THE INFLUENCE OF LEARNING ENVIRONMENT AND ACADEMIC SELF-EFFICACY TOWARDS MATHEMATICS ACHIEVEMENT IN MASTERSKILL GLOBAL COLLEGE, MALAYSIA

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Abstract
This study aimed to examine the influence of two constructs – mathematics classroom learning environment and academic self-efficacy in mathematics – and their influence towards students' mathematics achievement. For this purpose, a sample of 200 allied health college students was randomly selected from two campuses of Masterskill Global College. The questionnaire was a combination of two sets of inventories that had been modified to suit the purpose of study. They were the College and University Classroom Environment Inventory (CUCEI) and College Academic Self-Efficacy Scale (CASES). Two statistical procedures were utilized to examine the demographic and data analyses, which were descriptives and inferential statistics. The analyses reported respondents had high and positive perception on all constructs, and there were also significant difference in respondents' perception based on campuses and mathematics achievement grades. Moreover, different construct significantly influence achievement in mathematics. Thus, for future research purposes this study could also be conducted in other allied health colleges.

Keywords: mathematics, environment, academic, self-efficacy, achievement.

1. Background of Study

Teaching and learning mathematics are complex tasks (Grouws and Cebulla, 2000). Teachers need to ensure that their teaching techniques are effective so that their students are able to grasp what was being imparted to them during teaching and learning process. Students, on the other hand, need to have the interest to learn and have strong foundation in mathematics to prevent them from having difficulties when learning mathematics at a higher level. As stated by Graham and Provost (2012), without strong foundation in early mathematics, students are not prepared to enrol in more advance mathematics at high school and college level.

There are actually quite a wide range of factors that could lead to difficulty in learning mathematics. These factors can be in an intrinsic or extrinsic form. Among the extrinsic influences are entry mastery; opportunities to learn; external motivation; financial resources and language barriers (Saxe, 1988); Capraro (2009). Meanwhile, the intrinsic influences could be from the learner's will to learn; attitude; self-efficacy; cognitive ability and anxiety level towards mathematics.

Despite the different types of factors, some students do find it difficult to cope with the mathematics syllabus offered in the Masterskill Global College, although the syllabus covers similar topics during secondary school. Some of these students even managed to achieve good grades during their Malaysian Certificate of Education examination and yet could not handle the challenges portrayed in the syllabus. As stated by Pandit (2004), there are students who have average or above average intelligence but continuously fail to maintain normal progress in school subjects, even though these students are not handicapped.

The mathematics syllabus in Masterskill Global College is quite similar to those in the Malaysian secondary school mathematics curriculum. Students still need to focus on Geometry, Algebra, Calculus, Trigonometry and Statistics, but the problem solving situations are more likely to be linked to their own area of study. For instance, students in Environmental Health would use logarithm in identifying the pH value of a river, whereas Medical Lab Technology students would use logarithm in investigating cell duplication. Although the area of study is different, students still need to know the rules of logarithm when solving their respective problem, which is the very basic thing to index and logarithm.

Since the importance of higher education has increased several folds in the world, the awareness on the importance of mathematics in higher learning institution such as Masterskill Global College need to be established (Rizwan and Rafaqaat, 2010). Educators need to know how to generate students' optimal potential in this subject by identifying what factor affects students' performance the most. This indirectly requires educators to change their teaching approaches, strategies and practices in the classroom.

Thus, the purpose of this paper is to examine the influence of two contributing factors (both intrinsic and extrinsic) towards students' mathematics achievement. These factors are classroom learning environment and students' academic self-efficacy in mathematics. Although quite a number of researchers had studied on these two constructs, related studies in mathematics for tertiary level involving all two constructs are relatively few in comparison to those carried out at the primary and secondary level.

