A STUDY OF THE PERCEPTIONS OF HIGH SCHOOL STUDENTS ON MATHEMATICS LEARNING ENVIRONMENT

Khin Phyu Phyu [1], Nilar Myo Tint [2]

Abstract

The major purpose of this study was to investigate different factors that affect the attitudes and learning environment perceptions of high school mathematics students. For the purpose of measuring students' perceptions of learning environment, it was observed that the better the students' perceptions of learning environment, the higher the students' mathematical attitudes would be. Quantitative approaches were used in this study. A total of 629 Grade 10 students from six selected schools in Yangon and Ayeyarwaddy regions were participated in this study. As the research instruments, What is Happening In This Class Questionnaire (WIHIC) and Test of Mathematics Related Attitudes Questionnaire (TOMRA) defined by Fraser (2007) were used in this research. Subjects were evaluated using the What Is Happening In This Class Questionnaire (WIHIC) and Test of Mathematics Related Attitudes Questionnaire (TOMRA) including 49 items to assess high school students' perceptions of mathematics learning environment.

In this research, descriptive statistics, independent sample t-test and analysis of variance (ANOVA) were used. As a result of this study, it was found that the female students have better perceptions of mathematics learning environment than male students. It can be observed that there was significant difference in the students' perceptions of learning environment between schools. And then, students were different in their perceptions of learning environment between Yangon and Ayeyarwaddy Region. There were also significant difference in the students' perceptions of learning environment and mathematical attitudes according to their combinations. It can be concluded that student's perceptions of learning environment were positively related with their mathematical attitudes.

Key words : Learning environment, Attitude, Perception

Introduction

In the modern world, mathematics is being increasingly used in science, technology, industry, and education and economic. It is essential in public decision making and for participation in the knowledge economy. Mathematics classroom environment and mathematics achievement are some

[1] Lecturer, Department of Educational Psychology, Yangon University of Education
[2] Tutor, Department of Educational Psychology, Yangon University of Education

of the important mathematical constructs in teaching and learning of Mathematics in the classroom. An effective mathematics learning environment is one in which students and teachers interact in ways that allow students to have an opportunity to maximize how much they learn. Creating an interactive learning environment inside the mathematics classroom in which students are engaged in mathematics learning can be challenging. Learning environment can affect student behavior because students spend a lot of time at school. The classroom is the basic unit of organization of the educational system. Classroom is the most vital one for the transactional business going on between school and the society. Socially, the child is the product of environment. If the school is able to create a congenial, pleasant and favorable climate for learning, the child is likely to enjoy the schooling experience. (Sunitha, 2005).

Literature Review

Learning Environment

Learning environment refers to an environment experienced or perceived by teachers that supports positive learning outcomes. Creating and implementing a learning environment means careful planning for the start of the school year. The learning environment must be envisioned in both a physical space and a cognitive space. The physical space of the classroom is managed as the teacher prepares the classroom for the students. Teachers must also consider the cognitive space necessary for a learning environment. This cognitive space is based upon the expectations teachers set for students in the classroom and the process of creating a motivational climate.

Attitude

Attitude is a central part of human identity. Everyday people love, hate, like, dislike, favour, oppose, agree, disagree, argue, persuade etc. All these are evaluative responses to an object. Hence attitudes can be defined as a summary evaluation of an object of thought (Bohner & Wänke, 2002).They are inclinations and predispositions that guide an individual's behavior and persuade to an action that can be evaluated as either positive or negative . Attitudes develop and change with time. According to multicomponent model of Attitude, attitudes are influenced by three components. They are cognitive

(beliefs, thoughts, attributes), affective (feelings, emotions) and behavioural information (past events, experiences).

Students' attitude towards mathematics

Students' attitude towards mathematics has been a factor that is known to influence students' achievement in mathematics. When reviewing literature on students' attitude towards mathematics, it reveals that several factors play a vital role in influencing student's attitude. These factors can be categorized into three distinctive groups. Firstly, factors associated with the students themselves. Some of these factors include students' mathematical achievement score, anxiety towards mathematics, students' self efficacy and self concept, extrinsic motivation and experiences at high school. Secondly, the factors that are associated with the school, teacher and teaching.

