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# VBA media development for microsoft excel against students' mathematical problem solving

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**Abstract.** Problem-solving is an ability that must be trained on students from the elementary school level. Through mathematical problem-solving students will have a good way of thinking, persistence, curiosity and confidence in dealing with new situations in everyday life. The method used in this study is a quasi-experimental design with a nonrandomized pretest-posttest control group design. The object of research is elementary school level students at the centre of learning activities in the City of Cimahi. Based on the results of the study, it was found that VBA-based media for Microsoft Excel influenced students' mathematical problem-solving abilities. There are findings of the condition of students who find it challenging to solve coherent problems, because there is a rush and want praise when solving problems faster. The conclusion in this study is that VBA-based media for Microsoft Excel is better at improving students' mathematical problem-solving abilities.

## 1. Introduction

Problem-solving is an ability that must be trained to students starting from an early age from elementary school level. This is because every student will always find problems in daily life so that if students have been able to solve problems well, then the quality of life will be good. Problem-solving is the process of an individual in using knowledge, understanding, and skills in solving a problem in an unknown condition [1]. Problem-solving in mathematics is known as mathematical problem solving is a fundamental ability that must be possessed by students and becomes the core of mathematics learning [2,3].

Through mathematical problem-solving students will have the right way of thinking, persistence, curiosity, and confidence in dealing with new situations in everyday life [4]. Indicators of mathematical problem solving according to NCTM [4] that is (1) identify the elements that are known, were asked, and the adequacy of the required items; (2) formulate a mathematical problem or to develop a mathematical model; (3) implement strategies to solve the problem (and the kind of new problems) inside or outside of mathematics; (4) explain or interpret the results according to the problem of origin; (5) using mathematical significantly.

Based on the statement above, mathematical problem solving is an essential ability to be trained to start from elementary school. But in reality, there are still obstacles in practising problem solving as stated: understanding mathematical problems that are still low; the ability to simplify the problem is still low; solving problems not following the concepts given; and solve problems without any processes and reasons that are following the concept [5–7]. To overcome problems related to solving mathematical problems, especially in primary schools, namely by developing media that are interesting, creative, and following the characteristics of elementary school students. The development of media referred to in

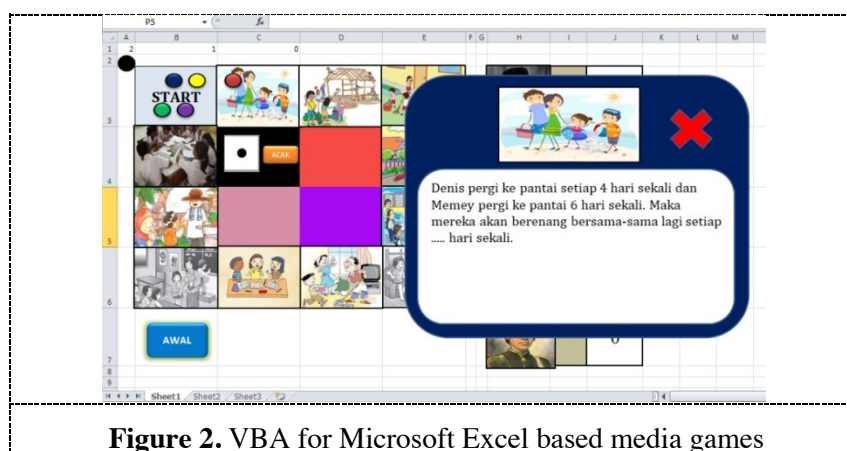


this research is to utilize applications visual basic application (VBA) for Microsoft excel become an exciting, creative media and can practice problem solving for elementary school students.

VBA-based media for Microsoft excel in this research is a monopoly game that can be played by small groups with one pawn of 1 student and a maximum of 5 students or large groups with one pawn of a group of 1-3 students. Every student or student group will be trained to solve mathematical problems through statements that are found in each of the monopoly boxes. The statements contained in each box differ concerning FPB and KPK material. The description of the media in question is as follows in Figure 1 and Figure 2.



**Figure 1.** VBA for Microsoft Excel Media Development



**Figure 2.** VBA for Microsoft Excel based media games

The choice of developing VBA-based media for Microsoft Excel is because the preparation of the media is easy, inexpensive, and the results are easy for students to use. In addition to the reasons for floating VBA-based media. The reasons for using VBA-based media for Microsoft Excel are based on previous studies which state that VBA-based learning media can be applied in primary schools and can have a positive impact on primary school student skills [7–9]. Other research states that VBA-based learning media can increase learning motivation, improve mathematical disposition abilities, and the confidence of SLB, SMP dan SMA students [7,10,11]. However, from the results of these studies, the use of VBA-based media has not been used in students in primary schools and elementary school-age students in non-formal education units such as community learning centres, especially in practising students' mathematical problem abilities. Therefore, in this study, VBA-based Microsoft excel-based media are used to see their effects on the ability to solve mathematical problem solving for elementary school-age students at the centre of community learning activities. It is expected that the results of this study can provide benefits for students, teachers, tutors, and other researchers who will develop and study learning media especially VBA-based media.