2. Objectives

This research would consist of the following objectives:

a) To identify students' perception on mathematics learning environment and perception on academic self-efficacy in mathematics.
b) To determine the differences in students' perception of mathematics learning environment based on campus.
c) To determine the differences in students' perception of academic self-efficacy in Mathematics based on campus.
d) To determine the relationship between mathematics learning environment with academic self-efficacy.
e) To identify the influence of mathematics learning environment and academic self-efficacy towards mathematics achievement.

3. Research Hypotheses

H_{o1} There is no significant difference in students' perception of mathematics learning environment based on campus.

H_{o2} There is no significant difference in students' perception of academic self-efficacy in Mathematics based on campus.

H_{o3}: There is no significant difference in students' perception of academic self-efficacy in Mathematics based on mathematics achievement.

H_{o4} There is no significant relationship between mathematics learning environment and academic self-efficacy.

H_{o5} There is no significant influence of mathematics learning environment and academic self-efficacy towards mathematics achievement.

4. Academic Self-Efficacy in Mathematics

Based on the definition of academic self-efficacy by Zimmerman (1995), May and Glynn (2008) had developed a Mathematics Self-Efficacy Questionnaire (MSEQ) that provides college mathematics instructors and mathematics-education researchers with information about students' self-efficacy (specific confidence) in their ability to learn mathematics. The questionnaire covered three subscales that are academic habits, mathematics anxiety and mathematics self-efficacy.

However, the MSEQ is not going to be used for the purpose of this research. Instead, a College Academic Self-Efficacy Scale (CASES) will be adapted. Similarly, CASES will also measures students' academic self-efficacy. It was designed by Owen and Froman (1988) to measure academic self-efficacy by asking students to rate how confident they feel regarding their abilities to perform common academic-related behaviours in college. In addition, Carroll *et al.* (2009) stated that academic self-efficacy had a strong relationship with academic achievement and young people who believe in their capabilities to exercise over their educational performance, achieve higher results academically than counterparts who have less efficacious beliefs in their academic pursuits.

Consequently, Ryan and Pintrich (1997) in Chamdimba (2008) stated that confidence in mathematics has been associated with mathematics achievement. Students who perceived themselves with high capability performed better than those who did not. According to Zimmerman (2000), self-efficacy beliefs have been found to be sensitive to subtle changes in students' performance context, to interact with self-regulated learning processes, and to mediate students' academic achievement. In another research of English language performance, the researcher found that when there is academic self efficacy or self perceptions of competence, the students succeed in their English language performance (Rahil *et al.*, 2006).

Then in a research conducted by Cheng and Westwood (2007), although it is not a powerful relationship, they proved that there is indeed an association between achievement and self-efficacy ($r = .31$) among primary school students in Hong Kong. Moreover, the similar findings was found in research among post-secondary first-term students'. It resulted that both General and Specific Self-Efficacy was related to first term academic success and grades (Becker and Gable, 2009).

In another study conducted by Dorman *et al.* (2003), they found that mathematics classroom environment is significantly associated with academic efficacy, which was based on four sources of academic efficacy, namely (a) performance; (b) vicarious experience; (c) persuasion; and (d) physical and affective states, which were designated by Bandura (1997). Another study also indicated the same result, whereby mathematics self-efficacy and mathematics achievement were positively related (Liu and Koirala, 2009).

There was probably no research that proves otherwise on the association between academic self-efficacy and academic achievement, especially among tertiary level students. Thus, this study will use this advantage to explore this research gap.

5. Mathematics Learning Environment

A study by Rosas and West (2009), proved that both pre-service and in-service teachers believed that classroom management plays an important role in supporting as well as improving students' academic achievement. Teachers who are able to manage their classroom well would be able to create a positive yet productive teaching and learning environment, which will motivate students to communicate, collaborate and connect to what is being taught in the classroom. This does not only cater for a particular subject but for every subject taught in school. Thus, it indirectly puts classroom learning environment as one of the factors affecting students' academic achievement.

