

# STUDENTS' PERCEPTIONS OF MATHEMATICS CLASSROOM ENVIRONMENT AND MATHEMATICS ACHIEVEMENT: A STUDY IN SIPITANG, SABAH, MALAYSIA.

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## ABSTRACT

*Mathematics classroom environment and mathematics achievement are some of the important mathematical constructs in teaching and learning of Mathematics in the classroom. This study compared such constructs between genders of schools students in Sipitang, Sabah. This study also focused on determining the relationship between these two constructs. All the secondary schools with sample sizes of 235 were selected to participate in this study. Two research instruments were used in this study. A 76-item mathematics classroom environment questionnaire based on "What is Happening in This Classroom" (WIHIS) and the Constructivist Learning Environment Survey (CLES) were used to determine the mathematics classroom environment. The students' mathematics achievement was determined using a test comprising of 20 multiple choice questions and 5 subjective questions based on the first five chapters in Mathematics Form 4 syllabus. Data from the study was analyzed with SPSS 17.0 using both descriptive and inferential statistical analyses. Findings showed the students had a moderate perception of their mathematics classroom environment. Mathematics achievement was low, with female students achieving better than males in their mathematics assessment. There was no significant difference in perception of mathematics learning environment based on gender. Significant of weak correlations were found between mathematics classroom learning Environment and mathematics achievement. The research findings bring some meaningful implications to the teaching and learning of mathematics at secondary school as well as the training of mathematics teachers in Malaysia.*

**Field of Research:** *Mathematics Classroom Environment, Mathematics Achievement, Gender*

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## 1.0 Introduction

Mathematics is a core subject in schools all over the world. The study of mathematics was designed to produce competent people with knowledge of mathematics in their everyday life; thus, enhancing effective problem-solving and decision making among individuals. In several education systems all over the world, mathematical basic knowledge acquired in lower levels is vital for a student to progress to upper classes in secondary schools. Since the introduction of eTEMS (English for teaching Mathematics and Science) in 2003, use of ICT-based approaches in the teaching and learning of mathematics was initiated and emphasized by the Malaysian Ministry of Education in order to create a new learning environment for students to learn mathematics. The Education Development Master Plan (PIPP, 2006) indicated that rural and urban school students are equally treated in order to produce quality workforce as envisioned under Vision 2020. Although numerous programs were carried out by the Education Ministry to improve the facilities in the rural schools, rural students' performance in Mathematics of public examination indicated that rural students were not performing as good as urban students (Robiah Sidin, 1994). Cox (2000) stated that the school locale is a significant determinant of students' performance in mathematics with rural students at a disadvantage compared to urban students. There have been a lot of researches carried out to

investigate trends in mathematics achievement and the factors influencing mathematics learning and performance (Ma & Klinger, 2000; Papanastasiou, 2000; Al Khateeb, 2001; Tsao, 2004; Mulis, Martin, Gonzalez & Chrostowski, 2004; House & Telese, 2008). Mathematics achievement and its relationship with students' gender, age, ethnicity, family socio-economic status and school characteristics were explored by Ma and Klinger (2000). In Al Khateeb (2001) study, he examined gender differences in mathematics achievement among high school students.

In this study, two aspects of mathematics teaching and learning namely; mathematics classroom environment, and mathematics achievement were investigated. One demographic element; gender is also investigated in relation to these mathematics attributes. Classroom environment refers to the circumstances of the classroom. The concept of classroom environment has existed since the 1930s (Goh & Fraser, 1998). Research conducted over the past few decades showed that the quality of classroom circumstances in schools is a significant determinant of learning (Fraser, 1994, 1998). Students perform better when they perceive the classroom environment positively. The Lewinian Model implied that classroom environment is related and influenced the students' attitudes while they are in the classroom (Lewin, 1943).

## **2.0 Problem Statement**

Researchers in the field of mathematics education had proposed that there are many factors with significant relationships with mathematics achievement. There are also many educational researches which focused on the relations between learning environment and student motivation and cognition. Such studies showed that students' perception of their abilities to succeed on academic tasks and intrinsic interest in these tasks are positively associated with their academic performance, choice and persistence (Ames & Archer, 1988; Pajares, 1996; Paris & Paris, 2001; Pintrich, Smith, Garcia, McKeachie, 1993; Pintrich & De Groot 1990; Schunk & Pajares, 2001, Wigfield & Eccles, 2000).

