

USING VBA LEARNING MEDIA TO IMPROVE STUDENTS' MATHEMATICAL UNDERSTANDING ABILITY

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Abstract

Trigonometry is one of the basic of mathematics that is taught in high school. Students always thinks that trigonometry is a hard theory and this research aims to overcome the students' problems by using VBA learning media base on the 6-question cognitive theory. This research will use the experiment method with a pre-test and post-test to see the difference on the students' mathematics understanding ability that uses VBA learning media based on the 6-question cognitive theory and the one that uses traditional teaching method. The result of this research is that there is a difference and an increase in the students' mathematics understanding ability that uses VBA learning media base on the 6-question cognitive theory compared to the students who uses traditional teaching method.

Keywords: VBA Learning, 6-Question cognitive theory, Microsoft excel, Understanding ability.

Abstrak

Trigonometri adalah salah satu dasar matematika yang diajarkan di sekolah menengah. Siswa selalu berpikir bahwa trigonometri adalah materi yang sulit dan penelitian ini bertujuan untuk mengatasi masalah siswa dengan menggunakan media pembelajaran VBA berdasarkan 6-question cognitive theory. Penelitian ini akan menggunakan metode eksperimen dengan pre-test dan post-test untuk melihat perbedaan kemampuan pemahaman matematika siswa yang menggunakan media pembelajaran VBA berdasarkan 6-question cognitive theory dan yang menggunakan metode pengajaran tradisional. Hasil dari penelitian ini adalah bahwa adanya perbedaan dan peningkatan kemampuan pemahaman matematika siswa yang menggunakan media pembelajaran VBA berdasarkan 6-question cognitive theory lebih baik dibandingkan dengan siswa yang menggunakan metode pengajaran tradisional.

Kata kunci: Pembelajaran VBA, Teori Kognitif 6 pertanyaan, Microsoft Excel, Kemampuan Pemahaman

PENDAHULUAN

Based on the aim of learning mathematics, the teaching focuses on the mathematics concept and students' Mathematical Understanding Ability (Badraeni et al., 2020; Cunhua, Ying, Qunzhuang, & Wijaya, 2019; Wijaya, Ying, & Purnama, 2020a). When teaching, teachers are encouraged to connect the mathematics concept into everyday life (Bernard & Chotimah, 2018a; Kulsum, Hidayat, Wijaya, & Kumala, 2019). The students' ability to master the mathematics concept is very important and being able to apply them into everyday life can be a provision for them in the future (Aminah, Wijaya, & Yuspriyati, 2018; Bernard & Chotimah, 2018a). Most of the students from primary school to university get a very difficult and unattractive mathematics subject (Rahmadani, Nurlaelah, Herman, & Anaguna, 2019). In high school, there is a lot of complex concepts and a correct way of teaching is required so that they would master the basic concepts that is why a lot of students do not like mathematics (Rohaeti, Bernard, & Novtiar, 2019).

Trigonometry is a theory that is related to triangles (Khuzaini & Santosa, 2016). Based on a field research, a lot of student study trigonometry by memorizing the formula which resulted in students unable to apply the concept into their everyday life (Bernard, Sumarna, Rolina, & Akbar, 2019; Kay

& Kletskin, 2012). But in fact, trigonometry is one of the theories that is very closely related to our everyday life. According to research, there are a lot of things on earth that uses the trigonometry theory which can make the topic more interesting to study(Jaelani, 2017).

A bad learning outcome of the students has become a concern for the teachers (Aixia, Ying, & Wijaya, 2020; Wijaya, Dewi, Fauziah, & Afrilianto, 2018). Various methods have been done to solve this problem but only a few of them were successful. The key problem is the lack of mastery on the basic concepts(Yi, Ying, & Wijaya, 2019).

The teaching method that is use to teach mathematics are mostly using the lecturing method with the help of power point or other presentation tool. This type of teaching method will enable students to easily memorize the formulas without understanding the basic concept of it. Research shows that by using various methods or approaches in class, it can increase the students' learning outcome, interest, effectiveness and eliminates students' boredom (Cunhua et al., 2019; Reis & Ozdemir, 2010).

6-question is a cognitive theory that is developed by Professor Zhou Ying based on Bernice McCarthy's 4MAT theory. The 6-question cognitive theory includes :

1. From Where: Explains the theory with everyday life situations
2. What: Case analysis separation
3. Why: Analysis concept definition
4. How to use: Connection between new and old concepts
5. What if it changes: Use variance technique to deepen a concept
6. Think about it: Summarize and review the basic concept

A learning activity that uses the 6-questions cognitive theory can make the learning system more accurate and can direct the students to a more effective learning activity. In figure 1, we can see the learning design with the use of the 6-question cognitive theory.

