

Correlational Analyses Between Mathematics Anxiety and Mathematics Achievement Among Vocational College Students

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Abstract

Students with mathematics anxiety have always been found different from their non-anxious peers on measures of mathematics performance. The current study investigated the phenomenon of mathematics anxiety among vocational college students and its relationship with mathematics achievement. A total of 150 second year students were selected to complete the mathematics anxiety scale. Relative mean analysis indicated that 50% (n=75) of the samples were categorized as mathematics anxiety students. Bivariate correlation analysis revealed that a significant negative correlation exists between mathematics anxiety and mathematics achievement. The results of simple regression showed that mathematics anxiety was a significant predictor of mathematics achievement. Findings of this study suggest that the phenomenon of mathematics anxiety among vocational college students should be addressed in order to ensure that they can perform well in mathematics courses and thus achieve their aims to graduate successfully.

Keywords: Mathematics anxiety; mathematics achievement; vocational college

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1.0 INTRODUCTION AND BACKGROUND

Fostering scientific and technological culture among Malaysians is important to achieve the position of a developed country. For this purpose, producing knowledgeable and highly skilled labor and human capital must be emphasized through the implementation of science, technology, engineering and mathematics (STEM) education in the national development plans so that the economy of the country can grow steadily. Specifically, mathematics is one of the subjects that must be mastered by the students to ensure that they could keep pace, adapt and operate with the advances of technology-centered world [1].

In Malaysia, vocational college is one of the institutions entrusted to carry out responsibility in enhancing STEM education. This is very significant because report revealed that many job opportunities will be created through the execution of economic transformation program (ETP) that require technical and vocational education (TVE) qualifications [2]. Thus, it should be noted that TVE becomes a crucial factor in producing workers who are equipped with high technical and literacy towards technology [3]. One of the initiatives implemented by the government to achieve this mission is by upgrading the TVE facilities through the establishment of more vocational colleges. In 2012, a total of 15 vocational secondary schools become the apprentice of vocational colleges. Additionally, the curriculum of the vocational schools was revamped to meet the required standards [4]. High standard is set for the TVE system by the

government to produce high number of national skilled workforce that in accordance with the demands of the industry.

Focusing on the students' achievement of required skills and knowledge is essential to ensure that the students of vocational schools can survive throughout their program of study. Literacy and numeracy skills must be given extra attention especially at early level of their study to minimize the drop-out rates. For that purpose, mathematics becomes one of the subjects that is emphasized as reported in the 10th Malaysian plan. The TVE will have a component of literacy, numeracy and acquisition of various languages [5]. This initiative indicated that more emphasis must be given to the students' mathematics achievement.

Student's academic achievement is a complex phenomenon but it has always been used as an indicator to measure student's learning and understanding. Specifically, mathematics anxiety is one of the affective variables that related to the students' mathematics achievement. Mathematics anxiety generally refers to an uncomfortable situation that exists when a student is required to perform mathematical tasks during the teaching and learning process or examination in or outside the classroom [6-8].

Previous research revealed that this phenomenon was experienced not only by the primary school students but also secondary school, college or even university students [9-10]. This situation could also be suffered by people of any age including the mathematics teachers themselves. Anxious towards mathematics experienced by the mathematics teachers indirectly may be transferred to the students which eventually affect the teaching and learning process [9]. Mathematics anxiety is associated with

the subsequent learning mathematics constraint such as avoidance of mathematics courses, particularly advanced mathematic courses [11-12]. Resultantly, the students form negative attitude toward activities involving mathematics.

Based on the abovementioned statements regarding the advancement of TVE and the impacts of mathematics anxiety to students, the current study was carried out to investigate the phenomenon of mathematics anxiety among vocational college students and its relationship to the mathematics achievement. The study was guided by the following three research questions:

- i. What is the relative level of mathematics anxiety among the respondents?
- ii. What is the relationship between mathematics anxiety and mathematics achievement?
- iii. How much can mathematics anxiety predict mathematics achievement?

2.0 RESEARCH METHODOLOGY

A total of 150 second year vocational college students who are taking different programs of study (technology of electric, technology of electronics, technology of automotive, technology of welding, technology of industry, technology of construction and technology of refrigeration) involved in this study. The respondents were required to provide their response to mathematics anxiety scale. The survey employed a 4-point Likert scale which measured four constructs of mathematics anxiety which are appraisal, bodily reaction, emergency response and facial expression. The reliability of the overall items and each of the constructs is shown in Table 1. Relative mean analysis was conducted to identify the frequency of students suffering mathematics anxiety. The identification of mathematics anxious student is based on the mean of each student who scored higher than overall mean value. Meanwhile, Pearson correlation and simple linear regression analysis were applied to identify the relationship pattern between mathematics anxiety and mathematics achievement.

