

Development of Interactive Learning Media Based on Open Ended Problem Approach Assisted by Visual Basic with Excel to Improve Creative Thinking Ability and Resilience of Students at Al Manar Private Junior High School

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Abstract

This study aims to: (1) describe the validity, practicality and effectiveness of developing interactive learning media based on an open ended problem approach assisted by visual basic with excel to improve students' creative thinking skills and resilience at Al Manar Private Junior High School; (2) Describe the improvement of creative thinking skills and resilience of students in learning media based on an open-ended problem-assisted visual basic approach that was developed; (3) Describe the increase in students' mathematical resilience who is taught using visual basic media with excel which has been developed using an open ended problem approach. The type of research used in this research is Developmental Research. The development model used is the formative evaluation type Tessmer development model. The subjects in this study were all students of the Al Manar Private Junior High School for the academic year 2021/2022, but the test subjects were only taken for class VII-A (25 students) for trial I and class VII-B (25 students) for trial II. The results showed that: (1) open-ended problem-based mathematics learning media assisted by visual basic with excel were included in the categories of validity, practicality, and effectiveness. (2) Based on the results of the analysis of the creative thinking ability test in trials I and II showed that students' creative thinking abilities increased. This increase in creative thinking skills can be seen from the average creative thinking ability test results obtained by students. In the first trial, students' creative thinking ability increased from 63.40 to 75.80 with moderate N-Gain criteria. (3) Students' mathematical resilience changes after learning by using visual basic assisted learning media.

Keywords: creative thinking skills, resilience, open ended problem approach, visual basic

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INTRODUCTION

Education is an important role in improving the quality of human resources. Because the success of the world of education as a determining factor in achieving the goals of national development in the field of education, namely the intellectual life of the nation. To achieve success in the world of education, the integration between teacher activities and student activities is very necessary. So in achieving a success in good education it is through a learning process.

Learning is carried out leading to the achievement of important competencies possessed by students. Subroto (2016) states that mathematics education materials in schools include arithmetic, algebra, statistics, and geometry materials. These materials are useful, both for mathematics itself and for use outside of mathematics. These materials aim to improve the 5 abilities described by (NCTM, 2000), namely reasoning skills, connection skills, communication skills, problem solving skills, and representation skills.

In addition to the five abilities above, one of the competencies that need to be developed in achieving the competence of graduating from primary and secondary education is the ability to think creatively. This is in accordance with Government Regulation Number 17 of 2010 in the 2013 curriculum (Utami, Endaryono and Djuharton, 2020: 44) regarding the management and implementation of education, one of the criteria regarding the qualifications of graduate abilities that must be possessed by students is that students have the ability to think creatively in the realm of abstract and concrete in accordance with what is learned in school and other similar sources.

Lestari and Mokhammad (Guntur, Aliyyatunnisa and Kartono, 2020:386) state that the ability to think creatively is an ability that generates new ideas or ideas in the form of a way to solve problems. Meanwhile, Martin (Kertayasa, 2019: 46) creative thinking ability is the ability to generate new ideas or ways to produce a product. From these two opinions, the ability to think creatively can be interpreted as the ability of students to generate new and diverse ideas in solving problems. A student is said to have the ability to think creatively if the student is able to come up with many ideas, or answers that are varied, new, unique and interesting.

The ability to think creatively is important to be owned and improved by every student in addition to the demands of the curriculum, as well as the demands of the times. Schools today are no longer just continuously

producing smart students, but must be at a creative level. The importance of creativity is also seen in the field where there are social media applications that demand creativity and even a promising new profession in the future is content creator. From the explanation above, the ability to think creatively should get more attention in the world of education.