However, differences in favor of male students begin to emerge with time (Campbell, 1995; Mullis & Stemler, 2002). Meanwhile, recent studies have challenged this trend indicating a decline in this gap (Barker, 1997; Hyde, Fennema, & Lamon, 1990; Knodel, 1997). Some studies even showed that there is no gender difference in mathematics achievement (Bronholt, Goodnow, & Conney, 1994). In Ma's and Klinger's (2000) study of a sample of high school seniors in four education systems (British Columbia, Ontario, Hong Kong, and Japan) from the Second International Mathematics Study, there was no gender differences in algebra but males were better in geometry compared to females. In another study by Baya'a (1990), there is a significant difference between the achievement in mathematics by males and females at the low socio-economic level, but no significant difference at higher socio-economic levels. Mittelberg and Lev-Ari (1999) showed in their study that girls have a higher perceived achievement and mathematics efficacy than boys.

Thus, the literature tend to show that mathematics classroom environment was directly influenced the mathematics achievement of a students in school. Therefore, this study focused on exploring the mathematics classroom environment and performance of students based on genders in Sipitang district.

## **3.0 The Mathematics Classroom Environment**

There are specific classroom environment such as the Geography Classroom classroom environment such as the Geography Classroom Environment Inventory (Teh & Fraser, 1994) that include the computer-assisted learning environment. The Constructivist Classroom Inventory (Taylor et al.,

1997) to assess the learning environment of a constructivist classroom. Mathematics teaching and learning in Malaysian education system is based on a constructivist and inquiry-discovery approaches (Curriculum Development Centre, 2003). Hence, there is a slight difference of a mathematic classroom learning to that of a general classroom environment as the aspect of constructivism is applied in the classroom teaching and learning. Over the years, there have been a whole range of classroom environment questionnaires for use in different school and classroom contexts. There is also a wealth of literature on the conceptualization, evaluation and investigation of student and teacher perceptions of various aspects of the classroom environment (Fraser, 1998, Fraser & Walberg, 1991). The What is happening in this class (WIHIC) questionnaire (Fraser et al., 1996) was developed to suit any classroom environment context. It was developed with the best features of the existing instruments as well as inclusion of new scales to accommodate contemporary educational concerns (Chua, Wong & Chen, 2009). In addition, the aspect of constructivist learning in the mathematics classroom necessitates the use of another instrument, the Constructivist Learning Environment Survey (CLES) which was developed to provide a credible perspective of teachers' attempts to transform their classroom learning environments in accordance with the critical constructivist epistemology (Taylor et al., 1995). Taylor and Fraser (1991) developed the instrument to enable teachers to monitor the transformation from a more teacher-centered approach to a more constructivist teaching approaches and to address key restraints to the development of constructivist classroom climates in school science and mathematics (Taylor et al., 1997).

### **3.1 Mathematics Achievement**

In Malaysia, the medium of teaching mathematics and science subjects in primary and secondary schools was changed from Malay to English in 2002. The change was made in view of the need to grasp scientific and mathematical understanding and learning in the universal language in preparing school children for their future in this borderless world. Mathematics performance is an important and critical element of students' success in secondary as well as at tertiary level. Halimah Awang and Noor Azina Ismail (2006) highlighted the importance of having a strong foundation in mathematics as a prerequisite for admission into institutions of higher learning in most disciplines. Ismail and Awang (2008) stated that students' achievements in mathematics in high school have a significant effect on their performance in college. In addition, Geary and Hamson (2000) indicated the relationship between mathematical and quantitative competencies with better chances of employability, higher wages and higher on-the-job productivity once employed. Hence, mathematics learning and students' performance in mathematics receive considerable attention from educators, teacher and parents. It becomes highly imperative that we identify and recognize the factors that could influence students' mathematics achievement so that they can be improved and able to make substantial academic progress.

In Malaysia, the growing awareness of the importance of mathematics competency in secondary school for tertiary education and future careers has led to high expectations from teachers and parents for students to perform well in mathematics examinations. Its apparent importance has resulted in mathematics being taught in tuition centres across all levels of schooling outside the school hours as well as appointed personal home tutors (Ismail & Awang, 2008). There is also a growing concern about the issue of disparity in mathematics achievement between different subgroups of the population as well as ways of improving students' overall performance and narrowing students' achievement gaps between rural and urban areas in Malaysia. Many factors contribute to the students' attitude towards mathematics. In addition, there is a strong correlation between a student's performance and his attitude as well as strategies being employed in mathematics study (Swetz, Hassan, Abdul Rashid, 1983).

### **3.2 Association Of Mathematics Classroom Environment And Mathematics Achievement with Gender**

In this study, only one main demographic factor of concern is gender. Trickett, Trickett, Castro and Schaffner (1982) stated that usage of actual learning environment scales vary according to gender.

