysis

Using Microsoft Excel and SPSS, internal consistency reliability, item means and paired t-test were calculated.

Findings and Discussion

Internal Consistency Reliability (Cronbach Alpha Coefficient)

A summary of the internal consistency reliability for the MCI (actual and preferred versions) is presented in Table 3. The Cronbach alpha coefficient for each MCI scale was calculated as a measure of internal consistency reliability. The individual was used as the unit of analysis.

In Table 3, the alpha reliability ranged from 0.25 to 0.82 for the actual version of MCI and 0.47 to 0.92 for the preferred version of MCI. Except for the Difficulty scale, all the others reported appropriate alpha reliability values. Table 3 showed 3 out the 5 MCI scales had cronbach alpha coefficient above 0.7. These 3 scales (Satisfaction, Competitiveness and Cohesiveness) had rather comparable values to the actual version of MCI conducted in the previous studies (Fraser & O'Brien, 1985; Fraser, Malone & Neale, 1989).

The alpha reliability for the difficulty scale was extremely low in the actual version of MCI. This could be due to the students' difficulty in understanding Item 9. From an examination of the student answers, it was observed that there was a mix of responses for Item 9 of the Difficulty scale within groups. This item read:

"Most of my group members can do their part of the project without help".

This was the first collaborative and interdisciplinary project that the students did. Unlike other subject specific projects, this project required students to apply

Table 3.
Internal consistency reliability (Cronbach Alpha Coefficient).

MCI Scale	No. of Items	Form	Alpha Reliability
Satisfaction (SA)	5	Actual	0.77
		Preferred	0.87
Friction (FR)	5	Actual	0.67
		Preferred	0.71
Competitiveness (CM)	5	Actual	0.72
		Preferred	0.79
Difficulty (DI)	5	Actual	0.25
		Preferred	0.47
Cohesiveness (CH)	5	Actual	0.82
		Preferred	0.92

knowledge from 2–3 subjects, and creative and critical thinking skills in searching, processing and presenting information. The scope of the project could be perceived as broad and some students asked for help in sourcing for information as well as in processing of the information gathered. On the other hand, there were some groups of students who did not need to ask for any assistance outside of the curriculum time for the project work. As part of the learning, the project also required students to work in groups of four, thus some students could have experienced some uncertainty in working with one another. Hence, the collated responses within a group showed that students were unsure of how to answer this item, resulting in contradictions within the group responses.

Comparison of Students' Actual and Preferred Perceptions on the MCI

In Table 4, the paired t-test (2-tailed) calculated for the results from the students' actual and preferred forms of the MCI showed four significant differences in four out of five scales. These four significant differences were found for the Satisfaction, Friction and Competitiveness ($p < 0.05$) and Cohesiveness ($p < 0.01$) dimensions.

Figure 1 shows the graph of significant differences between students' actual and preferred perception scores on the MCI. Both the actual and preferred versions of MCI showed similar trends. The students perceived high mean scores in Satisfaction, Competitiveness and Cohesiveness scales but low scores in Friction and Difficulty scales in their existing PW classroom learning environment. The students also preferred a lower degree of Friction and Competitiveness than what they presently experienced in their actual PW learning classroom environment. As was mentioned

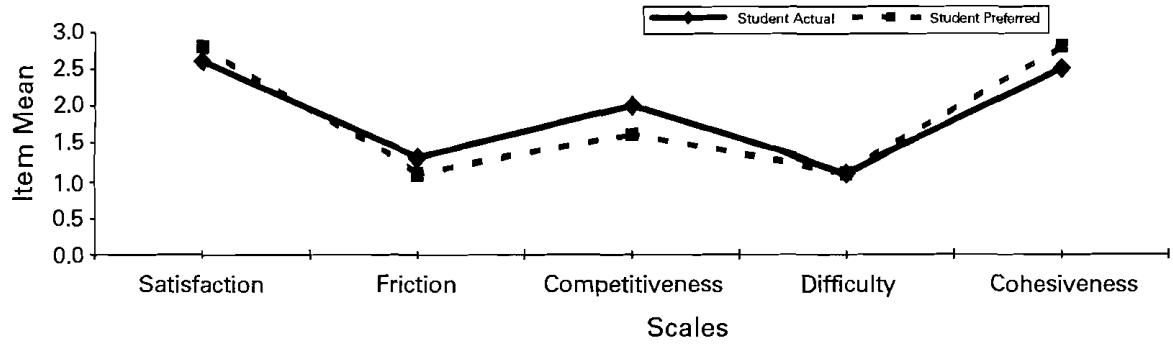

Fig. 1. Simplified plot of significant differences between students' actual and preferred perception scores on the MCI.