Perceptions

Perception is the process or the capability to attain awareness and understand the environment surrounding us by interpreting, selecting and organizing different type of information. Perception that it refers to evaluative concepts encompassing opinions and beliefs.. In the dictionary of psychology, it is defined as (1) the process of knowing objects and objective events by means of the senses; and (2) an intuitive awareness of truth or immediate belief about something.

Students' Perceptions of Classroom Environment

According to Fraser (2000), students have spent approximately 20,000 hours in classrooms by the time they finish their university education. This time devoted to schooling is focused mainly on the academic achievement of students. Teachers, students and school face a variety of problems when realizing a productive learning environment for all these hours, such as lack of choice and opportunity in educational programs, lack of funding, dissatisfied and burnt-out teachers, problems in teacher quality, low grades etcetera.

Method

This study aims to present about the research methods and procedures that applied in this study in assessing high school students' perceptions of

learning environment , their mathematical attitudes and their demographic factors.

Sample of the study

Participants of this research were Grade 10 students from Yangon and Ayeyarwaddy regions by using random sampling technique, in the academic year of 2013-2014. The total number of the participants were 629 (Male 295, Female 334).

Research Instrument

The first instrument, What Is Happening In the Class (WIHIC) was used to the participants of the study. The response type for each item is a five point Likert Scale. Based on past studies, Fraser (2007) developed a new learning environmental instrument named What Is Happening In This class? (WIHIC) which incorporates that have been used and proven to be significant predictors of learning outcomes. The six subscales (Student Cohesiveness, Teacher Support, Involvement, Task Orientation, Cooperation and Equity), was involved in WIHIC. The total items of WIHIC consisted of 24 items. The second instrument , Test of Mathematics Related Attitudes (TOMRA), was employed to the participants of the study. Test of Mathematics Related Attitudes (TOMRA) was modified by Fraser (2007).In this instrument, five subscales (Inquiry, Enjoyment, Leisure, Social and Career) were included. The total items of TOMRA were 25 items in the instrument. After testing the pilot study, Cronbach's alpha of the whole scale was 0.822. So, Cronbach alpha's value indicated that is satisfactorily reliable.

Procedure for Collecting Data

After preparing the questionnaire from the pilot study, data collection was conducted. The data was collected from BEHS 1 Dagon (East), BEHS 1 Tarmwe, BEHS 4 Alone in Yangon Region and BEHS 1 Malzali, BEHS 1 Inngapuu, BEHS 1 Kwinkauk in Ayeyarwaddy Region from the first week of December, 2013 to the first week of January, 2014. To get gender and subject specialization, data collection made between male and female in the arts and science section from all selected schools. The data were analyzed by descriptive analysis, independent sample t-test method, ANOVA method, correlation and Chi-square method.

Data Analysis and Result

Students' Perceptions of Mathematics Learning Environment from all Selected Schools

To investigate the students' perceptions of mathematics learning environment, descriptive statistics was carried out and the results were shown in table 1.

Table 1: Descriptive Statistics for Students' Perceptions of Mathematics Learning Environment

Subscales of Perceptions of Learning Environment and Mathematical Attitudes		Mean	SD	Minimum	Maximum
Perceptions of Learning Environment	Student Cohesiveness	13.210	1.252	9	15
	Teacher Support	15.820	2.040	8	20
	Involvement	25.400	4.052	11	35
	Task Orientation	12.350	1.544	4	15
	Cooperation	11.840	1.656	7	15
	Equity	16.290	2.248	8	20
Total		94.913	8.711	64	116
Mathematical Attitudes	Inquiry	13.620	2.497	6	20
	Enjoyment of Mathematics	23.480	2.573	15	34
	Leisure	17.900	2.620	10	48
	Social	15.850	2.180	9	25
	Career	7.300	1.624	3	10
Total		**78.154**	**7.047**	**58**	**114**

By using the data obtained from the selected schools, the students' perceptions of learning environment and mathematical attitudes can be estimated. According to the descriptive statistics, the mean and standard deviation of students' perceptions for the whole What Is Happening In this Class Questionnaire (WIHIC) is 94.912 and 8.711. It was clearly seemed that the students in this study have fairly good perception about the learning environment. Among them, the mean score of involvement is the highest and the second highest is equity. So, it was assumed that high school students from selected schools are satisfied with their class and participate actively in the class activities and the teacher always treats students equally in the

classroom activities. And then the third highest was the mean score for teacher support, followed by student cohesiveness. Moreover, the mean and standard deviation for the whole Test of Mathematics Related Attitudes Questionnaire (TOMRA) is 78.154 and 7.047. Among them, the mean score of enjoyment of mathematics was the higher than that of other variables. It may be interpreted that students enjoy learning mathematics in the classrooms.