#### **3.2.1 Gender And Mathematics Classroom Environment**

Students' perceptions of their learning environment are influenced by a great many factors including gender, subject, grade-level, school-type, school-location (city and rural) and ethnic-related differences in classroom learning environments (Fraser, 1998; Huang, 2000, 2001; Huang & Waxman, 1995a, 1995b; Waldrip & Fisher, 2000; Waxman & Huang, 1998; Wong, Young & Fraser, 1997). Huang (2003) stated that in a research study examining 13,000 students from urban elementary, middle and high schools, female students generally scored higher for their perceptions of their learning environment compared to males. The study also found that there were few differences by subject area, but that there were many statistically and educationally significant differences by grade level. Goh and Fraser (1998) found that girls perceived their classroom environments more favourably than boys although mathematics achievement favours the boys. A comparison of perceptions of learning environment between Asian and Anglo-American students with sample size of 1200 students in each group, Huang and Waxman (1995b) found that middle school girls had more favourable perceptions than boys had. Also, across both ethnic groups, girls were more involved and attentive in class, more affiliated with their classmates, and enjoyed their mathematics class more than boys did. Similar results were obtained by Wong and Fraser (1994) in their study with American students.

#### **3.2.2 Gender And Mathematics Achievement**

Halimah Awang and Noor Azina Ismail (2006) stated that achievement in mathematics varies across nations, regions, and a variety of socio-economic and demographic characteristics. Gender is one of the most discussed factors related to mathematics learning. For example, previous studies found that females generally scored lower than males on standardized test of mathematics (Gallagher & Kaufman, 2005; Cleary, 1992), and that there were more males than females scoring in the two extreme ends (Willingham & Cole, 1997; Wang & Maxey, 1995). According to Beller and Gafni (1996) study, mathematics performance was in favour of the boys within the age of 9 and 13 years old. Engelhard (1990) in his study of 13 year old students also obtained similar results as boys were found to perform better with changing level of complexity in mathematics content. However, recent study by Al Khateeb (2001) found that among high school students in the United Arab Emirates, females scored higher mathematics achievement than males.

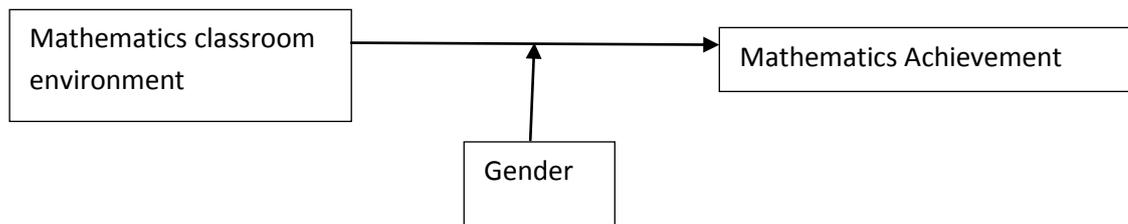
### **3.3 Relationship between Mathematics Classroom Environment and Achievement**

Results of studies conducted in the past three decades provided convincing evidence that the quality of classroom environment in schools is a significant determinant of student learning (Fraser, 1994, 1998). Past researches in Indonesia by Margianti, Fraser and Aldridge (2001), Singapore (Fraser & Chionh, 2000; Goh & Fraser, 1998) and Brunei (Riah & Fraser, 1998) support this general view. These studies suggest that students learn better when they perceive the classroom environment positively. In various studies, students' perceptions of the classroom environment account for appreciable amounts of variance in learning outcome, whereby this is due to factors beyond the student background characteristics. O'Reilly (1975) investigated the relationship between achievement and classroom environment in 48 mathematics classes in Ontario and found that the set of 15 Learning Environment Inventory Scales (Fraser, 1987) accounted for 67% of variance in raw achievement

scores. Fraser (1994) cites two meta analysis researches which link environmental dimensions with achievement. He found that better achievement on a variety of outcome measures consistently in classes perceived as having greater cohesiveness, satisfaction and goal direction and less disorganization and friction. In Tobin and Gallagher's study (1986) based on Grade 8 science students, all class environment scales were correlated significantly with achievement.

### 3.4 The Research Framework

The conceptual framework presented in Figure 2.3 below indicates the interrelationship between the two variables of this research – mathematics classroom environment and mathematics achievement. These two variables are moderated by one variables – gender.



**Figure 3.1:** The Research Conceptual Framework

### 4.0 Research Design

The goals of this research were to examine the level of mathematics classroom environments and performance, compare these two constructs based on gender and determine the relationships between the constructs. Thus, a quantitative descriptive research framework was adopted based on the cross-sectional survey method involving students from sub- urban secondary schools in Sipitang, Sabah.

