Development of Interactive Learning Media Based on *Open Ended Problem Approach* Assisted by *Visual Basic* With *Excel* to Improve *Creative Thinking Ability* 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 interactive learning media based on an open ended problem approach assisted by visual basic with excel to improve creative thinking skills in Al Manar Private Junior High School (2) Describe the improvement of students creative thinking skills based on an open-ended problem-assisted visual basic approach that was developed. This type of research includes development research using the Tesmer model. The research was carried out in T.A 2021/2022 for class VII students. The results showed: (1) Mathematics learning media based on an open-ended problem approach assisted by visual basic with excel to improve students creative thinking skills that were developed already met the valid, practical and effective criteria. (2) Increasing students creative thinking skills using learning media developed on rectangular and square material seen from the average results increased from 75.80 to 82.60.

Keywords: Creative Thinking Skills, Open Ended Problem Approach, Visual Basic.

1 Introduction

In achieving the success of the learning process, it is expected that a teacher can prepare learning materials that will be taught to students, one of the learning materials that can be prepared is teaching aids/practicum that will be used. Creative and innovative learning teachers can create learning media. The use of learning media is one of the determining factors in the success of the learning process. By using learning media, information related to learning materials will be conveyed easily, and the use of creative and innovative learning media can facilitate and improve learning efficiency so that learning objectives can be achieved.

According to Oemar (Purnamasari, Nugraheni, and Dyani, 2017: 64) Hamalik, learning is the combination of human elements, materials, facilities, equipment and processes that interact to achieve learning goals. Trinto (2009:17) argues that learning is a two-way interaction between teacher and student, focused and direct communication (communication) between the two of them toward a predetermined goal.) is said to take place. Ministry of National Education

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“Law No. 20 of 2003 on National Education and Education, Article 1 Section 20, learning is the process of interaction between students and educators and learning resources in a learning environment”. From these expert opinions, we conclude that learning is a two-way interaction between teachers and learners, and that communication (transmission) between learning, materials, and education takes place between her two groups. can be attached.

Lestari and Mokhammad (Guntur, Aliyyatunnisa, Kartono, 2020: 386) states that the ability to think creatively is the ability to generate new ideas and ideas in the form of ways to solve problems.On the other hand, Martins (Kertayasa, 2019: 46) Creative thinking is the ability to come up with new ideas and methods

The ability to think creatively must be acquired and honed by all students, In addition to the demands of the curriculum as well as the demands of the times. Schools today need to reach a creative level, not just develop cognitively competent students. The importance of creativity is also evident in areas where there are social media applications that require creativity, and even a promising new profession is content creator. From the above discussion, it is clear that the world of education should pay more attention to creative thinking abilities.

If you have creative thinking skills are not properly developed, mathematics becomes nothing more than a material that imitates examples and all kinds of procedures without knowing their meaning. Students are born without We are concerned that students lack the autonomy to deal with everyday problems.

Poor creative thinking skills when learning mathematics also mean that students are not used to coming up with their own ideas. Therefore, learning is only teacher-centered, teachers tend to abandon different learning models, students cannot find their own learning concepts, and most students end up doing learning activities in the form of memorization. I'm used to it. without the development of creative thinking skills.

We certainly do not expect this situation to come together. This means that we need to find precise solutions to solve problems withinside the global of education that relate to the creative thinking skills of both students. Possible solutions include motivational training for teachers and students, provision of scholarships for outstanding students, encouragement of teacher participation in government programs such as driving instructors, and use of appropriate learning models and learning media. included. Thinking ability.

From the above solution offerings, researchers are interested in solving problems by using different learning models and incorporating new learning media for schools. This solution does not require much cost and can be applied to more materials.

The following reason is based on the observations of Al Manar private secondary school researchers, who We received information that teachers did not consider aspects of subject characteristics when developing learning media. School researchers observed that the learning media used did not appear to be able to further arouse Student interest in problem solving. Because most of the questions were in the form of long story questions with no images or colors might arouse the student interest. Reading. Haggarty and Keynes state that improving mathematics Teaching and learning in the classroom requires efforts to improve understanding of teachers, students, and materials used in learning and interacting. (Muchayat, 2011:201). between them. For this reason, teachers should be able to create and develop these learning media.

