

## The Relationship between Self-Efficacy and Academic Performance among Engineering Students in Universiti Teknologi Malaysia

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### Abstract

The field of engineering and mathematics are interconnected with each other. Thus, the engineering students need to perform well in their mathematics skill in order to get better grades. However, not everyone has the courage and confident when it comes to mathematics. Therefore, this study was conducted to determine the level of self- efficacy and academic performance of the UTM's engineering students and to know whether there is a relationship between self-efficacy and academic performance among them. This study adopted the set of questionnaire from the Sources of Mathematics Self-Efficacy (SMES) and it was distributed to 107 final year students from Bachelor of Electrical and Electronic Engineering, UTM. The self-efficacy was measured by using the four dimensions, which were mastery, vicarious experience, social persuasion, and emotional and physiological states. The result revealed that self-efficacy had a positive significant but weak relationship with the academic performance among the respondents. Finally, suggestions are offered for the UTM's curriculum developer to reconsider self-efficacy in designing the academic modules, as well as the recommendations to the future research.

**Keywords:** Self-efficacy, mathematics, engineering major, academic performance

### 1. Introduction

Mathematics is the core subjects that must be learned by engineering students (Heinze *et al.*, 2003). However, there are issues that highlight some of these students do have the mathematics phobia (Ellis, Abrams, & Abrams, 2009). This is because the students are required to possess skills such as critical thinking, problem solving and some complicated calculation in numbers when solving the mathematics problems (Louis & Mistele, 2012). They need to believe in themselves that they can solve the mathematics problems. Therefore, self-efficacy is essential in helping the students to solve the task given. According to Bassi *et al.*, (2007), students with high self-efficacy is said to be more successful because they are able to adapt effective learning strategies. Furthermore, people with high motivation in doing action usually result in the desired outcome since they believe they have the ability to act in that way (Brady, 2009). Thus, if the students believe they can solve the mathematics task given to them, they can perform well and achieve good academic grades.

According to Brady (2009), by looking at their cumulative grade point average (CGPA) in each semester, it represents their efforts and performance in total. The academic performance was measured through their CGPA. In academic setting, self-efficacy does play an important role in managing students' performance (Brady, 2009). Moreover, the previous research also shows that there was a relationship between self-efficacy and academic performance among students (Shkullaku, 2013). Therefore, the study is conducted to determine the relationship between self-efficacy and academic performance especially among the engineering students that have most of the mathematics subjects to contribute to their academic performance.

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## **2. Literature Review**

### **2.1. Self-Efficacy**

Self-efficacy theory was first introduced by Albert Bandura, named as Social Cognitive Theory (Bandura, 1977). It is basically emphasizing on the cognitive component exists in human being. It also stress on the understanding in human learning and motivation (Byard & Sally, 2011). According to Bandura, people learn everything through several ways. Usually, they start by observing and modelling others performing something. He then claimed that after learning something, people create a mental representation tasks. This includes specific for its performance, its purpose, and its implication on social. They also evaluate their own experiences and thought process. Hence, he produced four sources of self-efficacy which consist of mastery, vicarious experience, social persuasion, as well as emotional and physiological states.

The first source of self-efficacy is mastery, where according to Bandura (1977), it is about someone's personal achievement in the past that may give effects to the upcoming task to be performed. Next, is through vicarious experience. This is where people learn to build their efficacy belief by observing others performing the task. They compared themselves with particular individual around them such as friends, parents or lecturers in performing the certain tasks (Usher & Pajares, 2009). Third, is through social persuasion, where they get persuasion and encouragement from surrounding to enhance the self-efficacy. Lastly is through emotional and physiological states such as anxiety, stress, fatigue, and mood (Bandura, 1977). These four sources determine how they build self-efficacy within themselves. Therefore, the first objective of this study is to determine the level of self efficacy among engineering students in UTM.

### **2.2. Academic Performance**

Academic performance can be conceptualized as an outcome measures (Bandura, 1997), and demonstrates the level of competence and effort performed by students that parallels expectations in many career paths (Brady & Fuertes, 2011). In this study, academic performance will be measure by using the Cumulative Grade Point Average (CGPA) obtained from the total of the Grade Point Average (GPA) every semester. According to Pejabat Pendaftar Bahagian Pengurusan Akademik (2010), there was a calculation done to measure the CGPA. The GPA obtained from every semester is calculated by the summation of the credit hours times with the pointer for that semester and dividing it with the summation of credits counted for that semester. Meanwhile, the CGPA is the total of the GPA from every semester. Therefore, it is calculated by the summation of credits hour times with pointer for all semesters and dividing it with the summation of credits counted for all semesters. From this model, students can know their level of academic performance. Therefore, the second objective of this study is to determine the level of academic performance among engineering students in UTM.