## 2. Method

The method used in this study is following the objectives of the research to determine the effect of a treatment that is a quasi-experimental method with the design is *nonrandomized pretest-posttest control group design* [9,12]. Design *nonrandomized pretest-posttest control group design* can be described in Table 1.

**Table 1.** Nonrandomized pretest-posttest control group design

Class	Pretest	Treatment	Posttest
Experiment	O	X <sub>1</sub>	O
Control	O	X <sub>2</sub>	O

This research was conducted at one of the centers of community teaching and learning in the Cimahi city area. The selection of the community teaching and learning center is based on several considerations including the community teaching and learning center that has a sufficient number of students or primary school-age citizens and adequate facilities to carry out learning with VBA-based media for Microsoft Excel and not yet the maximum problem-solving ability mathematically students. The population of this research is all students or residents learning elementary school level in package A program with a total of 61 students and the research sample is all elementary school students who are divided into two classes, namely class A as an experimental class whose learning uses VBA media for Microsoft Excel and class B as a control class whose learning uses conventional learning media.

The procedure of this study consisted of three stages: 1) the planning stage consisting of analyzing the results of previous studies, explaining students' mathematical problem solving abilities, the preparation of VBA-based media for Microsoft Excel, and the preparation of research instruments; 2) the implementation phase consists of the implementation of the pretest in the experimental and control class, carrying out learning in the experimental and control class, as well as the posttest in the experimental and control class; 3) completion stage consists of data processing, data analysis and drawing conclusions from the results of research. Retrieval of data in this study used a test instrument in the form of a matter of description that was developed in accordance with indicators of students' mathematical problem solving abilities.

## 3. Result and Discussion

### 3.1. Result

Learning in the experimental class using VBA for Microsoft Excel gives the effect on students' mathematical problem solving abilities. The results of research in an experimental class using VBA-based media for Microsoft Excel can be seen in the following Table 2.

**Table 2.** Test of Normality

Test of Normality	Pretest	Posttest
<i>Sig. Kolmogorov-Smirnov</i>	0.200	0.151
$\alpha$	0.05	0.05
	Normal	Normal

The results of the normality test as in Table 2 in the form of pretest and posttest in the experimental class showed a value of 0.200 and a value of  $\alpha$  posttest 0.151 which can be interpreted that the data is normally distributed. To see whether or not there is an influence of VBA-based media for Microsoft Excel on the ability to solve students' mathematics problems in the experimental class, it is continued with the t test of the average difference. As for the results of the t test the average difference is as follows.

**Table 3.** T test

Experiment class t test	Sig.(2-tailed)	Significance	Information
Pretest	0.000	0.05	There is an Increase
Posttest			

Based on Table 3, a sig value of 0,000 <0.05 was obtained, which means the results of the study showed that VBA-based media for Microsoft Excel had an influence on students' mathematical problem solving abilities, namely being able to improve students' mathematical problem solving abilities. For more details on improving students' mathematical solving abilities in the exhibition class can be seen in the Table 4.

**Table 4.** Average value and N-gain average

	Pretest	Posttest
Average Value	66	82
Average N-gain		0.53
N-gain category		Moderate

The results of research in the control class that uses conventional learning with learning media used as usual also have an influence on students' mathematical problem solving abilities. The results of his research are as follows.

**Table 5.** Test of Normality

Test of Normality	Pretest	Posttest
<i>Sig. Kolmogorov-Smirnov</i>	0.089	0.000
$\alpha$	0.05	0.05
	Normal	Not normal

The results of the posttest pretest normality test in the control class as in Table 5 show that the data are normally distributed and not normally distributed. Therefore, to see whether there is an influence of conventional learning with learning media as used normally on the students' mathematical problem solving abilities then proceed with the u test whose results are as follows.

**Table 6.** Mann-whitney U test

	Pretest - Posttest
Mann-Whitney U	382.500
Wilcoxon W	943.500
Z	-2.444
Asymp. Sig. (2-tailed)	.024

Based on the results of the u test in the control class as shown in Table 6, it was obtained a sig value of 0.024 <0.05, which means that conventional learning with media that is used daily has an influence, namely increasing the mathematical solving ability of elementary school students. From the results of processing in the control class and the experimental class both show the influence of both increasing the students' mathematical solving abilities. For more details on improving students' mathematical solving abilities in the exhibition class can be seen in the Table 7.

**Table 7.** Average value and N-gain average

	Pretest	Posttest
Average Value	64	72
Average N-gain		0,21
N-gain category		Low

Judging from the difference in the N-gain category, the experimental class is in the medium category while the control class is in the low category. To see which learning most significantly improved students' mathematical solving abilities, an N-gain test was carried out on the experimental class and the control class. The results are as follows.