Comparison of Students' Perceptions of Mathematics Learning Environment by Gender

To find out the differences of students' perceptions on mathematics learning environment between male and female from the selected schools, descriptive statistics was made. The mean score of male and female students were shown in table 2.

Table 2: Means and Standard Deviations of Students' Perceptions of Mathematics Learning Environment by Gender

Variable	Gender	N	Mean	Std. Deviation
Perceptions of Learning Environment	Male	263	93.517	8.587
	Female	366	95.915	8.671
Total		**629**	**94.912**	**8.710**
Mathematical Attitudes	Male	263	77.643	7.587
	Female	366	78.522	6.624
Total		**629**	**78.154**	**7.046**

For perceptions of learning environment, the mean score of female was higher than that of male. So, it can be interpreted that the perceptions of the female students on learning environment were higher than that of male. For mathematical attitudes, the mean score of female was higher than that of male. After conducting the mean and standard deviation by gender, it was carried out the independent sample t-test to find out the significant difference in the students' perceptions on mathematics learning environment by gender.

Table 3: Results of Independent Sample t-test of Students' Perceptions of Mathematics Learning Environment by Gender

Variable	t	df	Sig (2-tailed)	Mean Difference
Perceptions of Learning Environment	- 3.435	627	.001	- 2.398
Mathematical Attitudes	- 1.545	627	.123	- .879

From the result of independent sample t-test, there was statistically significant difference in the students' perceptions of learning environment but there was no significant difference in their mathematical attitudes.

Students' Perceptions of Mathematics Learning Environment by Schools

In order to investigate whether there were significant differences in students' perceptions of mathematics learning environment by schools, descriptive statistics was done and it revealed the differences in mean scores of the perceptions of mathematics learning environment by schools was presented.

Table 4: Descriptive Statistics for Perceptions of Mathematics Learning Environment between Schools

Variable	Schools	N	Mean	Std. Deviation
Perceptions of Learning Environment	KwinKauk	100	98.850	6.949
	Malzali	100	92.550	9.342
	Inngapuu	100	98.900	7.018
	Alone	101	93.237	10.286
	Tarmwe	99	92.666	8.269
	Dagon	129	93.635	7.591
Mathematical Attitudes	KwinKauk	100	77.910	5.318
	Mazali	100	77.040	6.555
	Inngapuu	100	78.640	5.788
	Alone	101	78.326	9.163
	Tarmwe	99	79.616	7.750
	Dagon	129	77.573	6.913

Based on the result of table 4, it can be interpreted that the mean score of Inngapuu was the highest on the perceptions of learning environment over all schools. And then, Kwin Kauk was the second highest on perceptions of learning environment , followed by Dagon and Alone. The two lasted mean scores among schools were Tarmwe and Malzali. It could be concluded that students' perceptions of learning environment from Inngapuu were effective than other students. Moreover , mathematical attitudes of students from Tarmwe was the highest. Inngapuu was the second in mathematical attitudes, followed by Alone, Kwin Kauk, Dagon and Mazali. Then, it was computed ANOVA to find out whether there was significant difference in the students' perceptions of mathematics learning environment between schools. It can be observed that there was significant difference in the students' perceptions of learning environment at 0.01 levels but there was no significant difference in their mathematical attitudes.