Given the importance of creative thinking skills, researchers want to know the extent of the creative thinking abilities of junior high school students. Efforts to find this out, the researchers took by giving questions based on indicators of creative thinking skills to Al Manar Middle School students. The researcher gave 4 essay questions with rectangular and square material. In the first question contains indicators of fluency in the indicator of fluency creative thinking skills, students will see the ability to generate many ideas, the second question contains indicators of flexibility in indicators of creative thinking abilities. seen the ability to generate many diverse ideas/ideas, the third question contains an indicator of originality in the indicator of originality, students will see the ability to generate new ideas/ideas to solve problems and the fourth question contains elaboration indicators. In the indicator of the elaboration creative thinking ability, students will see their ability to develop ideas to solve problems in detail.

The next reason, based on the observations of researchers at the Al Manar Private Junior High School, obtained information that the development of learning media by teachers did not pay attention to aspects of target characteristics. From the observations of researchers at the school, the learning media used still seemed less able to attract students' interest in solving problems, because most of them were in the form of long story questions without pictures or colors that could attract students' interest to read them. This is in line with the opinion of Haggarty and Keynes (Muchayat, 2011:201) which states that in order to improve the teaching and learning of mathematics in the classroom, efforts are needed to improve the understanding of teachers, students, materials used for learning and the interaction between them. For this reason, teachers are required to be able to create and develop these learning media.

The development of quality learning media must pay attention to curriculum requirements, meaning that the development of learning media must be adapted to the curriculum. The development of learning media is in accordance with the objectives of the 2013 curriculum. Where the purpose of developing the 2013 curriculum is that we will produce Indonesian people who are productive, creative, innovative, affective, through strengthening integrated attitudes, skills, and knowledge.

The characteristics of students are also one of the reasons for the need to develop learning media, because learning media are often not in accordance with the situation and conditions of students. For example ownership of ICT, ICT expertise, social environment, culture, student abilities, interest in learning and family background. Therefore, the development of learning media must adapt to student-oriented characteristics. In addition, students often have difficulty understanding learning materials, which may be due to abstract, complex, complicated material, and so on. Therefore, it is necessary to develop a learning media that can answer or solve problems or difficulties in learning.

In Permendiknas RI No. 16 of 2007 it has been emphasized that one of the pedagogical competencies that mathematics teachers must possess is being able to utilize information and communication technology (ICT) for learning purposes. However, from the survey results at Al Manar Private Junior High School, the use of computer media in schools has not been optimal, especially in learning mathematics. The number of mathematics teachers who do not use ICT-based media for learning mathematics is due to time problems and the inability to use these media.

Some of the benefits of learning media above, it can be concluded that before starting the learning process, of course, it is necessary to prepare learning media, because these learning tools/media play a very important role and influence the achievement of the desired educational goals. Given the very systematic learning process, patterned learning media is used as a teacher's tool in carrying out learning.

Learning media is used as a benchmark for professional teachers to evaluate the performance of each teacher. Teachers who can judge for themselves the extent to which they can apply the learning media designed in the classroom. Through learning media, teachers can improve their professionalism. In addition to learning media used as a benchmark to measure the level of professionalism of teachers, learning media must also be adapted to the needs of students so that students can easily understand the topics given by the teacher.

In accordance with the requirements of teachers' professional abilities, professional teachers can use good learning media. Therefore, every teacher in the educational environment is obliged to compile and produce learning media in a systematic and patterned manner so that learning can be carried out interactively, inspiring, fun, challenging, motivating students to participate actively, and for initiative, creativity and independence to provide sufficient space. In accordance with the talents, interests and physical and mental development of students.

In applying learning media the teacher must also be able to choose the right innovative learning method in learning mathematics, a teacher has made many efforts to improve the learning process. One of the mathematics learning methods that can be used to develop good learning media is to apply the Open Ended Problem

Approach learning method. One of the benefits of learning the Open Ended Problem Approach is that it can provide opportunities for students to find, recognize and solve knowledge/experience problems in various ways, so that students can use media to solve learning problems.

In classroom learning, teachers should avoid the lecture method in learning because teachers are required to create and develop learning experiences that encourage student activity. And to encourage the development of student learning activities and experiences, there must be supportive media to increase student learning motivation.