### 4.1 Population and Sampling Method

Parmjit, Chan, Gurnam (2005), defined population as “all members or the group of interest to the researcher”. Thus, the target population of this research was all Form Four students in the all secondary schools in Sipitang, Sabah. Sample students were selected using simple random sampling. In simple random sampling, all subsets of the frame were given an equal probability. Each element of the frame had an equal probability of selection. This minimizes bias and simplifies analysis of results (Ader et al., 2008). The sample size is based on Krejcie and Morgan (1970) as shown in Table 4.1. Form Four students’ population in the selected schools was obtained from Sipitang Education Department and the number of sample students selected in each school is shown in Table 4.1 below.

**Table 4.1:** Distribution of Form Four Students from Selected Schools

Schools	Population Size *	Sample Size
School A	164	118
School B	165	117
School C	178	122
School D	102	88
<b>OVERALL</b>	<b>709</b>	<b>445</b>

Source: Data obtained from Sipitang Education Department

## 4.2 Research Instruments

This study used two types of questionnaires to determine mathematics classroom environment and mathematics efficacy, and an assessment test to determine the students' mathematics performance in selected chapters of Form Four Mathematics syllabus.

### 4.2.1 Mathematics Classroom Environment Questionnaire

A mathematics classroom environment questionnaire was constructed based on two existing instruments: What is Happening in This Classroom (WIHIC) (Chionh & Fraser, 1998; Fraser et al., 1996) and the Constructivist Environment Survey (CLES) (Taylor et al., 1995). Since its initial development, the WIHIC has been used successfully in studies to assess the learning environment in Singapore (Fraser & Chionh, 2000), Australia and Taiwan (Aldridge & Fraser, 2000), Brunei (Khine & Fisher, 2001), Canada (Zandvliet & Fraser, 2003), Australia (Dorman, 2001), Indonesia (Adolphe, Fraser, & Aldridge, 2003), Korea (Kim, Fisher, & Fraser, 2000), and Canada, England, and Australia (Dorman, 2003).

The Constructivist Learning Environment Survey (CLES) (Taylor et al., 1995) was developed based on constructivist learning principles to investigate students' perceptions of their learning environments from constructivist views and to assist teachers to reshape their teaching practice. Initially, Taylor (1991) constructed this instrument based on social and personal notions of constructivism whose main concerns are to enhance students' conceptual understanding. Through an extensive and rigorous process, this version was found to be valid and reliable for use within classroom situations (Puacharearn & Fisher, 2004).

Combination of these two instruments resulted in a 76-item questionnaire based on ten dimensions of mathematics classroom environment. The Constructivist Learning Environment Survey (CLES) (Taylor et al., 1995) will be answers students perception based students negotiation and investigation dimension. In this research, alternation of positively and negatively worded questions was employed to combat response sets in respondents. The ratings on negatively worded items are reversed so that a total positively-orientated score is obtained. Sample of the questionnaire is appended in Appendix 1. Tabulation of the 76 items in the categories and ten dimensions are shown in Table 4.2 below.

**Table 4.2:** Tabulation of the 76 Items in the Mathematics Classroom Environment Questionnaire based on the Ten Dimensions

Categories	Items	No.of Item
1. Student Cohesiveness	3*, 25*, 52*, 65, 67, 69	6
2. Cooperation	27, 40, 45, 58*, 64	5
3. Equity	6, 13*, 17*, 23*, 30*, 35*, 43, 55*	8
4. Investigation	11, 24, 31*, 33, 34*, 54*	6
5. Involvement	2*, 4, 15*, 19, 39, 51*, 63, 75*, 76*	9
6. Task Orientation	9, 10*, 14, 20, 21, 44, 46, 53, 61, 68*, 71*, 72, 74	13
7. Teacher Support	5, 7*, 12*, 16, 18, 29*, 32*, 42*, 49, 50, 56, 60	12
8. Personal Relevance	8, 36*, 41*, 47*, 59*, 70*	6
9. Shared Control	1, 22*, 28*, 37, 48*, 62*, 66*	7
10. Student Negotiation	26, 38*, 57*, 73	4
	<b>Total</b>	<b>76</b>

\* Negative statement items

### 4.2.2 Mathematics Achievement

To assess the students' mathematics achievement, a test was constructed based on Mathematics Paper format, consisting of 20 multiple choice questions 5 subjective questions from five chapters in Form 4 mathematics syllabus. The selected chapters are: Standard Form, Quadratic Expressions and Equations, Sets, Mathematical Reasoning and The Straight Lines. The students were given 45 minutes to complete the test.

### 4.3 Pilot Research

A pilot research was carried out to determine the validity and reliability of the questionnaires and the assessment paper. A total of 30 Form Four students from a selected school in Sipitang, Sabah were involved in this pilot test. Table 4.3 presents the result of the reliability analysis of the research instrument. The Alpha Cronbach values ranged from .720 to .738, indicating an acceptable value. According to Nunnally and Bernstein (1994), a value of 0.70 and above shows an acceptable reliability coefficient; smaller reliability coefficients are seen as inadequate.