Table 1 Item reliability analysis

Constructs	Reliability Coefficient
Appraisal	0.95
Bodily Reaction	0.84
Facial Expression	0.94
Emergency Response	0.92
Overall	0.96

3.0 RESULTS AND DISCUSSION

3.1 Mathematics Anxiety among Vocational College Students

Mathematics anxiety was measured through four constructs (appraisal, bodily reaction, emergency response and facial expression) and the mean value for each construct is shown in Table 2.

Table 2 Mean analysis

Constructs of Mathematics Anxiety	Mean Value
Appraisal	2.92
Bodily Reaction	2.57
Facial Expression	2.42
Emergency Response	2.42
Overall	2.62

The overall mean value for mathematics anxiety was 2.62 which is relatively high. Meanwhile, relative mean analysis showed that out of 150 respondents, 75 students (50%) scored higher mean value than the overall mean value of mathematics anxiety. This indicated that there was high percentage of students experiencing mathematics anxiety.

The phenomenon of mathematics anxiety among school students in Malaysia could be related to the culture of the Asian community that perceived high school performance as the indicator of students' excellence and success especially in mathematics. Parents usually set a very high expectation and hope towards their children. They expect their children to get a good grade in mathematics. In the context of vocational education in Malaysia, TVE is labelled as a second class education by many peoples. In fact, students who registered at vocational colleges are often associated with the low academic achievement. Although various initiatives have been taken to change the reputation of the TVE as one of the Malaysia mainstream education, the mentality of the society seems does not show much different [13-14]. Underestimation towards the vocational college students' reputation poses great conflicts to the students when they fail to prove their ability in mathematics. This situation will elevate their worries on the enhancement of negative perception towards their parents or teachers. Furthermore, the existence of competition element among peers, classmates or even siblings specifically in normative evaluation will induce the feeling of anxious towards mathematics in order to be perceived as competent enough to compete with each other [11].

The exam-oriented Malaysian education system also has a great potential to give pressure on students to set a high target in their mathematics performance. Students will feel inferior when thinking about their failure or poor results in mathematics achievement since mathematics is one of the subjects considered for college or university admission. Students with good mathematics achievement are perceived able to get through rigorous study demanded in higher education institution.

The respondents of this study were second year students who have gone through their first year mathematics assessment. These students will sit for second year mathematics examination which the results of the examination will be counted in their cumulative grade point average (CPA). Their CPA score will determine whether or not they are able to continue their study in third year which is the diploma level. In line with the findings of the study by [15] which stated that senior students will have high level of mathematics anxiety as compared to their junior because of the more pressure they feel to perform well in their mathematics course that is the ticket for them to pursue their study in future. Additionally, the results of the examination for the first second year of vocational college students are very crucial for their future. This is because the vocational college students did not sit for the national examination called Malaysia Education Certificate (equivalent to British O-level). Thus, the students need to strive for excellence in the second year of their study including getting a good grade for the mathematics subject.

3.2 Relationship between Mathematics Anxiety and Mathematics Performance

The results of bivariate correlation (refer Table 3) showed that mathematics anxiety was negatively correlated with mathematics achievements and the relationship was significant.

Table 3 Correlation Analysis

	Mathematics Achievement
Mathematics Anxiety	-0.409**

Significance level=0.01 (2-tailed)

Mathematics anxiety is found to be an affective variable which has great impacts on all aspects of teaching and learning mathematics [15]. It is also correlated to many mathematics learning problems such as low mathematics achievement among school students [11]. High anxious students usually have poor mathematics performance. One of the significant rationales for this is the students feel distracted especially during mathematics test or examination in school [16].

The negative relationship between mathematics anxiety and mathematics achievement could be explained by considering two important dimensions of anxiety which are emotionality and worry. Emotionality refers to the perceived psychology response such as autonomic response or somatic response [17-19]. For example, in an evaluation situation, a person will experience physiological reaction such as higher rate of heart pulse, dizziness, diarrhea and panic [18, 20-21]. Emotionality level correlates to low level of achievement when an individual experience high level of worry.

