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To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v9-i13/6239> DOI: 10.6007/IJARBSS/v9-i13/6239

Received: 20 March 2019, **Revised:** 12 June 2019, **Accepted:** 27 July 2019

Published Online: 20 August 2019

In-Text Citation: (Muda, Halim, Hashim, & Mohamad, 2019)

To Cite this Article: Muda, W. H. N. B. W., Halim, F. B. A., Hashim, S. Bin, & Mohamad, S. F. A. B. S. (2019). Technical Students' Achievement in Mathematics Using Visual Learning Method. *International Journal of Academic Research in Business and Social Sciences*, 9(13), 36–43.

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Special Issue: Revolutionizing Education: Challenges, Innovation, Collaboration, 2019, Pg. 36 - 43

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Technical Students' Achievement in Mathematics Using Visual Learning Method

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Abstract

This study aims to identify student performance in Mathematics through the topic of Function using visual learning method. Case study was employed for this study and a mathematics test which composed of two questions that covered topic of Function were administered to 72 selected technical students in University Tun Hussein Malaysia. This study revealed that technical students performance in Mathematics are average to low. The result showed that 8.3% of the students answered correctly, 69.4% answers the questions half correct while the rest got below 4 marks. The most common error made by students were found to be sketch the graph based on the equation given. This study revealed that technical students have a poor visual learning method in Mathematics II. This is shows that the lecturer need to emphasize visual learning method to assist students gain more understanding of this method and applied them on the right topics in Mathematics.

Keywords: Visual Learning Method, Technical Students, Students' Achievement

Introduction

Mathematics is a mandatory subject in the Malaysian education system because Mathematics is the basis of Science and Technology. Students at Faculty of Technical and Vocational Education (FTVE) are educational students with technical and vocational skills have to take Mathematics as a core subject. With mastery in Mathematics subjects, students will be easier to understand the concepts of engineering and principles taught in the faculty especially when they are studying elective subjects. Moreover, it is one of the important subject for countries with developing economies, since Mathematics enables students to choose careers in the fields of engineering, the natural sciences, accountancy, and many others crucial to support economic development (Makgato & Mji, 2006). Achievement in mathematics is linked to future career opportunities, plays an important role in the level of the students general learning acquisitions.

Teaching Mathematics in the classroom required effective learning method. The steps and procedures implemented are to enable the learning objectives to be achieved effectively. The methods used should exposed students the opportunity to solve a Mathematical problem quickly and

thus can focus more on the basic concepts of Mathematics. According to Idris (2008), the use of new learning methods should be able to provide students with future worlds as well as recognize the importance of students through key skills in calculating numerical values as well as Algebra. Research by Demir, Serpil, and Ozer (2009) found that learning strategies is one of the factors that have significant effects on the achievement.

Teaching and learning is the process which information is communicated. Various methods and techniques are used during teaching and learning process. According to Tufte (2001) the visualization method is to define the information that can be obtained through pictures, tables, diagrams and graphs. Tartre (1990) defines visualization skills in common sense as a particular way of compiling thoughts to gain new information that linked to a previous knowledge structure to help someone understand something new. Hamzah (2004) states that visualization is one of the thinking skills in which individual capabilities imagine the shape and rotate the shadow from various directions either from two or three dimensions when manipulated.

Accordingly, teachers, parents and researchers noticed that students are suffering from difficulties in mathematics at all levels (Khair et al., 2012). Recent research from Ngasiman (2014) showed most of the students at diploma level are weak in mathematics even spending eleven years learning about it in Malaysia education system. Results from her study revealed that students' weaknesses are low of mathematical foundation and lack of comprehensive understanding in the computational subjects. Research of students' achievement in mathematics courses offered by the Faculty of Science, Technology and Human Development to all other engineering and field students in UTHM presented poor performance (Razali, 2015). According to this scenario, this study would like to determine the achievement of technical students in this subject focus on topic of Function in Mathematics II using visual learning approach.

Visualization Model

In this study, Atkinson and Shriffrin (1968) Memory Model (Figure 1) were selected to describe the visual working memory that related to the long term memory. The model describes three levels of memory, sensory memory, short-term memory and long-term memory. The model begins with information processing and develops from a cognitive psychology branch focused on memory and storage processes that make the learning process happened. They concluded that the process of human learning resembling on how a computer is processing information. Visual learning is an internal graphic imagination in cognitive observation to understand the concept. Gray and Tall (2002) state the importance of cognitive studies in mathematics education and teacher improvement are best handled by the learner supported by a mentor who is aware not only of the mathematics but of the underlying cognitive structures.