### **2.3. Relationship between Self-Efficacy and Academic Performance**

A study was done by Meral *et. al.*, (2012) to investigate the relationship between self-efficacy and academic performance. The result shows that there was a positive significant correlation between self-efficacy and academic performance. Also, the result indicated that students with the most gain in self-efficacy belief demonstrated the highest level of achievement in mathematics (Meral *et. al.*, 2012). Apart from that, Al-Harthy and Was (2013) also revealed that there was a positive significant correlation between knowledge monitoring, self-efficacy, mastery experience goals and total exam score. This finding also showed that self-efficacy did have positive relationship with the academic performance (Al-Harthy & Was, 2013). Other than that, Shkullaku (2013) also found that students' self-efficacy did influenced their academic performance.

Furthermore, Nicolaido and Philippou (n.d.) found that there is a strong relationship between self-efficacy and achievement. The result found that self-efficacy was the more powerful predictor than attitudes in the achievement (Nicolaido & Philippou, *n.d.*). Meanwhile, Loo and Choy (2013) revealed that among all the four sources of self-efficacy, mastery was the strongest predictor when predicting academic performance among the engineering students. Therefore, the third objective of this study is to determine the relationship between self efficacy and academic performance among engineering students in UTM.

### 3. Methodology

This study adopted the set of questionnaire called Sources of Mathematics Self-efficacy Scales (SMES) developed by Usher and Pajares (2009). The questionnaire was divided into two parts, which consist of Part A and Part B. Part A was the demographic background which consist of the gender, race, age, as well as the CGPA of the respondents. Part B measured the self-efficacy of the respondents in terms of their mathematics self-efficacy. It consists of 24 items from four dimensions, which are on mastery, vicarious experience, social persuasion, and also emotional and physiological states. All of these four dimensions were represented by the six items respectively. Meanwhile, the academic performance was measured through the CGPA located under the demographic background. The level of measurement used for all of the items was the nominal scale. In addition, the Likert-scale ranged from strongly disagree (1), disagree (2), less agree (3), agree (4), strongly agree (5) were used in the Part B. The Statistical Package for Social Science (SPSS) version 18 was used to analyze all the data.

Participants in this study consist of 107 final year engineering students from the Bachelor of Electrical Engineering, UTM. The questionnaires were distributed to the total population of 118 students. However, only 107 students managed to complete the questionnaire, 8 students refused to answer, while the other 3 set of questionnaires being rejected because of the incomplete answer. Majority of the respondents were males (56.1%), while 43.9% were female students. The respondents were from various races, with majority of them were Malay (71%), followed by Chinese (17.8%), and the rest (10.3%) were from Bidayuh, Tidong, Sungai, as well as the foreigners from Arabs, Yemeni, and African. Most of them were between 22 to 24 years old (92.5%), followed by 3.7% aged between 19 to 21, and only 1.9% aged between 25 to 27 years old.

### 4. Findings

#### Objective 1: To Determine the Level of Self-Efficacy among the Engineering Students in Universiti Teknologi Malaysia

Table 1 presents the mean and standard deviation of the four dimensions of self-efficacy. This includes mastery experience, vicarious experience, social persuasion, as well as emotional and physiological states. The level of self-efficacy according to the dimensions of self-efficacy is also presents in Table 1.

**Table 1:** Level of Dimensions of Self-Efficacy

Self-Efficacy Dimensions	Mean Score	Standard Deviation (SD)	Level of Self-Efficacy
Mastery experience	3.91	.5534	High
Vicarious Experience	3.76	.5661	High
Social Persuasion	3.54	.7549	Moderate
Emotional and Physiological States	3.83	.8006	High
Overall	3.76	.4818	High

Based from the above table, the mean scores gain in all the four dimensions for self-efficacy are between 3.56 to 3.93. For the mastery experience dimension, the mean score obtain is the highest among the four self-efficacy dimension, with a total of 3.91. This is followed by the emotional and physiological states with 3.83, vicarious experience dimension with 3.76 and social persuasion dimension with total mean score of 3.54. In addition, the overall mean scores for all the four dimensions are 3.76. Other than that, the highest standard deviation obtain is .80, from the emotional and physiological states dimension. This is followed by the social persuasion dimension with .75, vicarious experience dimension with .57 and the lowest standard deviation is from the mastery experience dimension, which is .55. Besides, the overall standard deviation from all four dimensions is .48.