Meanwhile, the dimension of worry refers to the cognitive aspect related to test or examination taking such as negative expectation or hope. Worry is a component of anxiety which found to be strong, consistent and negatively correlated with achievement and also primer predictor of performance [20-23]. Besides, this dimension always related to cognitive mathematics anxiety which refers to cognitive reaction towards the situation before, during or after the evaluation. Previous research revealed that the worry dimension contributes to the more variance of performance rather than emotionality dimension is parallel with the results of current study which showed that the higher value of mean for the construct of evaluation compared to others (bodily reaction, emergency reaction and facial reaction) which related to emotionality dimension.

By taking account the cognitive distraction model, highly tested anxious individual will have poorer performance because of their inability to control their negative thoughts including worries of bad outcomes, comparing their abilities with peers and also unprepared to sit for their test or exam during the evaluation process [24-25]. This situation related to the cue utilization concept. Students who suffering from high test anxiety will experience attention distraction towards the unnecessary or cues with the given tasks or feeling hard to identify the range of possible cues and also allowing incompatible thoughts to distract their aware state which in turn affects their performance on the respective test [25].

As for this study, the respondents were also likely to have negative thought during the examination. Feeling worry for the bad results and the possibility to dissapoint their teachers or parents for unable to fulfill their expectation and hope are the most possible thought of them. This is due to the curriculum of the vocational college system which still emphasized more on examination results in determining students competency. The weightage for calculating students overall achievement is 70 for final examination results while the other 30 is allocated for school-based assessment.

3.3 Mathematics Anxiety as the Predictor for Mathematics Achievement

Mathematics anxiety affecting students' mathematics achievement through the cognitive interference experienced by the students. This interference could occur during the mathematics class or taking mathematics test or examination. When this happens, students feel hard to retrieve or remember back the things that they already learned or memorized before [25]. Consequently, they are unable to give their best answers and solutions on the exam paper resulting poor achievement.

The cognitive interference could be experienced by the students when they are preparing for their test or examination. For example, too much thinking on the questions such as "how much my classmates have learned", "how much mathematics exercises my classmates have already done" or "what if my classmate perform better than me in mathematics?" are the sources in inducing the interference [21, 25]. Apart of that, the cognitive interference model is supported by Information Processing Model introduced by Naveh-Benjamin which proved that students who experiencing test anxiety and face difficulty in the stage of processing information are incapable to code, organize and retrieve information.

However, it should be noted that mathematics anxiety only contributed about 16.7% of unique variance of mathematics achievement (refer Table 4). This indicates that there are still many other factors that could be the predictor of students mathematics achievement. Hence, future study should be carried out by considering others potential variables in predicting mathematics achievement such as self-efficacy [26] or self-regulation [27].

Table 4 Regression analysis

Model (d)						
Model	R	R Square	Adjusted R Square		Std. Error of the Estimate	
1	.409 ^a	.167	.161		16.24977	
ANOVA (d)						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7839.366	1	7839.366	29.688	.000 ^b
	Residual	39080.134	148	264.055		
	Total	46919.500	149			
Coefficients (d)						
Model		Unstandardized coefficients	Standardized Coefficients		t	Sig.
		B	Std. Error	Beta		
1	(Constant)	110.536	9.315		11.867	.000
	Mathematics Anxiety	-.190	3.522	-.409	-5.449	.000

a. Dependent Variable: Mathematics Achievement

b. Predictor: (Constant): Mathematics Anxiety

■4.0 CONCLUSION

TVE aims to produce large number of skilled human capital supply that can immediately be used in Malaysia job market through high allocation for vocational education for students who have the tendency in the respective field. Apart from the attainment of technical skills, the core subject like mathematics also must be mastered by the students. The importance of mathematics to students is clearly reflected in any education systems. This subject is frequently considered difficult and unpleasant by many students. As a result, many students give up trying to learn it by heart while others quite satisfied with their existing achievement in solving mathematical problems.

Mathematics affects many aspects of life and it is impossible to escape from the application of mathematics. Therefore, awareness about the importance of the ability to apply mathematics knowledge and skills in the career world should be created among students. The importance of the acquisition of mathematics knowledge and skills can be seen for the students and for the nation. Thus, any element of prevention for students' mathematics achievement including mathematics anxiety should be resolved and not taken for granted. To reduce the level of math anxiety, it is necessary to minimize the negative effect of math anxiety during the examination situation so that the students will not held by negative thought. The myth of second class education of TVE must be eliminated from the mind of all since it acts as one of the barriers to encourage students to keep motivated in learning mathematics.

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