Learning media are used as benchmarks for professional teachers to evaluate each teacher's performance. Teachers who can determine for themselves the extent to which the designed learning media can be used in the classroom. Through learning media, teachers can improve their professionalism. In addition to using learning media as a benchmark to measure the professionalism of teachers, learning media should be tailored to the needs of students so that they can easily understand the topics given by the teacher. there is.

Excellent learning media are available for professional teachers according to the requirements of their professional qualifications. Therefore, all teachers in the educational environment believe that learning is interactive, stimulating, fun, challenging, motivates active participation, and has ample space for individual initiative, creativity, and independence. As such, we have a duty to edit and create learning media in a systematic and structured manner. Depending on the student's talents, interests, physical and mental development.

When using learning media, teachers must Choose appropriate and innovative learning methods. when learning mathematics teachers have made a lot of efforts to improve the learning process. One mathematics learning method that can be used to develop good learning media is to use an A free-form problem approach learning method. One of the benefits of learning a free-form problem approach is that it provides students with the opportunity to discover, identify, and solve knowledge/experience problems in a variety of ways. This enables students to use media to solve their learning problems.

Classroom learning requires teachers to create and develop learning experiences that encourage student activity and should avoid lecture-based learning methods. Also, to facilitate the development of student learning activities and experiences, a supportive medium is needed to motivate students to learn.

According to Irvian and Oktaviana (2017:64), Visual Basic is a program that can be used to quickly and easily create Microsoft Windows-based applications. Visual Basic provides tools for building simple to complex applications for personal or government use on large systems.

Rohaeti (2019:60) says Visual Basic for Excel allows you to develop math programs that understand numbers, arithmetic, and geometry. Existing learning media will become multimedia that can improve students' thinking patterns, allowing students to solve existing problems in a variety of ways/techniques. Learning that helps students engage in the use of learning media. Also, having a visual foundation can increase students' motivation to learn. Therefore, the development of learning-based learning media through an open-ended problem approach can be viewed as harmoniously combined with basic visual aids.

This approach can be seen as an attempt It improves the quality of math learning, enhances creative thinking skills and resilience, and is an open-ended approach to problems.

According to Shimada and Becker (Oktaviani and Tari, 2017: 134), an open-ended problem approach is one that gives students the opportunity to explore different strategies and methods that may be suitable for solving problems. Based on the expert opinion above, an open-ended problem-solving approach should be based on the freedom and ability of each individual student to develop knowledge in a variety of ways. Teachers can also encourage students to think creatively by asking application questions along the lines of everyday life and translating them into math form.

The purpose of this development is to create a new product that is a paid improvement of an existing product. The reason for product improvement is believed to be inconsistent with its ability to meet the expected learning goals of improving students' creative thinking.

Open-ended learning researchers are learners who help students Participate in the use of learning media. open-ended approach to problems supported by a visual foundation may Enhance students' creative thinking and resilience to learning. Therefore, the Developing Learning Based on Learning media through an open-ended problem approach can be viewed as harmoniously combined with basic visual aids.

Based on the explanation above, there is a positive association between the ability to think creatively and mathematics in general.The ability to think creatively influences learning in the classroom. An open learning approach also helps students engage with their use of learning media. Teachers can also use learning media to explore the effectiveness and practicality of approaches used to develop learning media with visual underpinnings that are likely to motivate students to learn. . gain. Development of learning media is based on open problems supported by a visual foundation using Excel is considered harmonious in improving students' creative thinking skills. Therefore, the authors title the study 'Developing an interactive learning medium based on an open-ended problem approach, supported by Visual Basic using Excel, to enhance the creative thinking skills of Al Manar Private students'. I am interested in middle school".