**Table 4.3** Reliability Test of the Research Instrument (Questionnaire)

Instrument	No. of Item	Alpha Cronbach Value	Reliability Level
Mathematics Classroom Environment	76	.738	Acceptable
Mathematics Achievement	25	.720	Acceptable

### 4.4 Data Analysis Procedures

Data from the research instruments were analyzed using SPSS Version 17.0. Descriptive statistics was used to determine the frequency, percentage, mean and standard deviation values of data from the three research instruments. Table 4.4 shows the categorization of mean values into three levels of students' perception: high, moderate and low, based on past researches practices (Azizi, 2007). This categorization will be answers of the students perception of mathematics classroom environment.

**Table 4.4:** Categorization of Mean Values

Mean Score	Level of Students' Perception
1.0 – 2.0	Low
2.1 – 3.0	Moderate
3.1 – 4.0	High

Mathematics achievement was based on percentage and categorized into grades: A, B, C, D and E. The ranges of percentage for each of the grades are shown in Table 4.5 below.

**Table 4.5:** Grading of Mathematics Achievement Based on Percentage

Grade	Range of Percentage
A (Excellent)	75 – 100%
B (Satisfactory)	65 – 74%
C (Good)	55 – 64%
D (Moderate)	40 -54%
E (Fail/Poor)	0 – 39%

In order to determine the correlation between two variables, Guilford Rule of Thumb (1956) in Chua Yan Piaw (2006) was used.

Inferential statistics were used to test the hypotheses, at 95 per cent confidence level ( $\alpha = 0.05$ ). The two inferential statistics used were: Independent sample t-test and Pearson Moment Correlation. Normality tests were also done to justify the use of these parametric tests (Independent sample t-test and Pearson Moment Correlation).

### 5.0 Reliability and Validation of the Survey Instruments

Data were analyzed to test the internal consistency of the two scales used in this study. Table 5.1 presents the result of the analysis. Results indicate a very satisfactory reliability level for the two questionnaires used to determine mathematics classroom learning environment (MCLE) and mathematics achievement.

**Table 5.1:** Cronbach Alpha Reliability of the Research Instruments

Scales	No. of Item	Alpha Cronbach Value	Reliability Level
Mathematics Classroom Environment	76	.753	Good
Mathematics Achievement	25	.742	Good

The result indicated that the Mathematics Classroom Environment instrument has a high internal reliability, ( $\alpha = .753$ ). Whereas Mathematics achievement instruments have an Alpha Cronbach value of .742. A value of 0.7 and above is good (Nunnally & Bernstein, 1994).

### 5.1 Students' Perception of the Mathematics Classroom Environment

Students' perception of the Mathematics Classroom Environment was determined based on the ten subscales. Table 5.2 presents the result of the analysis as follows:

**Table 5.2:** Students' Perception of their Mathematics Classroom Environment

Subscales	Low	Moderate	High	Mean	Standard Deviation	Level
Student Cohesiveness	17 (3.8%)	392 (88.1%)	36 (8.1%)	2.5972	0.3041	Moderate
Cooperation	21 (4.7%)	347 (78.0%)	77 (17.3%)	2.7742	0.5036	Moderate
Equity	14 (3.1%)	353 (64.5%)	78 (29.0%)	2.7674	0.3911	Moderate
Investigation	29 (6.5%)	287 (78.0%)	129 (17.3)	2.8544	0.4524	Moderate
Involvement	4 (0.9%)	387 (87.0%)	54 (12.1%)	2.7513	0.2809	Moderate
Task Orientation	2 (0.4%)	359 (80.7%)	84 (18.9%)	2.7939	0.2586	Moderate
Teacher Support	10 (2.2%)	386 (86.7%)	49 (11.0%)	2.6884	0.3142	Moderate
Personal Relevance	114 (25.6%)	297 (66.7%)	34 (7.6%)	2.4255	0.4792	Moderate
Shared Control	54 (12.1%)	345 (77.5%)	46 (10.3%)	2.5213	0.3960	Moderate
Student Negotiation	25 (5.6%)	345 (77.5%)	75 (16.9%)	2.7356	0.4267	Moderate
<b>Overall</b>	0 (0.0%)	421 (94.6%)	24 (5.4%)	2.6909	0.2433	Moderate

The result shows that all ten dimensions of the mathematics classroom environment have mean values ranging from 2.4255 to 2.8544, indicating moderate level. Overall, students' perception of their mathematic classroom environment was also moderate (Mean = 2.6909, S.D. = 0.2433).

The result in Table 4.3 shows that Investigation (Mean = 2.8544, S.D. = 0.4524) has the highest level of students' perception, followed by Task Orientation (Mean = 2.7939, S.D. = 0.2586), Cooperation (Mean = 2.7742, S.D. = 0.5036), Equity (Mean = 2.7634, S.D. = 0.3911) and Involvement (Mean = 2.7513, S.D. = 0.2809).