Rahmawati (2018:381) states that in this technological era, there are many portable software and applications that can be used in learning mathematics. For example Matlab, GeoGebra, GeoEnzo, Microsoft Mathematics, Speq Mathematical, Visual Basic and several other software. Apart from being a visualization tool, the use of technology in learning mathematics can also attract students' interest in learning and make them familiar with technology.

Therefore, one of the software that can help realize learning based on the Open Ended Problem Approach is Visual Basic with Excel. It is expected that students can develop a better mindset in learning mathematics. Therefore, in formal mathematics learning (school mathematics), teachers should start by exploring informal mathematical knowledge and promoting it with learning media that can support the learning process in the classroom.

Johnson and Hamonangan (2014: 100) Visual Basic is a development of Basic (Beginner's All-purpose Symbolic Instruction Code) is an "old-fashioned" programming language which is the beginning of other high-level programming languages. Basic was designed in the 1950s and is intended to be used by novice programmers. Usually Basic is taught to high school students who are new to computers, and is used to develop light and fun "fast food" programs. However, Basic's role is more than that. Many reliable programmers today start their careers by learning Basic.

The approach that can be considered to be used in efforts to improve the quality of mathematics learning to improve creative thinking skills and resilience is the open-ended problem approach. According to Shimada and Becker (Oktaviani and Tari, 2017:134), the open-ended problem approach is an approach that provides opportunities for students to investigate various strategies and ways that they believe are appropriate to elaborate problems.

After the learning media is made, a test must be carried out to ensure that the media is suitable for use. For this reason, it must be tested for the truth/validity of the practicality and effectiveness of the learning media. These three things are at the same time a standard that must be met to develop learning media. Validity includes two aspects, namely content validity and construct validity. Content validity is based on the theories that are used as guidelines in the formulation or manufacture of learning media, while construct validity is based on the relationship between the components of the learning media. The media developed has not been tested for validity.

With the help of visual basic, the development of learning media based on the open-ended problem approach is considered effective in applying at Al Manar Private Junior High School. The purpose of this development is to produce new products which are improvements to existing products that can be accounted for. The reason for improving the product is that it is considered less in accordance with the function of achieving the expected learning objectives, one of which is to improve students' creative thinking skills and student resilience.

Learning Researcher with an open-ended problem approach is learning that helps students to equally participate in the use of learning media. An open-ended problem approach assisted by Visual Basic is likely to improve students' creative thinking skills and resilience in learning. So that the development of learning media based on the open-ended Problem learning approach assisted by Visual Basic is considered suitable to be integrated.

Based on the explanation above, there is a positive relationship between the ability to think creatively and resilience and mathematics in general. Creative thinking skills and resilience will affect learning in the classroom. Learning with an open-ended problem approach can also help students to equally participate in the use of learning media. And teachers can also use learning media to pay attention to the effectiveness and practicality of the approach used in developing learning media with visual basic which is likely to increase student motivation in learning. So that the development of learning media based on an open-ended approach assisted by visual basic is considered suitable to be integrated to improve students' creative thinking skills and mathematical resilience. So that the authors are interested in raising the title of the research, namely "Development of Interactive Learning Media Based on an Open Ended Problem Approach Assisted by Visual Basic With Excel to Improve Creative Thinking Ability and Resilience of Students in Al Manar Private Junior High School".

METHOD

Research Pattern

The type of research used in this research is Developmental Research. The development model used is the Tessmer development model (Jurnadi and Zulkardi, 2017) formative evaluation type. In this study, which

developed a mathematics learning media based on the Open Ended Approach assisted by Visual Basic with Excel on the material of Flat Shapes (Rectangles and Squares).

Subject

The subjects in this study were all students of the Al Manar Private Junior High School for the academic year 2021/2022, but the test subjects were only taken for class VII-A (25 students) for trial I and class VII-B (25 students) for trial II.