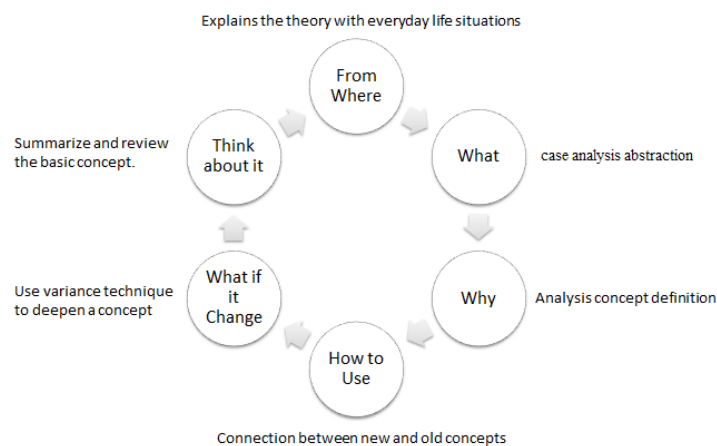


Figure 1. 6-Question Cognitive Theory

Based on the research done, the use of a technology based learning media is proved to be able to improve the students' ability in various aspects such as their understanding ability, self confidence, students' learning interest and etc (Listiawan, Purwanto, As'Ari, & Muksar, 2018; Wijaya, Sukma, Purnama, & Tanuwijaya, 2020; Wijaya, Ying, & Purnama, 2020b; Wijaya, Ying, & Suan, 2020). Other than that, a learning media can help students to understand the basic concept because the purpose of studying mathematics is not only so that the students are able to memorize various formulas but rather is so that they will be able to understand the basic concept of a topic. With mastering the basic concept, students would be able to use mathematics concept in their daily life.

Visual basic application in excel is a programming language that can make commands that are needed in Microsoft excel to make automatic shortcuts (Bernard et al., 2019; Fitriani, Suryadi, & Darhim, 2018). VBA or macro is a function or program command in Microsoft office that is stored in the old visual basic (Bernard & Chotimah, 2018b; Bernard et al., 2019). VBA allows Microsoft office to work at its maximal. As we all know, Microsoft excel is a software that is used by a lot of people in every part of the world to process data. Other than processing data, Microsoft excel can also be used to teach mathematics in class as it can make graphs or interactive animations so that the class will not be as boring than not using ICT (Bernard & Chotimah, 2018a; Chotimah, Bernard, & Wulandari, 2018).

With the problems in mind, this paper will research on the use of VBA learning media on the trigonometry topic based on the 6-question cognitive theory to improve the high school students' understanding ability.

METHOD

This research will use the experiment method with a pre-test and post-test to see the difference on the students' mathematics understanding ability that uses VBA learning media based on the 6-question cognitive theory and the one that uses traditional teaching method. The sample in this research are separated into experimental and controlled class. The students' mathematics understanding ability is arranged based on the students' characteristic of mathematics understanding. The data will be process by using SPSS 22 software and Microsoft excel.

Before the class is over, the students are given a mathematics understanding ability test. Both the controlled and experimental classes are given question test on their mathematics understanding ability before and after the experiment This will allow researchers to see if there has been an improvement in the students' mathematics understanding ability. The design of this research is shown below.

A : 0 X 0

A : 0 0

Key:

A: Class random sampling

0: Pre-test = Post-test of mathematics understanding ability

X: Learning using VBA media based on the 6-question cognitive theory

The population of this research are students from SMA Putra Juang, Cianjur, Jawa Barat, Indonesia.

The samples are chosen randomly from the 10th grade 1st semester student where they were just being taught trigonometry.

The students' understanding ability data will be taken from the pre-test and post-test result. The data from the two sample will then be processed by using Microsoft excel. The preliminary and final results will be processed by using SPSS 22 with the following steps:

- 1) Testing the normality of sample data.
- 2) Test the Homogeneity of Variance.
- 3) Average Difference Test.
- 4) N-Gain Test

RESULTS AND DISCUSSION

Results

In the beginning of the study, researchers did a pre-test to both classes to know their initial mathematics understanding ability on trigonometry.

Tabel 1.

Students' understanding ability during the pre-test

Class	Average(X)	Standard Deviation (S)
Controlled	4.43	0.78
Experimental	4.2	0.91

In table 1, we can see that the average initial mathematics understanding ability for the controlled class and the experimental class are 4.43 and 4.2 respectively. This data shows that the controlled class understands the topic a little better than the experimental class. While the standard derivation for the controlled and experimental class are 0.78 and 0.91 respectively. This shows that the controlled class students' understanding ability is more evenly distributed than the experimental class.