Table 2 shows the distribution of respondents for the total level of self-efficacy. The level of self-efficacy is measures with the high, moderate and lower level. The frequency, percentage and overall mean score for self-efficacy are also show in the Table 2.

**Table 2:** Distribution of Respondents' Total Level of Self-Efficacy

Self-Efficacy Level	Frequency (f) N=107	Percentage (%)
Low	0	0
Moderate	50	46.73
High	57	53.27
<b>Overall Mean Score = 3.76</b>		

Based from the table, majority of the respondents (53.27%) had a high level of self-efficacy and the rest of the respondent (46.73%) had the moderate level of self-efficacy. There was no respondent who had the low level of self-efficacy.

### Objective 2: To Determine the Level of Academic Performance among the Engineering Students in Universiti Teknologi Malaysia

Table 3 presents the level of academic performance among the respondents. The mean and standard deviation are use to measure the level of academic performance. Academic performance is measure through the overall CGPA of the respondents.

**Table 3:** Level of Academic Performance

Academic Performance	Mean Score	Standard Deviation (SD)	Level of Academic Performance
Overall	3.23	.5422	Moderate

Based from the table 3 above, the overall mean score for academic performance was 3.23 and was consider as moderate level of academic performance. Apart from that, the overall standard deviation obtained was .54. Other than that, Table 4 shows the distribution of respondents' total level of academic performance. The level of academic performance is measure through the high, moderate and low level.

**Table 4:** Distribution of Respondents' Total Level of Academic Performance

Academic Performance Level	Frequency (f) N=107	Percentage (%)
Low	6	5.6
Moderate	70	65.4
High	32	29.1
<b>Overall Mean Score = 3.24</b>		

Based on the table, majority (65.4%) of the respondents obtained moderate level of academic performance. Apart from that, 29.1% of the respondents obtained high level of academic performance while only 5.6% of the respondents obtained low level of academic performance.

### Objective 3: To Determine the Relationship between Self-Efficacy and Academic Performance among the Engineering Students in Universiti Teknologi Malaysia

Table 5 shows the correlation between self-efficacy and academic performance among the final year Bachelor of Electrical Electronic Engineering students in UTM. The values, directions and significance of the relationship between the self-efficacy and academic performance among respondents were analyzed by using the Pearson's correlation coefficient. A two tailed statistics was selected as the non-directional hypothesis was acquired in this research.

**Table 5:** Correlation between Self-Efficacy and Academic Performance

Variables	r	p
Mastery experience	.494**	.000
Vicarious experience	.339**	.000
Social Persuasion	.161*	.049
Emotional and physiological states	.274*	.004
<b>Self -Efficacy</b>	<b>.246*</b>	<b>.011</b>

Note: \*\* P<0.01, \* P <0.05 (2-tailed); N=107

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Based from the Table 5, the value of Pearson correlation ( $r$ ) between self-efficacy and academic performance was 0.25. The sign of the correlation coefficient indicated that the relationship between self-efficacy and academic performance was positive. In other words, this shows that as the level of self-efficacy increases, the level of academic performance also increases. The significance value is 0.011, which is less than 0.05 ( $p < 0.05$ ). Hence, it indicated that the result had a significant relationship between self-efficacy and academic performance. However, the value for correlation coefficient was only 0.25 indicated that there was only weak relationship between self-efficacy and academic performance.

## 5. Discussion and Conclusion

In this study, the first objective is to determine the level of self-efficacy among the engineering students in UTM. The finding of this study shows that there is a high level of self-efficacy among the respondents. This finding is congruent with the study done by Javed and Nizami (2012). According to the study, the result showed that there is high level of self-efficacy among the students (Javed & Nizami, 2012). Therefore, generally it indicates that students have high belief that they have the ability to do and solves problems regarding mathematics.