Data Analysis

Student Analysis

In this study, it was focused on class VII-A students as trial subjects I and VII-B as test subjects II. The activity carried out in this step is to explore information about the number of students and the characteristics of the seventh grade students of Al Manar Private Junior High School which are analyzed in this study including the development of knowledge, academic abilities, learning styles and motivation of students who will be tested.

Curriculum Analysis

Curriculum analysis in this study is to analyze the learning materials addressed to the Al Manar Private Junior High School in this study, namely the material of flat shapes (rectangles and squares) assisted by visual basic with excel class VII.

Class VII. Then arrange them into a hierarchical form and detail individual concepts to critical and relevant matters. Concept analysis is related to the analysis of student material with the concept map making it easier for students to understand the content of the material.

Material Analysis

Material analysis activities are aimed at identifying, detailing, and systematically compiling the main materials that will be studied by students based on curriculum analysis. This analysis helps in identifying the main materials that will be used as signs for the development of learning media.

Media Analysis

Media analysis in this study is a media problem faced by teachers in junior high school, one of which is the difficulty in making learning media. They tend not to have much time, have difficulty explaining the material and have difficulty choosing teaching methods to develop learning media. While the problem of junior high school students is the difficulty of students in understanding the content of learning materials which results in difficulties for teachers in making learning media, especially in the material of flat shapes (rectangles and squares) in class VII SMP in even semesters. To overcome the problems faced by teachers and students, research was carried out at the Al Manar Private Junior High School for the development of learning media using visual basic with excel, namely in the subject of Mathematics, the subject of rectangular and square.

Data Collection Instruments and Techniques

Questionnaire Lembar

Questionnaire sheets used in this study were questionnaire sheets for subject matter experts, questionnaire sheets for learning media experts, practicality questionnaire sheets for learning media for mathematics teachers and students, and questionnaire sheets for student resilience.

Creative Thinking Ability Test

The Creative Thinking Ability Test was conducted to measure the effectiveness of the developed learning media as well as to see students' Creative Thinking Ability.

RESULT

Expert Test (Expert Review)

At this stage, the prototype I validation process is carried out with the help of several validators by experts in their fields and practitioners. The expert in question is a UNIMED mathematics education lecturer consisting of 3 (three) lecturers and practitioners who are mathematics teachers consisting of 2 (two) teachers.

Analysis of Learning Media Validation Results

The validation of learning media for subject matter experts includes the quality of the format, language and content feasibility. Based on the results of expert validation of learning tools, it was found that the average value of learning by media experts was 2.94 and by experts the total validation of learning material media was 2.81. Furthermore, this value is referred to the established validity criteria. By referring to these criteria, it can be concluded that the developed learning media meets the validity and valid categories. The four validators concluded that the media could be used with little revision. From the assessment of the validators, corrections, criticisms and suggestions were obtained which were used as material for consideration in revising the mathematics learning media.

Analysis of the Results of the Validation of the Learning Implementation Plan

When making revisions, the researcher refers to the suggestions and instructions given by the validator. The results of the validation data analysis of the learning implementation plan experts are as follows:

Table 1. Results of Validation of Learning Implementation Plans

No	Value Aspect	Rata-Rata	Kategori
1	Format	3,25	Valid
2	Contents	3,16	Valid
3	Language	3,35	Valid
	Average	3,25	Valid

From Table 1. it can be seen that the total average value of learning implementation plan validation is 4.16, referring to the validity criteria that have been determined, it can be concluded that the developed meets the criteria for validity using the "valid" category. The five validators concluded that the lesson plans could be used with a few revisions.

Analysis of Student Activity Sheet Validation Results

The results of the validation data analysis on the student activity sheet experts are as follows:

Table 2. Results of Student Activity Sheet Validation

No	Value Aspect	Rata-Rata	Kategori
1	Format	3,28	Valid
2	Contents	3,23	Valid
3	Language	3,43	Valid
	Average	3.31	Valid

From Table 2. it can be seen that the average value of the total validation of the student activity sheet is 4.5 referring to the validity criteria that have been determined. It can be concluded that the developed student activity sheet meets the criteria for validity using the "valid" category. The five validators concluded that the student activity sheet could be used using a few revisions.