Due to this, some researchers had conducted studies to identify methods of improving students' academic achievement, specifically in mathematics. In 2007, Fraser and Kahle investigated on the impact of three different environments (classroom, home and peer) on students' outcomes in Science and Mathematics. Their research revealed that all three environments were to be consistently accounted for students' attitude scores, but only class environment was accounted for students' achievement scores (Fraser and Kahle, 2007).

Furthermore, according to Dunn and Harris (1998) in Sink (2005), judgements on the classroom climate or environment are based on a student perceptual consensus about the educational, psychological, social, and physical aspects of the environment. In other words, environment of a classroom must be taken into account for holistic measures. Teachers, who are also the managers in the classroom, must not overlook any of the four aspects mentioned. They should be a balance among the four aspects in order to generate an effective yet conducive learning environment.

This construct (learning environment) is generally based on Lewin's (1936) pioneering work that stated behaviour is co-determined by the environment and its interaction with personal characteristics of the individual. Lewin's work was later developed into a nine-factor model by Walberg (1981). This model claimed that learning is a multiplicative, diminishing-returns function of students' age, ability and motivation; of quality and quantity of instruction; and of the psychosocial environments of the home, the classroom, the peer group and the mass media (Chionh and Fraser, 2009).

In accordance, studies on Mathematics' classroom environment, showed that classroom learning environment does affect students' academic achievement, whereby students who responded positively towards classroom environment, obtained higher academic achievement in class (Dorman *et al.*, 2003; Chionh and Fraser, 2009; Fraser and Khale, 2007; Rizwan and Rafaqat, 2010). Here, most researchers used the "What is happening in this class? (WIHIC)" questionnaire, which consists of seven scale factors; (a) Student cohesiveness; (b)Teacher support; (c) Involvement; (d) Investigation; (e) Task orientation; (f) Cooperation; and (g) Equity, to measure classroom learning environment in primary or secondary schools.

However, since this paper focuses on college students, the College and University Classroom Environment Inventory (CUCEI) would be used. This inventory also consists of seven constructs, which are; (a) Personalization; (b) Involvement; (c) Student Cohesiveness; (d) Satisfaction; (e) Task Orientation; (f) Innovation and (g) Individualisation (Fraser, 1998).

6. Methodology

Design: Applying quantitative approach with non-experimental design by using servay.

Sample: 200 allied health college students from two campuses of Masterskill Global College (formerly known as Masterskill College of Nursing and Health) participated in the study, applying purposive and random sampling technique.

Instruments: A combination of two sets of inventories that had been modified to suit the purpose of study. They were the College and University Classroom Environment Inventory (CUCEI) and College Academic Self-Efficacy Scale (CASES). All instruments used 5 Likert Scale from Strongly Disagree – Strongly Agree.

Validity and reliability: Exploratory Factor Analysis showed that all items for both variables carried minimum factor loadings for each construct (>.40). In addition, Cronbach's alphas were also adequate for both variables (>.70).

Data Analysis: Two statistical procedures were utilized to examine the demographic and data analyses, which were descriptives and inferential statistics.

7. Findings

The findings will be discussed based on the hypotheses as mentioned previously.

H_o1: There is no significant difference in students' perception of mathematics learning environment based on campus.

In Table 1, it was reported that there was significant difference in students' perception of mathematics learning environment between Kuching and Kota Kinabalu respondents because the significant value is less than the alpha value. Thus, the null hypothesis (H_01) was rejected at a 95% confidence level. This result suggested that Kuching campus' respondents perceived their mathematics learning environment slightly poorer than respondents in Kota Kinabalu campus.

Table 1: Independent Samples *t* - test for CUCEI

Campus	Mean	SD	*p* - value
Kuching	3.480	0.400	0.033*
Kota Kinabalu	3.600	0.369	

*Note: * indicates significance at 0.05 (p < 0.05)*

H_o2: There is no significant difference in students' perception of academic self-efficacy in Mathematics based on campus.