2 Research method

Based on the problem and set research objectives, the research type used in this study is development research. The formative assessment model Tessmer Development Model (Jurnadi and Zulkardi, 2017) is used as the development model. In this study, it was developed in the form of a mathematics learning medium based on a free-form problem approach supported by Visual Basic using Excel with four pages of material.

Research subjects and objects

The All subjects in this study were Al Manar private secondary school students in grades 2021/2022 subjects were in grades VII-A (25 students) and VII-B (25 student). of test I. students).) On the other hand, the purpose of this study is a visual basic mathematics learning medium using Excel in squares, used to improve students' creative thinking and mathematics abilities.

Data analysis

- Student analysis

The student analysis in this study focused on class VII-A students as subject exam i and VII-B students as subject exam II. It aims to provide information on the number and characteristics of students in Class VII. increase.

- Curriculum analysis

Curriculum evaluation on this examine is an analysis of the gaining knowledge of materials targeted at Al Manar private secondary school for this course that is, Visual Basic Assist 4-page materials using Class VII Excel, and concept analysis is related to analysis of student

materials. I'm here. Having her map of concepts here helps students understand the content of the material.

- Material analysis

The purpose of the Material Analysis of Material Analysis activity is to identify, refine, and systematically collate the key material that students will study, based on a curriculum analysis. This analysis helps identify key materials used to guide the development of learning media.

- Media analysis

The media analysis in this research is a media problem faced by junior high school teachers, one of which is the difficulty of learning media production. They usually don't have the time, have difficulty explaining the material, and have difficulty choosing pedagogies to create learning media. On the other hand, the problem of junior high school students is that the contents of the teaching materials are difficult to understand. and teachers have a hard time creating learning media, especially her four-page teaching materials for her VII junior high school, even semester . To overcome the teacher-student problem, Al Manar Private Secondary School conducted a study on developing learning media using Visual Basic and Excel in a four-page material math subject.

The development an open-ended problem-based learning medium supported by Visual Basic and Excel used in this study is a modified formative evaluation Tessmer development model. The study consists of his two phases, a preliminary evaluation and a formative evaluation (prototyping), which include expert evaluation, one-on-one small group and field testing. Further details on the development of formative evaluative tessenger learning media are presented below. This has his two stages in Figure 1.

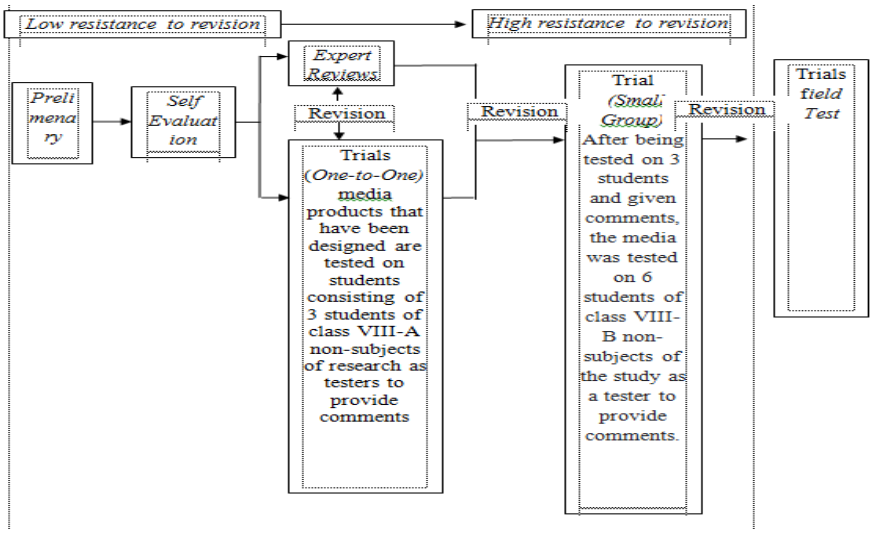

Figure .1 Tessmer's research flow

- Research instruments

In this development study, the following research tools will be used to evaluate the developed learning media.