**Table 8.** T-test N-gain

N gain test	Sig.(2-tailed)	Significance display	Information
Experiment	0,000	0,05	There is a difference in improvement
Control			

Based on the results of the N-gain t test in Table 8 with the sig (2-tailed) value of  $0,000 < 0.05$ , it can be interpreted that there is a difference in the students' mathematical problem solving ability and based on the category of the average N-gain in table 7 can be concluded that learning in the experimental class is better than in the control class in improving students' mathematical problem solving abilities..

### 3.2. Discussion

The implementation of learning in the experimental class and the control class there are differences in the stages of the delivery of learning material. The steps of the delivery of material in each class are as follows.

**Table 9.** The implementation of learning

Learning in the experimental class	Learning in the control class
Apersepsi delivery of media-based games using VBA	Apperception begins with the media story
Delivery of material	
Division of groups	Division of groups
Completion of student worksheets using VBA media linked to the KPK and FPB material	Work on student worksheets on KPK and FPB questions
	Delivery of material
Invite students to present the results of problem-solving discussions related to the KPK and FPB	
Giving awards to the best group	Joint conclusions with students
joint conclusions with students	

According to Table 9, different stages of learning material in each class have an impact, namely the discovery of some interesting findings in each class. These interesting findings are one of the factors from the results of the research that have been presented previously. During the learning process in the experimental class using VBA-based media for Microsoft Excel the things that are found are students who feel enthusiastic when seeing the learning media, but when invited to try the media some students look awkward in using the media, so there are only a few students who dare to try. Based on the results of interviews and observations during the learning process, this happens because students are first using VBA-based learning media for Microsoft Excel. This is in line with the results of previous studies which state that when students first use ICT-based media, most students will feel awkward [8,13–15].

The findings in the control class were first learning to use Microsoft Excel based VBA media ie students were not too enthusiastic when learning took place. Based on the results of interviews and

observations during learning this happens because students are not accustomed to learning in groups and rarely use learning media. This is in line with what was stated in previous studies that group learning and learning to use the media require the creativity of the teacher so that children feel motivated [16–19].

In addition to the learning process, other findings are in the problem solving process. Of the five indicators of students' mathematical problem solving, indicators that are considered difficult by students are indicators of problem solving coherently. The indicators that are most easily considered by students are the indicators that identify what is known and write a formula that fits the problem to be solved. Students will find it difficult to solve problems coherently because students are less thorough in the calculation process according to known formulas and students are in a hurry in solving problems because there is an urge on him wanting to finish faster than other students so that they are given an award or praise by the teacher [3,20–22]. As for the complete findings related to solving students' mathematical problems in the FPB and KPK material are as follows

**Table 10.** Invention mathematical problem solving in learning

<b>Invention mathematical problem solving in the experimental class</b>	<b>Invention mathematical problem solving in the experimental class in the control class</b>
Initially students are more cool to play than to understand the related statements FPB and the Commission is in VBA-based media	
Students begin to understand that the statements that appear in the VBA media are a matter of FPB and the KPK	Students look confused distinguishing between FPB and KPK questions
Students more easily understand the difference between FPB and KPK problems with the help of VBA media	Students begin to understand the difference between FPB and KPK questions after being modeled by the teacher several times
Students look more enthusiastic to solve the problem FPB and the Commission with the help of VBA-based media	Students look bored in solving problems of FPB and KPK without the help of image media
Indicators of problem solving that are considered difficult are indicators of problem solving coherently	The more mastered problem solving indicator is the writing indicator that is known and the formula writing that is the factor tree
Most students master all indicators of problem solving well	Most students still find it difficult to solve FPB and KPK problems, especially indicators of solving problems coherently

Based on Table 10, the results and discussion in this research, it is hoped that research can provide implications such as 1) Learning using VBA-based media can improve students' problem solving abilities; 2) learning using VBA-based media is carried out following technological developments that are increasingly developing and the characteristics of elementary school age children who are still happy to play; 3) learning using VBA-based media for Microsoft Excel makes students more respectful between students, fosters cooperation during learning, fosters courage to solve problems, expresses opinions and accepts differences between students that are expected to be applied in daily life so that individualist attitudes within students will be minimized; and 4) VBA-based learning media for ms. Excel can be used as a source or basis of learning in schools because it has many advantages that have been described in the findings and discussion in this study.

#### 4. Conclusion

Based on the results and findings of research such as the conclusions of this study, 1) VBA-based media for Microsoft Excel can improve students' mathematical problem solving abilities; 2) learning using VBA-based media for microsoft excel is better in increasing students' mathematical problem solving

abilities compared to conventional learning media, 3) requires careful planning in the development and use of VBA-based media for microsoft excel because not only learning planning must be prepared but learning media must be well prepared so that students are motivated, according to the characteristics of students, and in accordance with the material and abilities to be taught; 4) the need for creativity when the implementation of learning takes place to respond to student responses that are beyond predictions.

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