Creative Thinking Ability Test Validity

Validity and Reliability of Creative Thinking Ability Pretest Questions

The validity of the student's creative thinking test is determined by whether or not the test items are valid. With a significance level of 5%, the rcount and validity of each pre-test item. The results of the calculation of the validity of all items in the pretest of creative thinking skills are shown in the following table:

Table 3. Validity of Pretest Items for Creative Thinking Ability

Items	r_{xy}	t_{hitung}	t_{tabel}	Interpretation
1.	0,827	7,063	2,069	Valid
2.	0,813	6,703	2,069	Valid
3.	0,830	7,125	2,069	Valid
4.	0,865	8,278	2,069	Valid

Validity and Reliability of Creative Thinking Ability Posttest Questions

The validity of the student's creative thinking test is determined by whether or not the test items are valid. With a significance level of 5%, the rcount and validity of each posttest. The results of the calculation of the validity of all items of the posttest of creative thinking skills are shown in the following table:

Table 4. Validity of Posstest Items for Creative Thinking Ability

Items	r_{xy}	t_{hitung}	t_{tabel}	Interpretation
1.	0,508	2,831	2,069	Valid
2.	0,674	4,376	2,069	Valid
3.	0,886	9,177	2,069	Valid
4.	0,886	9,177	2,069	Valid

Increasing Students' Mathematical Resilience

Mathematical resilience questionnaires were given to students at the beginning and at the end of the first trial. The purpose of this resilience questionnaire was to see the improvement of students' mathematical resilience. Mathematical resilience data was analyzed by looking at the percentage of students' mathematical resilience categorization before and after trial I. The results of the categorization of students' mathematical resilience can be seen in appendices 21 and 22 for the summary results of the categorization results can be seen in table 5.

below:

Table 5. Results of the Test Student Mathematical Resilience Questionnaire

No	Categorization	Total students		Persentase (%)	
		Trial I	Trial II	Trial I	Trial II
1	Very High Category	2	4	8	16
2	High Category	4	6	16	24
3	Medium Category	4	8	16	32
4	Low Category	5	2	20	8
5	Very Low Category	10	5	40	20

From table 5. above, it can be seen that when doing the I test of mathematical resilience, most of the students were in the very low category with 10 students or around 40%, then the low category with 5 students or about 20% for the medium category with 4 students. students or about 16%. It can be seen for the very high and high categories with the number of students 2 and 4 students and the percentages are around 8% and 16%. Furthermore, the results of the resilience questionnaire after the second trial showed that the category most contained in the very low category with the number of students was 5 students or about 20%. Furthermore, for the high category with the number of students 6 students or about 24%. And the medium category with 8 students or about 32%. While the very high and low categories include the two lowest categories with the number of students 4 and 2 and the percentage is around 16% and 20%.

From the results of the resilience questionnaire, the questionnaire data for the first and second trials were analyzed. from the analysis of the data it was concluded that there was an increase in the very high category, namely from 2 students to 4 students or an increase of about 8%, then the category that increased was the high category from 4 students to 6 students or an increase of about 24%, the next increasing category was low category from 5 students to 2 students or an increase of about 8%. Furthermore, the medium category experienced an increase before the trial there were 4 students after the trial to 8 students an increase of about 32%, and the very low category also experienced an increase before the trial there were 10 students after the trial to 5 students an increase of about 20%. From these data, it can be concluded that the ups and downs of the number of students in the category indicate a change in the students' mathematical resilience in the first try and second test in learning.