Table 1 shows that there is not much difference in the students' mathematics understanding ability initially so with this data, we can use it to compare the improvement in their understanding ability towards trigonometry between the controlled and experimental class.

Tabel 2.

Normality Test

	Class	Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Value	Controlled	.163	30	.040	.929	30	.046
	Experimental	.188	30	.008	.888	30	.004

Table 2 shows the pre-test normality test of the two classes. The significant result of the controlled and experimental class on their Kolmogorov-Smirnov normality test are 0.040 and 0.008 respectively. The result of the two classes are below 0.05, the data should be further tested with the test difference of non-parametric which is the Mann-Whitney test.

Tabel 3.

Pre-test Mean Difference Test

Mann-Whitney U	415.500
Wilcoxon W	880.500
Z	-.518
Asymp. Sig. (2-tailed)	.605

The result for the Mann-Whitney value is 415.500 and the Asymp. Sig is 0.605. The significant value is more than 0.05 which means that there is no big difference in the students' initial understanding ability in both the controlled and experimental class. This also means that the research can be carried out as planned.

Tabel 4.

Students' understanding ability during the post-test

Class	Average(X)	Standard Deviation (S)
Controlled	14.01	1.99
Experimental	12.84	1.96

The post-test result shows that there is an increase in the average value which means that there is an improvement in the students' understanding ability for both classes. The average value of the controlled and experimental class is 12.84 and 14.01 respectively. We can see that the average value of the experimental class that uses VBA learning media based on the 6-question cognitive theory is doing better than the controlled class that uses the traditional teaching method. The standard deviation of the controlled and experimental class is 1.99 and 1.96 respectively. This means that the experimental class students' understanding ability is more evenly distributed than the controlled class. These data are then processed further with SPSS to know a more specified data of the students' understanding ability.

Tabel 5.*Normality Test of Post Control Class and Experiment*

	Class	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Value	Controlled	.181	30	.013	.899	30	.008
	Experimental	.246	30	.000	.752	30	.000

Table 5 shows the post-test normality test of the two classes. The significant result of the controlled and experimental class on their Kolmogorov-Smirnov normality test are 0.013 and 0.000 respectively. The result of the two classes are below 0.05, the data should be further tested with the test difference of non-parametric which is the Mann-Whitney test.

Tabel 6.*Average Test of Experiment Class and Post-test Control*

	Value
Mann-Whitney U	270.500
Wilcoxon W	735.500
Z	-2.678
Asymp. Sig. (2-tailed)	.007

Table 6 shows that the result for the Mann-Whitney value is 270.500 and the Asymp. Sig is 0.007. To be able to find out whether or not the experimental class is doing better than the controlled class, a one-party test was done with the mean value sig $0.007/2 = 0.0035 < 0.05$. With this result, we can conclude that the experimental class that uses VBA learning media based on the 6-question cognitive theory is doing better than the controlled class that uses traditional teaching method.

During the research in class, researchers found some mistakes made by the students based on their pre-test result. These mistakes focus on the mistakes they make when they were doing trigonometry questions which can be seen in their solving steps. Table 7 shows the mistakes found from the students.

Tabel 7.*Average Test of Experiment Class and Post-test Control*

Conjecture	Explanation
Drawing a trigonometry graph by using straight lines	Students have never seen a trigonometry that is real and visual so they had difficulties when asked to draw a graph with a straight line.
Forgot the special angle of trigonometry	Students were unable to state the special angles of trigonometry.
Did not payed attention to the quadrant	Students answered $\sin C = 6/10$ so $\cos C = 8/10$, while the correct answer is $\cos C = -8/10$ and $C = 8/10$. So, their answer were incomplete.

With the problems faced by the students in mind, the students' mathematics understanding ability

on the topic of trigonometry can be improved with Microsoft excel that is a VBA learning media that is based on the 6-question cognitive theory. Microsoft excel based on the 6-question cognitive theory can help students to understand the position of the quadrant as shown in figure 2 and see trigonometry basic graphs as shown in figure 3. It will be easier for the students to understand and the class will also be more interesting. Not only that, the students are also allowed to try using the VBA learning media so that the class will be more active and it can boost the students' confident level.