- Questionnaire

The questionnaires used in this study were: (1) a questionnaire for subject matter experts (2) a questionnaire for learning media experts (3) a questionnaire for math teachers to measure the practicality of learning media.

- Creative thinking test

This test of creative thinking ability is administered to measure the effectiveness of the learning media developed and to ascertain students' creative thinking ability. The Creative Thinking Test is conducted in an essay format.

3 Research result

Trial I and II (*Field Test*)

After a small group test, several students with varying abilities are graded in very high, high, medium, low and very low categories. Of the several modifications made in the small group tests, the equipment developed was modified again and tested again for its effectiveness when all equipment was declared valid, viable and effective. After that, Prototype III (third) is generated. The research object under test (field test). Experiment I subjects were conducted in her VII-A class with a maximum of 25 students, while Experiment II was conducted with a maximum of 25 students in class VII-B.

Description of the validity of developing visual basic assisted learning media with excel

Learning media must be valid based on expert/practitioner evaluation of the learning media in which it is developed. An analysis of the adequacy of mathematics learning media using Excel compatible with Visual Basic, developed from the two perspectives of learning media experts/practitioners and mathematics subject experts/practitioners. The evaluation of learning media experts and learning material experts was previously described during the development stage of validation results using validators. In Experiment I, the result was that the developed learning media was declared effective with an average score of 2.98 between learning media experts and learning media experts. In Experiment II, the learning media developed were declared to have a learning media expert mean score of 3.00 and a learning media expert mean score of 2.85. See Tables 1 and 2:

Table 1. Results of learning media validation by trial experts I

Validator	Rata-rata skor	Kriteria
Learning Media Expert	2,98	Valid
Mathematics Subject Matter Expert	2,81	Valid

Table 2. Results of learning media validation by trial experts II

Validator	Rata-rata skor	Kriteria
Learning Media Expert	3,00	Valid
Mathematics Subject Matter Expert	2,85	Valid

Description of the Practicality of Developing *Visual Basic* Assisted Learning Media With *Excel*

Description of practicality based on teacher assessment

Learning media was validated or determined to be highly relevant based on the results of testing learning media developed with an open-problem approach supported by Visual Basic and Excel.

Teacher evaluations of Probelernen I, which developed Visual Basic-enabled learning media in Excel, are positive. Based on an average score of 2.67. This value is then related to the actual criteria. From this we can conclude that the first practicality criterion, which can be used with minor modifications, is met. It is also positive given teachers' evaluation of Trial II learning with Excel on Visual Basic enabled learning media.

Based on an average score of 2.95. This value is then related to the actual criteria. From this we can conclude that the first practicality criterion, which can be used with minor modifications, is met.

Description of practicality based on student responses

The reaction of students to Trial Learning I, which uses Visual Assisted Learning Media developed by Excel, is positive. Based on an average score of 2.75. This value is then said to be within practical standards.

Based on student reaction to learning in Experiment II using the Visually Aided Learning Media developed by Excel, it can be said to be positive. This gives an average score of 3.26. This value is then said to be within practical standards.

Based on student responses to Trial Learning II, the basic visual media used in Excel is the result of improved media as a result of suggestions and criticisms. From the results of the student questionnaire, we can see that student response values increase from Trial I to Trial II. The increase in Trial I was 0.51, while the increase in Trial II was influenced by media improvements with suggestions and criticisms.