From the results of the analysis, it can be seen that the average indicator 1. Perseverance, confident/confident, working hard, not giving up easily in dealing with problems, failure and uncertainty of 12.32 obtained from the results of trial I and trial II, namely 10,52 and 14.32. Average indicator 2, Desire to socialize, easy to give peer help, and adapt to the environment of 12.06. obtained from the results of trial I and trial II were 10.80 and 13.32. The average indicator is 3, Generating new ideas or ways and looking for creative solutions to challenges of 11.88 which were obtained from the results of trial I and trial II, namely 10.44 and 12.00. The average indicator 4. Using the experience of failure to build self-motivation of 12.02 which was obtained from the results of the first trial and second trial, namely 10.48 and 13.56. The average indicator is 5. Shows curiosity, reflects, researches, and utilizes various sources of 11.02 obtained from the results of trial I and trial II, namely 10.72 and 11.32. The average indicator is 6. Having language skills, self-control and being aware of his feelings is 11.28 which is obtained from the results of the first trial and second trial, namely 11.28 and 11.28. The summary of the students' total mathematical resilience can be seen in Figure 1. below:

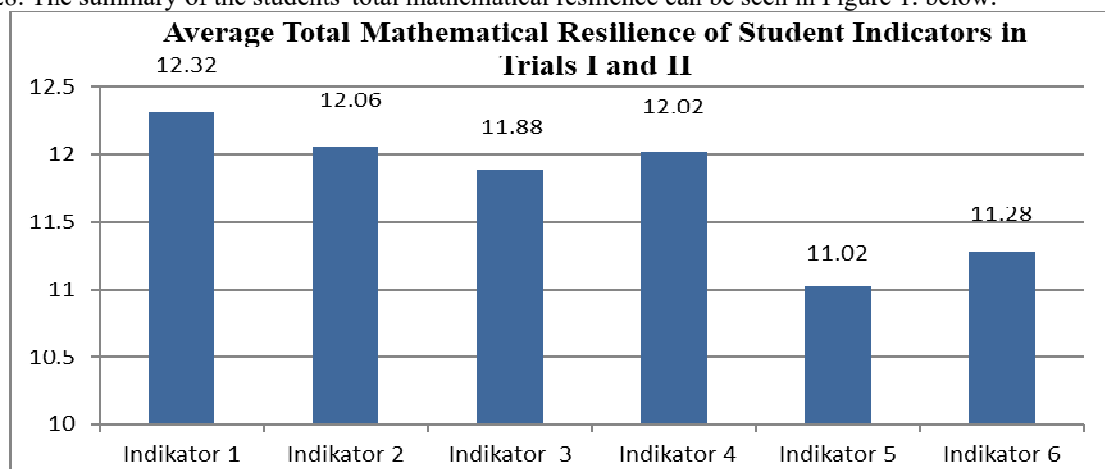


Figure 1. Average Total Mathematical Resilience of Student Indicators in Trials I and II

From Figure 1. it can be seen that the highest total average is an indicator of Perseverance, confident/confident, working hard, not giving up easily in dealing with problems, failure and uncertainty of

12.32, while the lowest average is an indicator of having language skills, controlling self and aware of his feelings by 11.28. The average total indicator of the desire to socialize, easy to give peer help, and adapt to the environment is 12.06. Average indicator Generating new ideas or ways and looking for creative solutions to challenges is 11.88. The average indicator Using the experience of failure to build self-motivation is 12.02 and the last average indicator Showing curiosity, reflecting, researching, and utilizing various sources is 11.02.

Discussion

Learning Media Development

The results of data analysis obtained from trial I and trial II show that: (1) visual basic-assisted mathematics learning media with excel developed are valid, (2) visual basic-assisted learning media with excel are developed practically, (3) learning media mathematics assisted by visual basic with excel which was developed effectively, (4) and the ability to increase students' creative thinking ability and resilience through mathematics development.