In Table 2, the outcome suggested that there was a significant difference in students' perception of academic self-efficacy in mathematics between Kuching and Kota Kinabalu respondents because the significant value is lesser than the alpha value, and therefore the null hypothesis (H_02) was rejected at a 95% confidence level. This result suggested that Kuching campus' respondents had lower perception of academic self-efficacy in mathematics as compared to Kota Kinabalu respondents.

Table 2: Independent Samples *t* - test for CASES

Campus	Mean	SD	*p* - value
Kuching	3.637	0.415	0.023*
Kota Kinabalu	3.786	0.478	

*Note: * indicates significance at 0.05 (p < 0.05)*

H_o3: There is no significant difference in students' perception of academic self-efficacy in Mathematics based on mathematics achievement.

From Table 3, it was reported that there was a significant difference on respondents' perception of academic self-efficacy in mathematics based on mathematics achievement [F (4, 195) = 2.662,]. Thus, the null hypothesis (H_05) was rejected, and at least one pair of mean score showed a statistically significant difference. Consequently, the Post-Hoc comparisons using Tukey HSD method showed that the mean difference for Distinction-Average Pass pair was significantly different than the other pairs of mean (*p* - value = 0.023 < 0.05). This indicates that respondents with higher grade level perceived academic self-efficacy in mathematics positively as compared to those of lower grade levels.

Table 3: ANOVA Result for CASES

	SS	df	MS	F	*p* - value
Between Groups	2.163	4	.541	2.662	0.034*
Within Groups	39.621	195	.203		
Total	41.784	199			

*Note: * indicates significance at 0.05 (p < 0.05)*

H_o4: There is no significant relationship between mathematics learning environment and academic self-efficacy in Mathematics.

In Table 4, the two variables were positively correlated to one another. Based on the scale illustrated, the relationship between CUCEI and CASES, was quite low with r = 0.344, n = 200. Therefore, the null hypothesis (H_{04}) was rejected at a 99% confidence level. This result suggested that there is significant positive relationship between mathematics learning environment and academic self-efficacy in Mathematics.

Table 4: Correlation analysis

		CASES
CUCEI	Pearson Correlation	0.344
	Sig. (2-tailed)	0.001*
	N	200

H_o5: There is no significant influence of mathematics learning environment and academic self-efficacy towards mathematics achievement.

Table 5.1 illustrates five model summaries. All five models portrayed a low positive correlation coefficient (R), where Distinction grade has the highest correlation (0.235) and Fail grade has the lowest (0.112). The coefficient of determination (R^2), on the other hand, also showed quite low values, indicating that little of the variation in the dependent variable (mathematics achievement/ grades) can be explained by variation in the independent variables (learning environment and academic self-efficacy). The highest coefficient of determination was from the Distinction grade (5.5%) whereas the lowest were from the Credit and Fail grades (1.3%).

Table 5.1: Model Summary

DV	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.235	0.055	0.041	0.410
2	0.113	0.013	- 0.002	0.412
3	0.121	0.015	0.000	0.489
4	0.193	0.037	0.023	0.349
5	0.112	0.013	- 0.003	0.157

Referring to Table 5.2, five multiple regressions were analysed at once. It was found that the learning environment construct only significantly predicted on the grade Distinction (1), with and p – value = 0.011 (< 0.05). Thus the null hypothesis ($H_0$5) for the first model was rejected at a 95% confidence level.

Table 5.2: ANOVA for the Regression Equation

DV		SS	df	MS	F	Sig.
1	Regression	1.926	3	0.642	3.819	0.011*
	Residual	32.949	196	0.168		
	Total	34.875	199			
2	Regression	0.429	3	0.143	0.841	0.473
	Residual	33.326	196	0.170		
	Total	33.755	199			
3	Regression	0.697	3	0.232	0.971	0.407
	Residual	46.883	196	0.239		
	Total	47.580	199			
4	Regression	0.926	3	0.309	2.535	0.058
	Residual	23.869	196	0.122		
	Total	24.795	199			
5	Regression	0.061	3	0.020	0.833	0.477
	Residual	4.814	196	0.025		
	Total	4.875	199			

Since the rest of the models had a p-value of 0.473, 0.407, 0.058, and 0.477 respectively, which were more than 0.05, both constructs did not significantly predict on the remaining grades (Credit, Pass, Average Pass and Fail). Thus, the null hypotheses for all four models were rejected at a 95% confidence level.