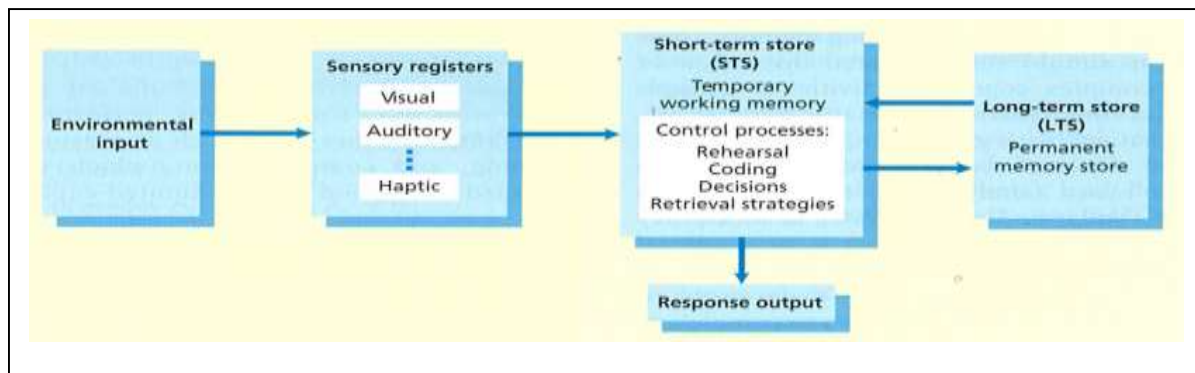
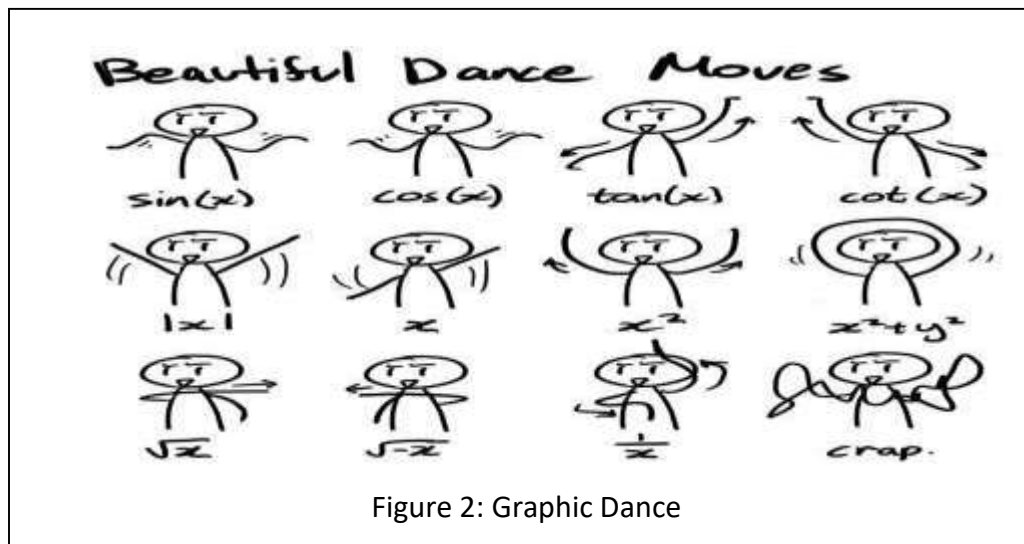


Figure 1: The flow of information through memory system by Atkinson and Shiffrin (1968)

Zazkis et al. (1996) defined visual thinking have been based variously on pictorial representations of objects, geometrical or graphical representations, questions of internal versus external representations, and intuition. Sometimes defined by what it is not, visual thinking has been set into such oppositions as visual versus verbal; visualized versus actual; visualization from memory versus perception in the present; visualization as spatial versus abstraction; thinking about images that are static versus images that change. Mathematics lecturer are met with the difficult task of creating a constructivist learning environment, while also considering the learning style preferences of the learners in the class. Visual learners tend to learn by pictorial representations of objects, geometrical or graphical representations (Pylyshyn, 1973; Webb, 1979; Zimmermann & Cunningham, 1991). Defining students as "visualizers" may indicate that certain individuals are closed out of understanding certain mathematical concepts that have no concrete antecedent. Arcavi (2003) defines visualization as ability of thinking, developing ideas and understandings, the procedure and the output, interpretation, attracted pictures, images, diagrams, in our minds, using paper or with scientific tools, with the purpose of presenting and communicating information.