Description of practicality of student activities (LKPD)

LKPD data are included to confirm the extent of the role of visually assisted learning media with Excel designed in the learning process to improve students' creative thinking skills. A total of 25 students, he divides into 5 groups, each group consisting of 5 of her. LKPD will be provided to each group at her 3 meetings. Her LKPD given to her students includes activities aligned with indicators and learning objectives to enhance students' creative thinking. The results of her LKPD analysis for Experiment I are shown in Table 3:

Table 3. LKPD assessment in *field test* II

	TRIAL I		
	1ST MEETING	2ND MEETING	3RD MEETING
Top Rated	81	88	88
Lowest Value	44	50	56
Average	63.6	71.4	76.4
Group Completion	2 GROUPS (40%)	2 GROUPS (60%)	3 GROUPS (60%)

A description of the LKPD analysis in Study II (Field Test II) is shown in Table 4:

Table 4. LKPD assessment in *field test* II

	TRIAL II		
	1ST MEETING	2ND MEETING	3RD MEETING
Top Rated	88	94	94
Lowest Value	69	63	69
Average	78.5	78.5	81.5
Group Completion	2 GROUPS (60%)	2 GROUPS (80%)	3 GROUPS (80%)

Description of The Effectiveness of Developing *Visual Basic* Assisted Learning Media With *Excel*

Effectiveness of learning media development is demonstrated by measures of goal attainment (a) Classical creative thinking of at least 85% of the total number of students participating in learning with Visual Basic media using Excel level of ability. Students with good creative thinking skills have a minimum score of 62.75, or at least a B grade, or 2.51 when converted to a standard 4 grade; is the same as.

Completeness of Students' Creative Thinking Ability Value

Determining criteria for the effectiveness of the use of Visual Basic learning media with Excel developed in the teaching and learning process can be based on the integrity of the value of the student's creative thinking ability. Table 5 shows a description of the students' creative thinking ability values in Experiment I (Field Test I). Further afield:

Table 5
Pre-Test/Post-Test Scores of Creative Thinking Ability in Trial I
(*Field Test* I)

Range of Values	Letter	Pret-Test			Post-Test		
		Many Students	Average	Highest/ Lowest	Many Students	Average	Highest/ Lowest
96,25 – 100	A	-			-		
87,75 - 96,24	A-	-			2		
79,50 - 87,50	B+	1			6		**Highest**
71,25 - 79,49	B	2		**Highest**	8		**90,00**
62,75 - 71, 24	**B-**	10		**80,00**	9	**75,80**	
54,50 - 62,74	C+	8	**63,40**	**Lowest**	-		**Lowest**
46,25 - 54, 49	C	4		**53,00**	-		**65,00**
37,75 - 46, 24	C-	-			-		
29,50 - 37,74	D+	-			-		
< 29.50	D	-			-		

A description of the student's creative thinking ability values in Experiment II (Field Test II) is shown in Table 6:

Table 6
Pre-Test/Post-Test Scores of Students' Creative Thinking Ability in Trial II

Range of Values	Letter	Pret-Test			Post-Test		
		Many Students	Average	Highest/ Lowest	Many Students	Average	Highest/ Lowest
96,25 – 100	A	-	73,40	Highest 85.00 Lowest 65,00	-	82,60	Highest 95,00 Lowest 70,00
87,75 - 96,24	A-	-			8		
79,50 - 87,50	B+	7			11		
71,25 - 79,49	B	6			4		
62,75 - 71, 24	B-	11			2		
54,50 - 62,74	C+	1			-		
46,25 - 54, 49	C	-			-		
37,75 - 46, 24	C-	-			-		
29,50 - 37,74	D+	-			-		
< 29.50	D	-			-		

To determine improvements in creative thinking ability, data were obtained from pre- and post-trial spatial ability results of the acetia pad test. Improvements in student spatial ability can be obtained from the normalized Victory Index data as follows:

$$N - Gain = \frac{Posttest - Pretest}{Skor\ Ideal - Pretest} \text{(Hake, 1999)}$$

The normalized gain index criteria (g) are:

$g > 0.7$: High

$0.3 < g \leq 0.7$: Medium

$g \leq 0.3$: Low

On trial I, we got a pre-test mean of 63.40 and a post-test mean of 75.80, so the N-Gain value was:

$$N-Gain=\frac{Postest-Pretest}{Ideal\ score-Pretest}=\frac{75{,}80-63{,}40}{100-63{,}40}=\frac{12{,}4}{36.6}=0{,}33$$

On the other hand, Experiment II had a pre-test mean of 73.40 and a post-test mean of 82.60, so the N gain values were:

$$N-Gain=\frac{Postest-Pretest}{Ideal\ score-Pretest}=\frac{82{,}60-73{,}40}{100-73{,}40}=\frac{9{,}20}{26{,}60}=0{,}34$$

Based on the normalized gain index (g), scores increased at low criteria ($g \leq 0.3$) in trial I and moderate criteria ($0.3 \leq g \leq 0{,}7$) in trial II.