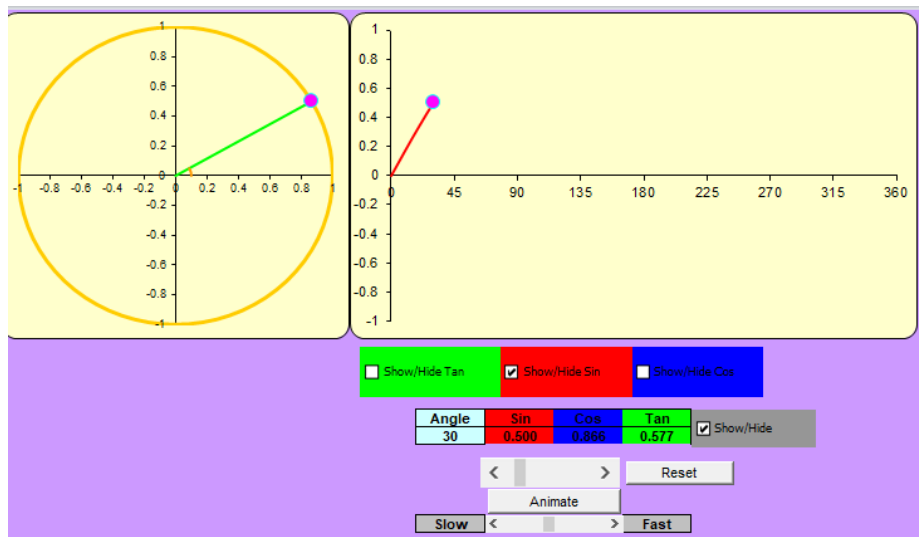


Figure 2. Relation between graph and quadrant on sinus

At the beginning of the learning process, the 6-question cognitive theory explained the purpose of learning trigonometry in our everyday life. An effective learning is a learning method that can direct the students to solve problems in their everyday life. Also, a learning method that is closely related to our everyday life will be easily remembered by the students. In the case analysis stage (separation), the 6-question cognitive theory explained what is trigonometry, how to draw the trigonometry graph, and what is the relationship between radian and trigonometry. These explanation can be use to deepen the students' understanding towards trigonometry. While in the concept analysis stage (definition), the teachers will guide the students to analyse the concept deeper such as why sine is negative in the 3rd and 4th quadrant, why consine is negative in the 2nd and 3th quadrant and also tangent, cosecant and secan. In the connection between old and new concept stage, students are required to incoperate the basic concepts they learned to solve a more difficult problems. In this stage, we can see if the students are able to use basic concepts in a more difficult problem. In the stage of using various technique to deepen a concept, the teacher will change the trigonometry question format into an essay question to see if the students are able to use various technique to solve the problem. In the last stage, teachers will help the students to make a summary and review on the basic concept of trigonometry that they learned.

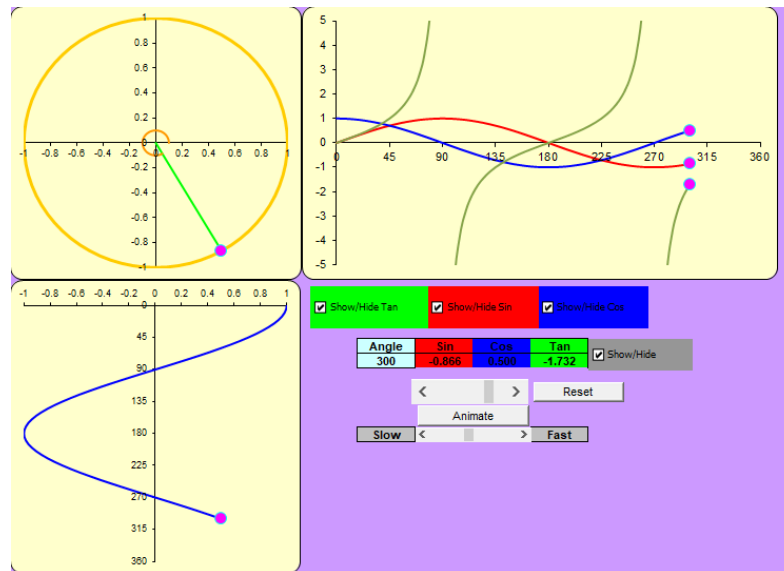


Figure 3. Trigonometry graph of $0^{\circ} < x < 300^{\circ}$

After seeing the steps of the 6-question cognitive theory, we can see that the theory is very systematic and it can help teachers to explain the trigonometry concept that students find it difficult to understand. Through out the class, researchers saw that students were more confident and active to answer questions given. This is because trigonometry is an abstract concept and its a difficult topic but in this case, its explained in a simpler way which is closely related to our everyday life and teachers guides the students to understand the basic trigonometry concept. After students understand and master the concept of trigonometry, even if teachers change the form of the question or the difficulty level, the students will still be able to solve the problem without any difficulties or confusion (Gani & Marlinda, 2017; Mulyawati, Salmawati, Subianto, & Wafdan, 2017).

CONCLUSION

Based on the research result, it shows that VBA learning media based on the 6-question cognitive theory can improve the students' mathematics understanding ability of high school students. The 6-question theory can direct the mathematics learning to be more effective and efficient. While the VBA learning media can make a complicated mathematic subject to be more interesting, boost the students' confident level and encourage the class to be more active.

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