Table 4.
Item mean for students and the teacher for the actual and preferred forms of the MCI.

MCI Scale	No. of Items	Form	Mean	
			Student	Teacher
Satisfaction (SA)	5	Actual	2.6*	2.2
		Preferred	2.8*	3.0
Friction (FR)	5	Actual	1.3*	1.4
		Preferred	1.1*	1.0
Competitiveness (CM)	5	Actual	2.0*	2.2
		Preferred	1.6*	1.8
Difficulty (DI)	5	Actual	1.1	1.0
		Preferred	1.0	1.0
Cohesiveness (CH)	5	Actual	2.5**	2.2
		Preferred	2.8**	3.0

*$p < 0.05$ **$p < 0.01$ $N = 39$

earlier, these are high ability students. As such they could have already experienced a high degree of competitiveness and friction in their normal classroom environment outside of PW. Here, even though in PW, the emphasis was on collaborative learning rather than Competition, these students would still like the level of friction and competitiveness to be reduced, which as a result could render the PW classroom learning environment to be more satisfying and cohesive.

Overall, the mean scores obtained for all the five MCI scales indicated that the PW classroom learning environment was conducive for students to collaborate effectively because it was viewed favourably in terms of high levels of satisfaction and cohesiveness with some competitiveness and low levels of friction and difficulty.

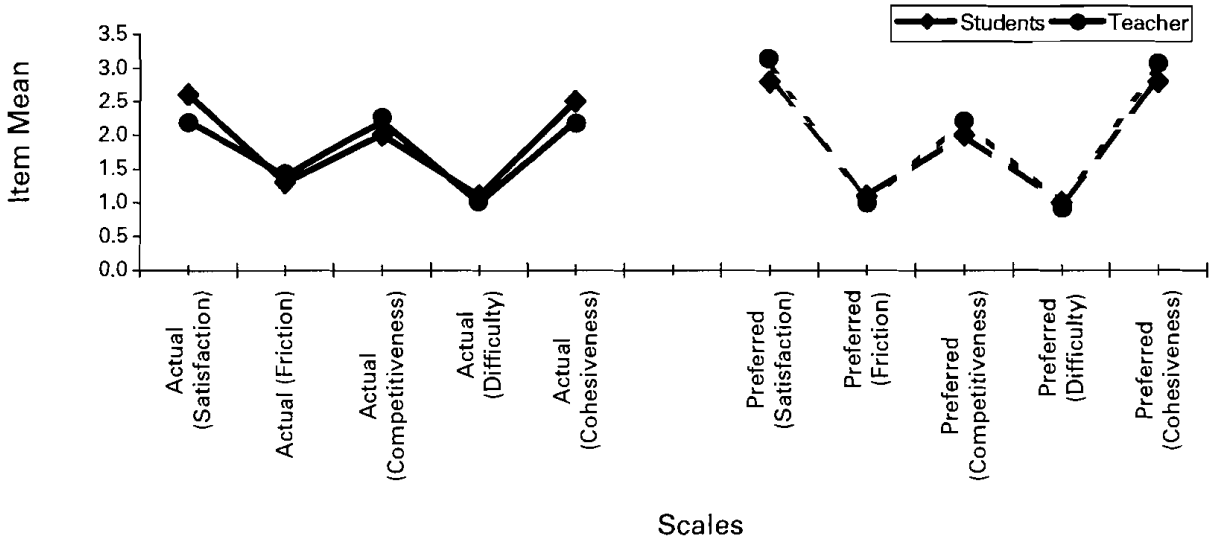

Fig. 2. Simplified plot of students' and teacher's actual and preferred perception scores on the MCI.