8. Conclusion

Results of independent samples t-tests portrayed that both variables had a significant difference between Kuching and Kota Kinabalu campuses. The only similarity between these tests was students from Kuching campus had lower mean score on both variables as compared to those in Kota Kinabalu campus. These findings suggested that students in Kota Kinabalu campus had better mathematics learning environment, and were more confident in solving mathematical problem.

Moreover, looking into the differences based on mathematics achievement, the one-way ANOVA analysis reported that there were four pairs of mean that showed significant difference in both variables. Two of the pairs were from learning environment variable that indicated a significant difference between Distinction-Pass and Distinction-Average Pass. Meanwhile, from academic self-efficacy variable revealed that the Distinction-Average Pass pair of mean had a significant difference. This implied that students who obtained Distinction for mathematics had higher perception on both variables as compared to those who obtained Credit and below.

The result of the correlation analysis, on the other hand, indicated that there were positive relationships between the variables. As stated by Dorman *et al.* (2003), learning environment is significantly associated with academic self-efficacy. However, in this study there was only a low positive relationship (r = 0.344).

Finally, the outcomes of the multiple regression analyses reported that mathematics achievement of grade Distinction could be significantly predicted by only one variable, which was learning environment. Meanwhile, the other variable (academic self-efficacy) had no influence on mathematics achievement. These results obviously revealed an inconsistency with the findings in the literature that proved both variables to be associated with mathematics achievement (Dorman *et al*., 2003; Chionh and Fraser , 2009; Fraser and Khale, 2007; Rizwan and Rafaqat, 2010).

This basically meant that even though students have perceived learning environment and academic self-efficacy as high or positive, it is yet not a good predictor for mathematics achievement in Masterskill Global College. This is probably due to the fact that the college might had a conducive learning environment, students would have liked the subject and have confidence in answering or solving mathematical problem beforehand. Consequently, it could be caused by other contributing factors such as socio-economic, family and psychosocial problem, knowledge background, as well as peer influence.

The results of this study demonstrated a new breakthrough in the relationship of the independent variables involved (learning environment and academic self-efficacy) towards mathematics achievement. Students who had positive perception on their mathematics learning environment do not necessary have good grades in mathematics; and students who had positive perception on their academic self-efficacy in mathematics also might not develop better grades in the said subject as well. In addition, this study provides empirical evidence that there is a difference between allied health and engineering technology students when it comes to utilizing learning environment in predicting students' achievement in mathematics. It was clear that the variable alone would not influence achievement, and would have been caused by other contributing factors. The outcomes of the findings also suggested that only learning environment can predict one grade in mathematics achievement that was Distinction, whereby students with positive learning environment would have the tendency to get good grades.

Although these variables had no influence on achievement in mathematics, the importance of having positive judgement on both variables among college students are vital. This is because in order to ensure that they can perform well in mathematics, students need to be developed holistically. As stated in our National Education Philosophy (NEP), education in Malaysia is to produce individuals who are intellectually, spiritually, emotionally and physically balanced. In this case, students seem to be physically, emotionally and spiritually balanced for the had good environment, attitude and confidence. But, they might be lack of intellectual ability, which could be researched on in the near future.

Consequently, results from this study can be generalized to the population of all nursing and allied health college that offers similar programs and core subjects. Here, instead of using CUCEI and CASES questionnaires in predicting achievement, academicians can use them to identify the strengths and weaknesses in their teaching and learning process, for it could identify poor mathematics learning environment, poor attitude towards mathematics or poor academic self-efficacy in mathematics. That way, they could focus on improving their weaknesses and at the same time, maintain the strengths of their teaching strategies.

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