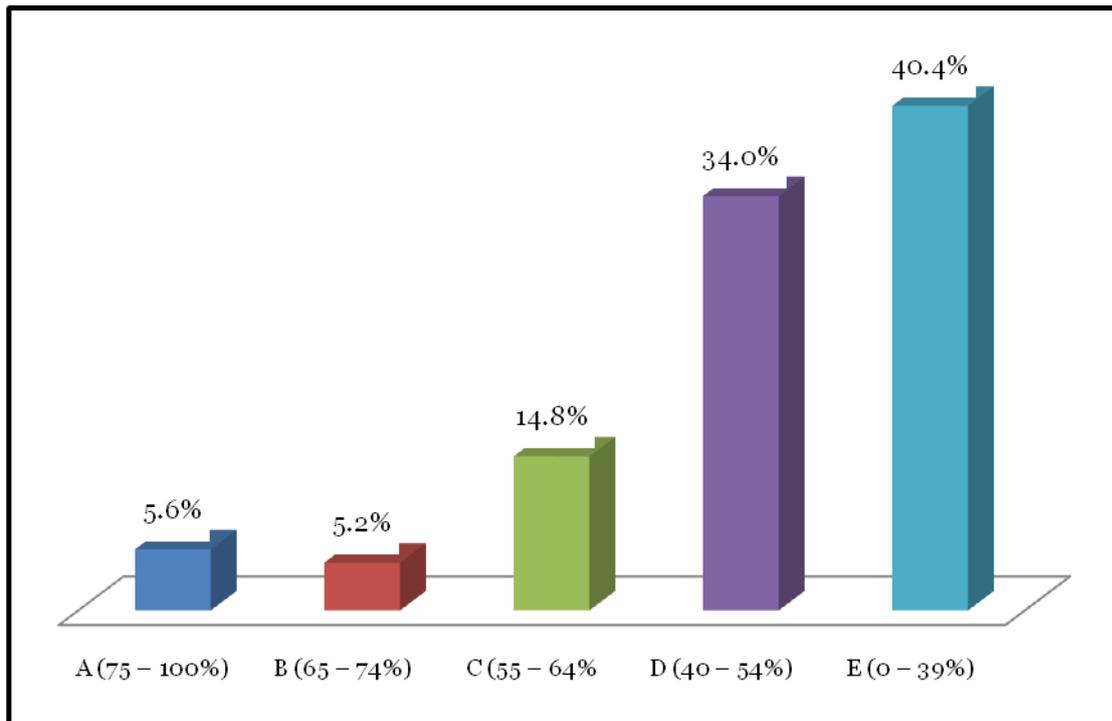
Five other dimensions with lower students perceptions are Student Negotiation (Mean = 2.7356, S.D. = 0.4267), Teacher Support (Mean = 2.6884, S.D. = 0.3142), Student Cohesiveness (Mean = 2.5972, S.D. = 0.3041), Shared Control (Mean = 2.5213, S.D. = 0.3960) and Personal Relevance (Mean = 2.4255, S.D. = 0.4792).

## 5.2 Students' Mathematics Achievement

Figure 5.1 shows the results of the students' Mathematics Assessment. As shown in Figure 5.1, a total of 40.4 percent of the students did not passed the assessment (Grade E). A total of 151 students (34.0 percent) obtained Grade D, 66 students (14.8 percent) with Grade C, 23 students (5.2 percent) with Grade B and only 25 students (5.6 percent) managed to get Grade A. The mean score was 1.740 percent with a standard deviation of 0.628.

**Table 5.3:** Students' Mathematics Achievement

Grade	Frequency	Percentage	Mean	Standard Deviation
A	25	5.6	1.740	0.628
B	23	5.2		
C	66	14.8		
D	151	34.0		
F	180	40.4		



**Figure 5.1:** Students' Achievement in their Mathematics Assessment

### 5.3 Comparison of Mathematics Classroom Environment Based on Gender

The mathematics classroom environment was compared according to gender: male or female students. The first hypothesis,  $H_{01}$  was tested with independent sample t-test at 95% confidence level and results are presented in Table 5.4 Based on gender ( $p = 0.357$ ), the null hypothesis was also not rejected and therefore concluded that there was no significant difference between students' perception of mathematics classroom environment based on gender (see Table 5.4).