Validity of Visual Basic Assisted Mathematics Learning Media Development with Excel

Based on the results of the validation of the developed visual basic-assisted mathematics learning media with excel, it was found that the developed mathematics learning media was declared valid or had a good degree of validity. Then, the visual basic assisted mathematics learning media with excel that was developed was said to be feasible from all aspects of the validity of the learning media. Furthermore, the results of the validation of the learning implementation plan, student worksheets, creative thinking ability tests and resilience questionnaires are also valid or have a good degree of validity. This shows that the visual basic-assisted learning media with excel which was developed with the learning implementation plan, student worksheets, creative thinking ability tests and resilience questionnaires have met the validity criteria.

Practicality of Visual Basic Assisted Mathematics Learning Media Development with Excel

The practicality of media development in this study is viewed from three aspects, namely teacher questionnaires, student response questionnaires and student worksheets scores.

Teacher Questionnaire

In the practicality of developing the teacher's role, it is very important to determine the development of media because the teacher is used as a facilitator for the use of mandatory media or even comfortable using the media that will be used in the classroom. Opinions, suggestions and subjective assessments from teachers remain a consideration for improving the media that has been developed but has many shortcomings.

Student Response Questionnaire

In general, the students' responses in the first trial were total average (2.75) and the second trial was the total average (3.26). This can be seen from the statements and responses of students who are more centered in choosing the learning media presented, which makes students not difficult in learning the material presented by the teacher. The material presented with learning media makes students understand the material faster without having to be explained repeatedly by the teacher, and hopes for every other topic to continue using visual basic media with excel.

Student Activity Sheet

The results of the LKPD analysis data were included to see to what extent the role of visual basic-assisted media with excel which was developed in the learning process helped increase students' creative thinking skills. Each trial consists of three meetings

From the three meetings, it can be seen in tables 4.28 and 4.38 that the first meeting had an average trial value of 63.6 and 78.5, the second meeting had an average trial value of 71.4 and 78.5 and the third meeting have a trial average value of 76.4 and 81.5. it can be concluded that visual basic learning media with excel is very helpful in the learning process to improve students' creative thinking skills.

Effectiveness of Visual Basic Assisted Mathematics Learning Media Development with Excel

The media developed is effective if the media meets the effective category, the results can be seen in the first trial and second trial. Effective media can be seen from the results of the complete value of students' creative thinking abilities. The aspects of the effective category are described as follows:

Completeness Value of Creative Thinking Ability

Based on the first and second trials, the results of the test data were analyzed and it was found that the students' creative thinking skills had met the criteria for classical completeness. This is because the materials and problems of learning mathematics developed and student activity sheets have been adapted to the conditions of the student learning environment. By using media during the learning process in class, students better understand all forms of flat shapes (rectangles and squares), and students can use this media to provide results from student worksheets. So that students can use the media directly. This is in line with the research by Bernard and Primandhika (2019) with the title "Developing Interactive Learning Media For School Level Mathematics

Through Open-Ended Approach Aided By Visual Basic Application For Excel", it can be concluded that: (1) learning with interactive media that uses Excel-based visual basic to improve students' creativity is better than expository learning method. (2) learning with interactive media that uses Excel-based visual basic to increase students' creativity is a combination of mastery of students' material at school.

It can be seen from previous research and previous research support that the developed visual basic-assisted mathematics learning media with excel can help teachers and students achieve completeness of students' creative thinking skills. Thus, it can be concluded that the use of visual basic-assisted learning media with excel has met the effective criteria.

Learning Time Achievement

The achievement of learning time based on research conducted on trial I and trial II, the use of time to teach the material of flat shapes (rectangles and squares) using visual basic learning media with excel is appropriate seen from the learning implementation plan made by the researcher, namely the time The learning carried out is the same as the usual learning time, so it can be said that research using visual basic assisted mathematics learning media with excel that has been developed has a good time achievement.