Table 5 : ANOVA Results for Students' Perceptions of Mathematics Learning Environment Between Schools

Variable	Sum of Squares	df	Mean Square	F	Sig
Perceptions of Learning Environment	Between Group – 4691.518	5	938.304	13.608	.000
	Within Group – 42956.673	623	68.951		
	Total – 47648.191	628			
Mathematical Attitudes	Between Group – 411.789	5	82.358	1.667	.140
	Within Group – 30772.252	623	49.394		
	Total – 31184.041	628			

Students' Perceptions of Mathematics Learning Environment between Yangon and Ayeyarwaddy Region

After matching the students' perceptions by schools, it was found out the descriptive statistics for the student' perceptions of mathematics learning environment between Yangon and Ayeyarwaddy Region. The result of descriptive statistics was shown the following table 6.

Table 6: Means and Standard Deviations of Students' Perceptions of Mathematics Learning Environment Between Yangon and Ayeyarwaddy Region

Variable	Region	N	Mean	Standard Deviation
Perceptions of Learning Environment	Yangon	329	93.222	8.680
	Ayeyarwaddy	300	94.913	8.374
	Total	629	96.767	8.089
Mathematical Attitudes	Yangon	329	78.154	7.932
	Ayeyarwady	300	78.420	5.926
	Total	629	77.863	7.047

It can be assumed that the total mean score of students from Ayeyarwaddy Region was higher than that of students from Yangon Region in examining learning environment questionnaire. But, on the other hand, the mean score of students from Ayeyarwaddy Region was higher than that of students from Yangon Region in assessing mathematical attitudes. Moreover, it was calculated the independent sample t-test to see whether there was significant difference between Yangon and Ayeyarwaddy Region.

Table 7: Results of Independent Sample t-test of Students' Perceptions of Mathematics Learning Environment between Yangon and Ayeyarwaddy Region

Variable	t	df	Sig (2-tailed)	Mean Difference
Perceptions of Learning Environment	5.202	627	.000	3.545
Mathematical Attitudes	- .989	627	.323	- .556

The result of independent sample t-test indicated that there was significant difference in the students' perceptions of learning environment but there was no significant difference in their mathematical attitudes.

Students' Perceptions of Mathematics Learning Environment by Subjects

To assess whether the students have difference in selecting the subjects among them, descriptive statistics was calculated. The results were shown in table 8.

Table 8: Means and Standard Deviations of Students' Perceptions of Mathematics Learning Environment by Subjects

Variable	Subjects	N	Mean	Standard Deviation
Perceptions of Learning Environment	Science	319	95.720	8.323
	Arts	310	94.913	9.031
	Total		**94.123**	**8.711**
Mathematical Attitudes	Science	319	79.174	6.555
	Arts	310	78.154	7.392
	Total		**77.163**	**7.047**

It was observed that the total mean score of science was higher than that of arts in students' perceptions of mathematics learning environment in examining the questionnaire. Thus, the students' perceptions of mathematics learning environment who were studying in science were higher than that of arts. After conducting the mean and standard deviation by subjects, it was carried out the independent sample t-test to find out the significant difference in the students' perceptions on mathematics learning environment by subjects.

Table 9: Results of Independent Sample t-test of Students' Perceptions of Mathematics Learning Environment by Subjects

Variable	t	df	Sig (2-tailed)	Mean Difference
Perceptions of Learning Environment	-2.298	627	.022	-1.591
Mathematical Attitudes	-3.613	627	.000	-2.011

From the result of independent sample t-test, there were statistically significant difference in the students' perceptions of learning environment and mathematical attitudes.

Table 10: Chi-square Test Result for the Perceptions of Learning Environment and Mathematical Attitudes

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.107	4	.000
Likelihood Ratio	51.385	4	.000
Linear-by-Linear Association	46.673	1	.000
N of Valid Cases	629		

To investigate whether mathematical attitudes differ on perceptions of learning environment , a chi-square statistics was used. Table 10 showed the Pearson chi-square results and indicates that mathematical attitudes was significantly different on perceptions of learning environment

($\chi^2 = 60.107$, df = 4, N = 629, P< .000).

Table 11: ANOVA Results of Mathematical Attitudes by Perceptions of Learning Environment Level

	Sum of Square	df	Mean Square	F	Sig
Mathematical Attitudes	Between Groups-3166.832	2	1583.416	35.379	.000
	Within Groups-28017.210	627	44.756		
	Total-31184.041	629			

According to the result of table 11 , the observed F-value for the perceptions of learning environment level (df= 2,627) was 35.379 and the p-value was less than 0.001. The significant difference was found in mathematical attitudes by the perceptions of learning environment level at 0.001 level. The mean score of high perceptions of learning environment level was high in mathematical attitudes. It may be interpreted that the perception of an enjoyable learning environment was the high in mathematical attitudes.