Other than that, the finding of this study also shows that a high level of self-efficacy in terms of mastery experience, vicarious experience as well as emotional and physiological states among the students. This finding is supported from a study conducted by Cantrell *et al.* (2013), where the finding of the study showed that students possessed a high level of self-efficacy for mastery experience, vicarious experience and also emotional and physiological states (Cantrell *et al.*, 2013). Furthermore, a study done by Loo and Choy (2013) also revealed that there was high level of self-efficacy on all four sources of self-efficacy among the students. Thus, this finding generally indicates that the sources of self-efficacy did come from their own performances experiences, modeling and observing their friends and lecturers performed the mathematics tasks, and managed to control their emotional and physiological states when doing mathematics very well.

Apart from that, among all of the four sources of self-efficacy, social persuasion is the only source that had moderate level among the students. The finding is not consistent with previous study done by Loo and Choy (2013) that had a high level of self-efficacy on the social persuasion. Besides, the previous study done by Cantrell *et al.* (2013) also showed that social persuasion was high among the students. The finding indicates that final year Electrical and Electronic Engineering students rarely hear the encouragements that they are good at learning mathematics or that they have talent in mathematics.

The second objective in this study is to determine the level of academic performance among the engineering students in Universiti Teknologi Malaysia. The finding of this study shows that students had a moderate level of academic performance. Thus, it indicates that majority of final year Electrical and Electronic engineering students had their CGPA above 2.00 and can be classified as good pass.

Besides, the finding of this study is supported by the previous study conducted by Nur Jumaadzan Zaleha Mamat and Fatin Fasihah Mazelan (2010) on the learning encouragement factors and academic performance for the science and technology students in Univeristi Kebangsaan Malaysia. The result of that study show that majority of the students have a moderate level of academic performance (Mamat & Mazelan, 2011). This result is also similar with a study done by Tabesh and Hukai (2013) on the level of academic performance of 208 students at the Midwest universities. The result also revealed that majority of the students had a moderate level of academic performance (Tabesh & Hukai, 2012).

The third objective in this study is to determine the relationship between self-efficacy and academic performance among the engineering student in Universiti Teknologi Malaysia. The finding of this study shows that there is a weak but significant relationship between self-efficacy and academic performance among the final year Electrical and Electronic engineering students in UTM. Furthermore, the results indicates that students' performance in mathematics tests and assignments, modeling and observing others performing the mathematics task, persuasion and encouragement from the surrounding, as well as the emotional and physical states when doing mathematics, did influence their grades and academic performance.

The finding is supported by a previous study done by Amoon (2008), where it shows that there was a significant positive relationship between self-efficacy and academic performance. Furthermore, there are also studies done on students, and the results show a significant result between self-efficacy and academic performance among students (Ayotola & Adedeji, 2009; Meral *et al.*, 2012; Shkullaku, 2013).

In addition, the finding of this result is also corroborate with a study done on a group of undergraduate students enrolled in Educational Psychology course at Midwestern University, and conducted by Al-Harthy and Was (2013). They found that there was positive significant correlation between knowledge monitoring, self-efficacy, mastery experience goals and the total exam score. Based from the finding, it indicates that self-efficacy do have a positive relationship with the academic performance among the students (Al-Harthy & Was, 2013).

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In conclusion, as the result shows that there is a weak but positive significant relationship between self-efficacy and academic performance, it indicates that self-efficacy did give influence to student's achievement in academic. Thus, the management and lecturers should give more attention and encourage the blooming of self efficacy elements among students during the teaching and learning process, especially in mathematics subjects. Perhaps, the UTM curriculum developers, especially the mathematics subjects' experts, can help in designing the modules that embed self-efficacy elements among the students.

The lecturers can also play their role to increase the academic performance among the students. They can help the students to increase their level of self-efficacy by giving more encouragements. For example, the lecturers can always praise the students' efforts that they have show in learning mathematics subject, even though they may not get the good marks. Indirectly, they will feel motivated and willing to learn more. Accordingly, it will increase their level of self-efficacy of the student as well as their academic performance

## **6. Recommendation for Future Research**

For the future research, it would be beneficial for other researcher to conduct the same study in different populations and domains as the result may differ in other populations and domains. Hence, it will help to further examine and extend the findings that were presented in this study.

Secondly, it may be worthwhile for the other researcher to further examine if students' self efficacy in mathematics subject can indeed be a strong predictor for their academic performance. Perhaps there are other predictors that could come together with this self efficacy variable to influence the academic performance of students in engineering course. Therefore, the future research can also focus on others variables in determining the students' academic performance.

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