4 Research discussion

Development The results of the data analysis for Learning Media Experiment I and Experiment II show the following: (1) Visual Basic-enabled mathematics learning media effectively developed in Excel, (2) Visual Basic-enabled mathematics learning media practically developed in Excel, (3) Visual Basic-enabled mathematics learning media with excel which is developed effectively, (4) students` creative thinking ability improves through the development of mathematics.

Validity of Visual *Basic* Assisted Mathematics Learning Media Development With *Excel*

Based on the results of testing Visual Basic enabled math learning media developed in Excel, the developed math learning media was declared valid or found to have sufficient validity. The practicality of developing Visual Basic assisted math learning.

Practicality of Developing *Visual Basic* Assisted Mathematics Learning Media with *Excel*

Media with Excel The feasibility of media development in this study was confirmed using three aspects: teacher questionnaire, student response questionnaire and LKPD results. Based on the results of testing Visual Basic-enabled math learning media developed in Excel, the developed math learning media was declared to be practical or found to have sufficient validity.

The Effectiveness of Developing *Visual Basic* Assisted Mathematics Learning Media With *Excel*

Developed Vehicle is effective If the vehicle is in the effective category, results can be seen in Trial I and Trial II. Effective mediums are seen as a result of perfecting the value of a student's creative thinking skills.

Completeness of Creative Thinking Ability Values

The integrity of the value of creative thinking ability Based on Trial I and Trial II, we analyzed the test data results and found that the students' creative thinking ability met the criteria for a classical degree. This is because the materials developed and the math learning

problems and student activity sheets were adapted to the conditions of the student's learning environment. By using media in the learning process in the classroom, students will have a better understanding of all the shapes of the rectangle and students will be able to use these media to produce results from their worksheets. Allow students to use media directly.

5 Conclusion

Based on the analysis and discussion results of this study, several conclusions were drawn, including:

Mathematics learning media based on an open-ended problem approach supported by a visual foundation using Excel were placed in the "effective" category as determined by validation results from UNIMED Math Tutors and Math Teacher Validators . Media expert media validation scores averaged 2.98 in Trial I and 3.00 in Trial II for valid categories. Subject matter expert validation scores averaged 2.81 and valid categories averaged 2.85. Furthermore, the overall RPP validation was categorically valid with an average of 3.25 in Trial I and an average of 3.32 in Trial II. LKPD efficacy was 3.31 on average and 3.37 with category valid.

A mathematics learning medium based on a free-form problem approach underpinned by a visual foundation with Excel was developed, and as a result of teacher and student responses, fulfilled the practical application category. Teacher responses averaged 2.67 for test I and 2.95 for test II, categorized as good. Student responses were found to be in the category "Good" with an average of 2.75 for Experiment I and an average of 3.26 for Experiment II. In addition, complete a group worksheet (LKPD) for students at each meeting achieving 50% or more of the group.

Mathematics learning media, developed with a free-form problem approach using Visual Basic and Excel, met efficacy categories determined from pre- and post-test student learning test results. Classical student performance of 12% (3 students) in Experiment I and 48% I (12 students) in Experiment II was achieved, based on student pretest results. And the final grades of the students who took the posttest in the Classic were 64% (16 students) on Trial I and 88% (22 students) on Trial II.

A Visual Basic-supported approach using Excel for a 4-page document based on a normalized return index. We found that there was a score increase of 0.33 for moderate criteria in study I and a score increase of 0.34 for moderate criteria in study II.

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