To understand definitely, which particular level had significant difference in the perceptions of learning environment among other levels, the Post Hoc Tests by Turkey HSD Method was calculated.

Table 12: Results of Turkey HSD Multiple Comparisons for Mathematical Attitudes by the Perceptions of Learning Environment Level

	(I)Level	(J)Level	Mean Difference(I-J)	Pr>F
Mathematical Attitudes	High Group	Middle Group	4.805**	.000
		Low Group	7.923**	.000

Note: ** The mean difference is significant at 0.01 level.

Based on the results of table 12, it may be considered that the mean score of students from high group level of perceptions of learning environment was significantly higher than that from other two groups for that area, (middle group and low group) in the mathematical attitudes at 0.01 level. It may be remarked that if the students have good perceptions on learning environment, their mathematical attitudes will high.

Table 13: Inter-correlations for Learning Environmental Perceptions and Mathematical Attitudes of Students

Variables	PLE	IN	EM	L	So	C
PLE	-	.257**	.140**	.176**	.112**	.390**
IN		-	.171**	.208**	.128**	197**
EM			-	349**	.246**	.225**
L				-	.234**	.187**
So					-	.146**
C						-

**Correlation is significant at the 0.01 level (2-tailed).

Note: PLE =Perceptions of Learning Environment , IN = Inquiry, EM = Enjoyment of Mathematics, L = Leisure, So = Social, C = Career. As already mentioned above, perceptions of learning environment were positively related with mathematical attitudes .

Conclusion

The major purpose of this study was to investigate different factors that affect the attitudes and learning environment perceptions of high school mathematics students. For the purpose of measuring students' perceptions of learning environment, it was observed that the better the students' perceptions of learning environment, the higher the students' mathematical attitudes would be. As a result of this study, it was found that the female students have better perceptions of mathematics learning environment than male students. It can be observed that there was significant difference in the students' perceptions of learning environment between schools. And then, students were different in their perceptions of learning environment between Yangon and Ayeyarwaddy Region. There were also significant difference in the students' perceptions of learning environment and mathematical attitudes according to their combinations. It can be concluded that student's perceptions of learning environment were positively related with their mathematical attitudes.

Suggestion

The sample used in this research is from six selected schools of Yangon and Ayeyarwaddy region. To be more representative, more students from remaining schools should be participated in this study. In this study, the research tried to investigate the students' perceptions of mathematics learning environment in schools. Creating an effective learning environment is really important for students. So, the research is required to study the students' perceptions of classroom environment and their mathematical attitudes. It was also found that mathematical attitudes were more favorable in classrooms perceived as having more teacher support, task orientation and equity. Future research should incorporate structured interview and other qualitative data – collection techniques, as suggest by Tobin and Fraser (1998), in addition to questionnaires. According to Tobin and Fraser (1998), combining qualitative and quantitative research methods can help to provide a clearer understanding of the learning environment and enhance the information obtained from quantitative methods alone. The use of the combination of qualitative and quantitative methods in future is likely to enrich findings from the research. To overcome the limitation, future research should be undertaken with bigger

and broader samples to improve confidence in the findings. Such studies could include samples from primary, secondary and college levels. It is also suggested that future studies include outcomes beyond student attitudes, such as academic achievement. Associations between learning environment and student outcomes could be investigated at different grade levels and for different learning areas.

Education in Myanmar is undergoing profound transformation. Critical within this process is the introduction of advanced educational techniques, improvement of the innovative skills of teachers, and the enhancement of the self-learning ability of students. All of the processes require evaluation at all levels of their development from policy formulation at government level through to implementation of the curriculum framework at the school and classroom levels. These processes require different approaches to evaluation. Research, involving the use of learning environment instruments, such as the WIHIC, could prove generally useful in evaluating the impact of these innovate curricula in terms of the learning environment created at the school and classroom level.

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