**Table 5.4** Mean Difference in Perceptions of Mathematics Classroom Environment Based on Gender ( $N_{\text{Male}} = 223$ ,  $N_{\text{Female}} = 222$ )

		<i>M</i>	<i>SD</i>	Mean Difference	<i>T</i>	<i>df</i>	<i>P</i>
Student Cohesiveness	Male	3.2422	.7132	-.2759	-4.348	443	.000
	Female	3.5180	.6217				
Cooperation	Male	3.1883	.7293	-.0909	-1.397	443	.000

	Female	3.2793	.6404				
Equity	Male	3.0404	.7553	-.0993	-1.374	443	.170
	Female	3.1396	.7689				
Investigation	Male	3.1570	.7813	.0173	.236	443	.813
	Female	3.1396	.7630				
Involvement	Male	3.1928	.5723	-.2216	-4.091	443	.163
	Female	3.4144	.5703				
Task	Male	2.8161	.9041	-.1208	-1.507	443	.132
Orientation	Female	2.9369	.7819				
Teacher	Male	2.8206	.8243	-.0533	-.631	443	.529
Support	Female	2.8739	.9524				
Personal	Male	2.3812	.7552	.0388	.516	443	.606
Relevance	Female	2.3423	.8293				
Shared	Male	2.3543	.7322	.0389	.484	443	.629
Control	Female	2.3153	.9511				
Student	Male	3.1076	.6956	-.1897	-3.056	443	<b>.002</b>
Negotiation	Female	3.2973	.6105				
Overall	Male	204.0493	16.4613	-1.3516	-9.21	443	0.357
	Female	205.4009	14.4284				

Evaluation of the dimensions indicated that there was significant difference in students' perception for three dimensions – student cohesiveness, cooperation and student negotiation. In these three dimensions, females have better perception (Mean for Student Cohesiveness = 3.2973; Mean for Cooperation = 3.2793; Mean for Student Negotiation = 3.5180) compared to males (Mean for Student Cohesiveness = 3.1076; Mean for Cooperation = 3.1883; Mean for Student Negotiation = 3.2422).

#### 5.4 Comparison of Mathematics Achievement Based on Gender

Table 5.5 below shows the result of mean difference analysis with t-test to compare Mathematics achievement based on gender. The second hypothesis,  $H_{02}$  was tested. The hypothesis are rejected as the p values for gender are less than 0.005. Therefore, there is a significant difference between students' mathematics achievement based on gender. Females scored higher (mean = 48.2523, SD = 15.5508) compared to males (mean = 38.7534, SD = 14.3639).

**Table 5.5 Mean Difference of Students' Mathematics Achievement Based on School Location and Gender**

	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Mean Difference</i>	<i>t</i>	<i>df</i>	<i>P</i>
Male	223	38.7534	14.3639	-9.498	-6.694	443	0.000
Female	222	48.2523	15.5508				

#### 5.5 Relationship between Mathematics Classroom Environment, Mathematics Achievement

The Pearson Moment Correlation was used to test the last hypothesis,  $H_{03}$ , to determine the possible associations between the two constructs; mathematics classroom environment and mathematics achievement. Table 5.6 below shows that the relationships between mathematics classroom environment and mathematics achievement (Pearson correlation = 0.105,  $p = 0.026$ ) and

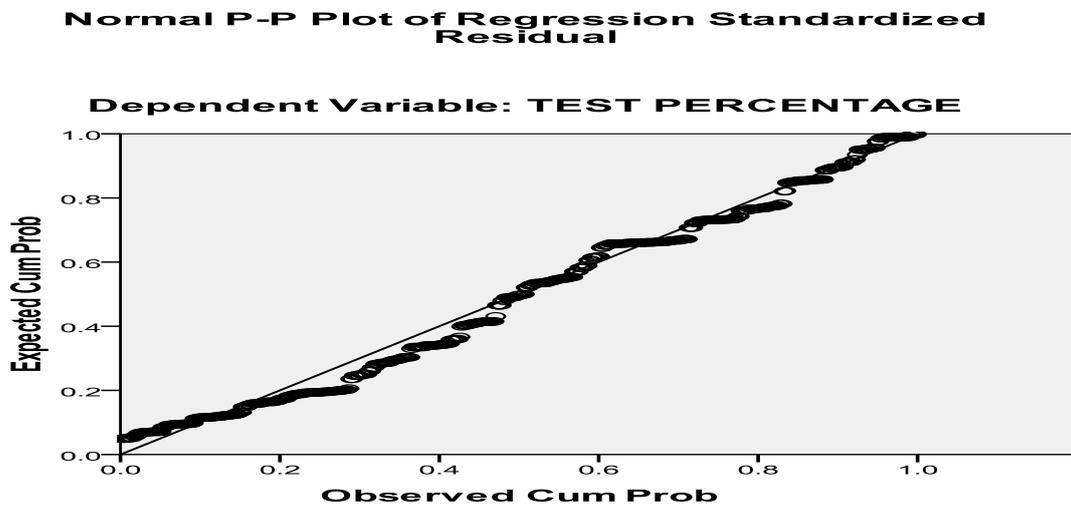
Hence, the third hypothesis was rejected. There is a significant relationship among the two constructs although the relationships were weak.