Methodology and Research Procedure

This study was conducted using case study method among 72 technical students who took Mathematics II in FTVE in semester 2 2017/2018. The sample of the students was given an achievement test in mathematics in the fifth weeks of the academic semester (2017/2018). From the first week to fourth weeks, the respondents exposed to the topic of function using visual learning approach. In the second week, the students were divided into twelve groups (six members) and each group was given a graphic cartoon sketch (Figure 2). Individual from each group need to present their cartoon sketch of the graph given and other group members need to guess the styled graph.



Once the activity is completed, the groups will be disbanded and the lecturer will ask them again to ensure they are understood. They will sit the test in the fifth weeks of semester. The test is from the topic of Function which is the first topic in the course. The questions have been developed by lecturer who teach Mathematics II. The questions have been ordered continuously which mean that the correct graph (question S1 (a)), will assist the student to answer all the next questions. Two questions were developed where the total score is 12 marks. The details of question are as in Figure 3.

(a) Given function, $f(x) = \begin{cases} 0; x < -2 \\ -x^2 + 4; -2 \leq x \leq 1 \\ -x + 3; x > 1 \end{cases}$

(i) Sketch the graph of $f(x)$ (4 marks)

(ii) Determine the domain and range of $f(x)$ (2 marks)

(b) Based on the graph S1(a)

(i) Find the limits of $f(x)$ at $x = -2$ (3 marks)

(ii) Evaluate $f(x)$ continuous or discontinuous (3 marks)

Figure 3: Questions

Results

Table I shows the respondents' demographic characteristics. The table explained the distribution and percentage of respondents' gender and courses. Female respondents were 58% and 42% were male.

Table 1: Respondents' demographic characteristics

Socio Demographic		Number	Percentage (%)
Gender			
	Male	30	58
	Female	42	42
Total		72	100
Course			
	BBA	22	30.6
	BBB	30	41.7
	BBD	20	27.7
Total		72	100

Table 1 shows the courses taken by respondents. Three from eight courses were taken Mathematics II for this semester. Respondents from BBA (general machining) is 30.6%, BBB (Building and construction) is 41.7% and BBD (welding and metal fabrication) is 27.7%.

Two question has been given to the respondents to determine their tendency of visual learning method. The result revealed that only two students get full marks and only four students get between between 11-9 marks, while 50 students get between 8-5 marks and 12 students get between 4-0 marks.

The findings show that most of the students who sketched the correct graphs will answers the next questions correctly. The second question (b) demanded the students to find the limit without using calculation. Then they will be able to determine either they piece-wise graph is continuous or not. Based on the test given, most of the mistake is they fail to remember the shape of the graph which is indirectly influenced them to calculate the point of the graph where is its took a long time to solve. The findings also revealed that poor of interpretation and illustrates the graph has lead students to sketch a wrong graph. On the other hand, most of the students did not use visualization to approach the questions.

Discussion

The findings of this study revealed that the overall achievement level of technical students of FTVE through visual learning method is average in Mathematics II, which is maybe because of the students are comfortable to use other methods to solve the mathematics problems. Similarly, Rosken and Rolka (2006) found that only 8% of their respondents sketched the graph to find the area of integral. Findings from Bosman and Schulze (2018) indicates significant positive correlations between group-learning and kinesthetic learning, between kinesthetic and visual learning, and between visual and auditory learning. This suggests that the learners in this study were able to be multidimensional in

their learning styles. The lecturer selected visual learning methods to avoid the difficulties to sketch the graph using calculating the point of equation. But the result showed that the students are in moderate level of visual learning methods in Mathematics II especially for the topic of functions. Furthermore, it also may be due to student anxiety in Mathematics or they are analytical learning person in this subject.

Conclusion

It was unfortunate that the results of the study showed underachievement of the students in Mathematics II. Moreover, the study reported that the basic of equation in function cannot be remembered by students which is common mistakes done by the students. To improve mathematics teaching, the lecturer should create active learning in classroom, designing teaching strategies and methods to improve technical students' achievement level in using visual learning method for mathematics. Lecturers ought to be knowledgeable, supportive and patient, and build the self-concepts of the students in order to strengthen their belief that they have the ability to learn mathematics individually at home. The quality of the implementation of a suitable teaching practice greatly influences its impact on student learning. Visual learning method is a necessity for the students in learning mathematics. This is because some topics in mathematics required imagination and graphically answers. Students with analytical ability will face a little bit problem but with a continuous exercise they will become mastery in this method.

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