Comparison of Students' and Teacher's Actual and Preferred Perceptions on the MCI

In Table 4, the comparison of 39 students' and one teacher's perceptions on the MCI are shown. Generally, the students and the teacher indicated almost similar trends in their actual and preferred perceptions. Also in Fig. 2, the students' and teacher's perceptions on the MCI (Actual) indicated that the teacher perceived a lower degree of cohesiveness and satisfaction than the students. Perhaps, the teacher had set high expectations for this high ability class and therefore would expect more from the students. On the other hand, the teacher perceived this class to be rather competitive during PW lessons. As these students were the better students of a single sex upper primary cohort, it would mean that they are already placed in a highly competitive environment. Hence, the competitiveness in the existing PW classroom could be easily perceived by their teacher.

Interestingly, both students and teachers perceived a similarly low degree of two dimensions: Friction and Difficulty in their PW classroom. This could suggest that these students generally could get along and they worked well in their collaborative groups. The low difficulty score indicated that the students could cope with the project task without difficulty.

For the preferred version of the MCI, the teacher and students seemed to prefer a higher degree of Satisfaction and Cohesiveness in the PW classroom than what was existing. In fact, the teacher wanted more of these than the students did. Both teacher and students preferred a lower level of friction and competitiveness in their PW learning environment as shown in Fig. 2. In terms of the difficulty dimension, both the teacher and students were satisfied with the difficulty level of the project task currently assigned.

Limitations of the Study

This study only focused on one class of 39 high ability pupils from an all-girl school in the southern part of Singapore. Hence, the findings of this study cannot be generalised to cover all primary school students and PW classrooms, because of the small sample size and the type of students used. Differences in school ethos, traditions and environment would need to be taken into account. In addition, due to the limited research conducted in the interdisciplinary project-based classroom in the Singapore context, the review of the literature on interdisciplinary project work was also limited.

Implications and Conclusion

This study set out to investigate the PW classroom learning environment in a single sex primary school. The MCI was found to be a reliable instrument for assessing the PW classroom learning environment. The Cronbach alpha reliability showed that three out the five MCI scales had Cronbach alpha coefficients above 0.7 in the Satisfaction, Competitiveness and Cohesiveness scales of the MCI. It was also found that students had difficulty with one of the items in the Difficulty scale for both the actual and preferred versions of the MCI. Perhaps, rewording would be necessary for the items in the Difficulty item. The clarity and context of the items could be further enhanced in MCI. With these improvements, the MCI would certainly be a more workable instrument for use by both teachers and students in the primary and secondary school Singapore classrooms.

By using the perceptual information provided by the students and teacher, the gaps that exist in the PW classroom learning environment could be addressed. The gaps were indicated by the significant student perceptual differences in Satisfaction, Friction, Competitiveness and Cohesiveness scales. In order to enhance the cohesiveness and satisfaction of the collaborative groups in the PW learning environment, teambuilding activities should be incorporated in the initial stage of PW lessons (Goodrich, Hatch, Wiatrowski & Unger, 1995). This will also help to reduce competitiveness and friction in the existing learning environment. Teachers should hold regular student-teacher conferencing to better understand the learning needs of the students. Time has also to be set aside for students to write their reflection logs. In terms of the difficulty level of the project task, the teachers did select an appropriate project task to meet the learning needs of the students. As one of the learning outcomes of PW is collaboration, the teacher would need to emphasise this aspect in the PW classroom learning environment. As PW is a new initiative, teachers would also need to play a more effective facilitative role in helping the students to pick up skills as they embark on interdisciplinary projects collaboratively (Post, Ellis, Humphreys & Buggey, 1997).

Generally speaking, the MCI could be used by primary school teachers to assess the PW classroom learning environment based on their students' perceptions.

However, such an approach that uses the perceptions of the participants might not be exhaustive enough in providing the teachers with a complete picture of the PW processes and students' engagement in learning. In order to fully understand the collaboration among groups of 4–5 students, teachers' observations and use of checklists should be an on-going process throughout the entire duration of the PW. The qualitative information would certainly complement the quantitative perceptual data obtained from such studies. Through this study we hope that teachers would take the necessary steps in promoting a more collaborative PW classroom learning environment and help the students to enjoy PW lessons. We also hope that the students would realise that collaboration is an important life skill to be learnt while working with their peers and that the learning of this skill goes beyond the classrooms (Goodsell, Maher, Tinto, Smith & MacGregor, 1992).

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