Improvement of Creative Thinking Ability

Based on the results of the analysis of the creative thinking ability test in trials I and II showed that students' creative thinking abilities increased. This increase in creative thinking skills can be seen from the average creative thinking ability test results obtained by students. In the first trial, students' creative thinking ability increased from 63.40 to 75.80 with moderate N-Gain criteria. However, after the visual basic media with excel was redesigned according to the suggestions and evaluations in the first trial, then in the second trial the students' spatial ability increased from 73.40 to 82.60 with moderate N-Gain criteria. This shows that the use of visual basic-assisted learning media with excel has an impact on increasing students' creative thinking skills. The same thing was also expressed in Rohaeti, Bernard and Primandhika's research (2019) with the title "Developing Interactive Learning Media For School Level Mathematics Through Open-Ended Approach Aided By Visual Basic Application For Excel" it can be concluded that: (1) learning with interactive media that uses Excel - based visual basic to increase students ' creativity is better than learning by expository method . (2) learning with interactive media that uses Excel-based visual basic to increase students' creativity is a combination of mastery of students' material at school. The research by Bernard and Senjayawati (2019) with the title "Developing the Students' Ability in Understanding Mathematics and Self-confidence with VBA for Excel" can be concluded that: (1) learning with interactive media using visual basic with excel can improve understanding ability mathematics in junior high school. (2) there is a relationship between students' self-confidence and students' mathematical understanding abilities in junior high school with interactive media learning using visual basic with excel.

One of the expert recommendations is to become the main focus in improving creative thinking skills (Rohaeti, Bernard and Primandhik, 2019). However, in this study, in the first trial the average value of the elaboration indicator from pretest to posttest was 1.00 and even in the first trial and second trial it was 0.18. Although the average elaboration indicator during the post-test increased from 3.64 in the first trial to 3.16 in the second trial, this needs to be analyzed considering the role of developing visual basic media with excel is quite maximal in this research.

Increasing Mathematical Resilience With Media Developed Based on Open Ended Problems

From the results of the resilience questionnaire, the test questionnaire data I and trial II were analyzed in trial II, the average indicator 1. Perseverance, confident/confident, working hard, not easily giving up in the face of problems, failures and uncertainties of 12.32 obtained from trial I and trial II were 10.52 and 14.12. Average indicator 2, Desire to socialize, easy to give peer help, and adapt to the environment of 12.06. The results obtained from the first trial and second trial are 10.40 and 13.32. The average indicator is 3. Generating new ideas or ways and looking for creative solutions to challenges is 11.88 which is obtained from the results of trial I and trial II, namely 10.44 and 12.00. The average indicator 4. Using the experience of failure to build self-motivation of 12.02 which was obtained from the results of the first trial and second trial, namely 10.48 and 13.56. The average indicator is 5. Shows curiosity, reflects, researches, and utilizes various sources of 11.02 obtained from the results of trial I and trial II, namely 10.72 and 11.32. The average indicator is 6. Having language skills, self-control and being aware of his feelings is 11.28 which is obtained from the results of the first trial and second trial, namely 11.28 and 11.28.

Conclusion

The validity of the open-ended problem-based mathematics learning media assisted by visual basic with excel is included in the valid category with an average total media validity value of 4.25 from media experts a total average of 2.98, from learning material experts a total average of 2.83, then the average total validity of the lesson plans is 4.16; the average total validity of LKPD is 4.25; and similarly, the tests of creative thinking skills

and resilience were declared valid. The practicality of open-ended problem-based mathematics learning media assisted by visual basic with excel has also met the practical criteria. The effectiveness of open-ended problem-based mathematics learning media assisted by visual basic with excel in terms of classical student learning mastery has reached 52% in the first trial and learning mastery students in the 68% trial. The students' creative thinking ability increased after learning by using learning media and learning tools based on open ended problems assisted by visual basic with excel seen from the average results of the pretest and posttest of the first trial with an N-gain score of 0.33 with the medium category and in the second trial the average pretest and posttest results based on the N-gain calculation got a score of 0.34 with the medium category the students' mathematical resilience changed after learning by using visual basic assisted learning media with. With the resilience questionnaire, the data for the Trial I questionnaire and the Trial II questionnaire were analyzed in the first test, the average indicator is 1.

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