**Table 5.6 Pearson Correlation of Mathematics Classroom Environment, Mathematics Efficacy and Mathematics Achievement**

<i>Relationship between</i>	<i>N</i>	<i>Pearson Correlation</i>	<i>P</i>
Mathematics Classroom Environment x Mathematics Achievement	445	0.105*	0.026

\*. Correlation is significant at the 0.05 level (2-tailed).

Figure 5.2 below show the Normal P-P Plot of Regression Standardized Residual to show the correlation between the two variables.



**Figure 5.2 Normal P-P Plot for Mathematics Classroom Environment and Mathematics Achievement**

## 6.0 Discussion of the Findings

### 6.1 Mathematics Classroom Environment and Comparison Based on Gender

Results in this study disagreed with Huang (2003), Goh and Fraser (1998), Huang & Waxman (1995b) and Wong and Fraser (1994) who found that there was a significant difference in perception of male and female students with females scoring higher for classroom environment. In Huang's (2003) study involving 13,000 students from urban elementary middle and high schools, female students generally scored higher for their perceptions of their learning environment compared to males.

Goh and Fraser (1998) found that girls perceived their mathematics classroom environments more favorably than boys although mathematics achievement favors the boys. A comparison of mathematics learning environment between Asian and Anglo-American students with sample size of 1200 students in each group, Huang and Waxman (1995b) found that middle school girls had more favorable perceptions than boys had. Also, across both ethnic groups, girls were more involved and attentive in class, more affiliated with their classmates, and enjoyed their mathematics class more than boys did.

## **6.2 Mathematics Achievement and Comparison Based on Gender**

Halimah Awang and Noor Azrina Ismail (2006) stated that achievement in mathematics varied across nations, regions, and a variety of socio-economic, gender and school location. Other studies (Gallaher & Kaufman, 2005; Cleary, 1992; Willingham and Cole, 1997; Wang and Maxey, 1995; Beller & Gafni, 1996; Engelhard, 1990) showed that males were better achievers than females. However, similar results indicating females as the better achiever was reported by Al Khateeb (2001).

## **6.3 Relationship of Mathematics Classroom Environment and Mathematics Achievement**

The significant relationship between Mathematics classroom environment and Mathematics achievement also agreed with past research studies (Margianti et al., 2001; Fraser & Chionh, 2000; Goh & Fraser, 1998; Tobin & Gallagher, 1986).

## **7.0 Implications of the Findings**

The results of this study showed that both the scales; Mathematics classroom learning environment (CLES) and Mathematics efficacy (PISA, 2004) are reliable scales to measure the classroom learning environment and students' efficacy in mathematic-related contexts. Results showed that students perceived their Mathematics classroom learning environment as moderate. Overall, students' Mathematics achievement was low with almost half of the class (42.7 percent) failed in the assessment. Findings showed not a significant difference in students' perception of Mathematics classroom environment on gender.

Besides that, by knowing students perceptions, teacher can reformulate the best strategies to provide ideal mathematics classroom environment and ensure better performance in mathematics with specific regards to gender. In addition, education policy makers can plan strategic interventions to ensure equality in education distribution in Malaysia in order to achieve equality of education.

## **8.0 Recommendations for Further Research**

Mathematics classroom environment is an important variable to determine students' achievement in mathematics. As the findings showed moderate students' perception of mathematics classroom environment, it is imperative that further studies should be conducted to determine the causal factors of this phenomenon. In this case, teachers play a crucial role to set the environment of the classroom and ensure that teacher-students relationship is positive and contributing to learning motivation.

In addition, the study contradicted most studies which favored males with better mathematics achievement compared to females. This study indicated that females fared better than male students. Hence, further study should be conducted in other areas or district in Sabah (and Malaysia) to provide more information pertaining to this trend. As the sample size was limited in this study, a bigger sample size may provide a better picture of the situation.

This study also showed that students overall performance in mathematics was poor in Sipitang. This should be a concern to school administrative and the Education Department at state and district level to investigate the main causal factors for the poor achievement. As the country is progressing to produce competent k-workers, such poor performance in mathematics must be addressed accordingly and promptly.

## **9.0 Conclusion**

This study concludes that students perception of mathematics classroom environment in Sipitang, Sabah is average and their mathematics achievement was poor. These findings imply that females were better achievers than males. This study extended learning environment theories as well as used instruments to a local context by putting emphasis on teaching and learning processes through

a constructivist view in relation with learning environment in a Mathematic classroom in Sipitang, Sabah, Malaysia.

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