

# Development of Mathematics Mobile Learning Application Through Discovery Learning Method

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**Abstract.** This study aims to produce learning media for Mobile Learning for class VII students of SMP/MTs through the Discovery Learning method and test the feasibility of applications in mathematics learning. This research is a development research with steps 4-D Research and Development (R & D) model (Define, Design, Develop, Disseminate). The study was conducted at SMP Muhammadiyah 1 Kalasan, Sleman Regency. This research data is obtained from student response evaluation sheets by students. Research data were analyzed by descriptive analysis process and questionnaire analysis process with Likert scale. The results showed that the Mobile Learning Mathematics application developed was of good quality. Thus, the application of Mobile Learning mathematics material is set for students of class VII SMP/MTs through Discovery Learning methods that are feasible to be used in mathematics learning.

**Keywords:** Learning, Media, Mobile, Application

## 1. Introduction

Law Number 20 of 2003 concerning the National Education System explains that learning activities are the process of interacting students with educators and learning resources in a learning environment that aims to develop the potential of learners so that they become faithful and fearful people of God Almighty, noble, healthy, knowledgeable, capable, creative, independent, and democratic and responsible citizen. Based on educational goals, it appears that student learning is not just about teaching knowledge. The law has laid strong foundations in supporting the development of national character and identity.

National education aims to develop abilities, one of the abilities developed is the ability to think creatively. Creative thinking is classified as high-level competency (high order competencies) and can be seen as a continuation of basic skills. Creativity plays an important role in the cycle of advanced mathematical thinking [1]. Furthermore, according to the Maine Career Center Department of Labor USA, the ability to think creatively is important because this ability is one of the abilities desired by the workforce [2]. These statements indicate that the ability to think creatively is an important ability to be improved.

One of the successes of student learning is determined by the teacher as an educator. The use of varied learning models can support student learning success. This is in line with the opinion which states, the application of innovative and constructive learning models is more

appropriate in developing and exploring student's knowledge in a concrete and independent manner [3]. There are so many learning models that can be applied by the teacher in the learning process so that students can absorb the material and improve thinking skills.

The performance and competencies of the teacher bear the main responsibility in changing student orientation from ignorance to knowledge, from dependence to being independent, from being unskilled to skilled, to learning methods no longer preparing passive students, but knowledgeable students who are always able to absorb and adjust yourself with new information by thinking, asking, exploring, creating, and developing certain ways to solve problems related to their lives [4].

One model that teachers can apply is cooperative learning which is a learning model that emphasizes the process of cooperation in a group [5]. Cooperative learning is designed so that every individual involved in learning works together and interdependently with each other in a task structure and purpose [6]. In cooperative learning, students are directed to cooperate and help to help in groups to understand the material of a lesson so as to grow a high social sense among fellow members in the group [7]. The cooperative learning model is carried out by dividing students into small groups in learning the material being studied the division of the group was made heterogeneous, both in terms of learning achievement and gender [8] [9]. This cooperative skill serves to facilitate work relationships and tasks [10]. Cooperative learning model one of which is discovery learning.

Discovery learning is a learning theory that is defined as a learning process that occurs when students are not presented with lessons in their final form but are expected to organize themselves [11]. Discovery learning foster student creativity in learning [12]. The purpose of discovery learning model, which is to give students the opportunity to be actively involved in learning, encourage students to learn actively by connecting the experiences of students with new experiences learned so that students can find answers to the problems given by the teacher [13].

Discovery learning models are considered able to boost student's mathematical problem-solving abilities in mathematics learning [14]. This model is effective in encouraging student involvement and motivation while helping them gain an in-depth understanding of clear topics [15]. Discovery occurs when individuals are involved, especially in using their mental processes to find several concepts and principles, through observation, classification, measurement, prediction, determination, and inferiority. Therefore, with the discovery learning model, students will be able to store knowledge longer in their memory because they find their own answers [16].

In discovery learning requires students to find new things, the process of discovering new things requires creativity, so that the discovery learning model and the syntax in it can improve student's creative thinking. This is in line with the results of Schlenker's research which shows that the practice of inquiry can improve understanding of science, productive in creative thinking, and students become skilled in obtaining and analyzing information [3].

To overcome this problem, learning media is needed in order to produce maximum learning outcomes. One of them is the media using the eXe learning application. eXe eLearning is a writing program, where teachers can develop and publish learning material without the need for expertise in programming languages [17]. The material can be presented in the form of tutorials and accompanied by multiple choice practice questions. The eXe learning program is an acronym for eLearning XHTML editor, a program used to make Web-based teaching materials designed to convey learning materials easier and more interesting [18].

In eXe learning programs, teachers can create Web-based teaching materials without needing to know about HTML, even easier than Web editors like Ms. Frontpage. In the eXe learning program, the teacher only opens the eXe learning page, then fills with text, images, videos and then automatically forms a table of contents that links to all pages [19]. But in these studies, the mathematical concepts associated with Discovery Learning have not been applied in eXe learning media development.

Mobile Learning is the next generation of e-Learning and is based on mobile devices [20]. In cellular learning, two main concepts are cellular people and students. Smart learners are supported by their willingness to cellular learning and objects [21]. Cellular learning is a relatively new phenomenon and its theoretical foundation is under development [22]. Cellular learning refers to the use of cellular devices in the learning process considering two mobility attributes and wireless connections anywhere on the right path [23].

Mobile learning is defined as the use of portable computers or interactive electronic devices and constantly communicating in collaborative learning sessions field work, guidance or counseling and the process is more specific to experience specific domains and support application innovation in learning [24]. Mobile Learning has received a lot of critical, theoretical and empirical research attention in recent years. More and more sophisticated mobile devices and their potential for use in education are described as 'new paradigms' [25].

By utilizing technological developments at this time, researchers try to develop a Mobile Learning mathematics learning media set material through Discovery Learning methods that are designed as attractive as possible. In supporting the development of the Mobile Learning mathematics learning media, researchers used an open source application that is in accordance with the e-learning standard, eXe (learning XHTML editor).

## 2. Methods

Research on the development of Mobile Learning applications is in accordance with the steps contained in Research and Development (R & D) developed by Sugiyono by adapting the 4-D development model through 4 (four) stages, namely Define, Design, development (Develop), and spread (Disseminate) [26]. The subjects in this research and development consisted of seventh-grade students of SMP Muhammadiyah 1 Kalasan, Sleman Regency. This development research uses data collection techniques, namely literature study and questionnaire. Research data was obtained using data collection instruments, namely student response test instruments. From the data that has been collected, the average can be calculated using the equation (1) [27].

$$\bar{X} = \frac{\sum_{i=0}^n X_i}{N} \quad (1)$$

Information :

$\bar{X}$  : Average score

$\sum_{i=0}^n X_i$  : Total score

N : Number of assessors

Furthermore, the data obtained from class VII students are converted into qualitative values based on the ideal assessment criteria. The provisions of the ideal assessment criteria are shown in Table 1.

**Table 1.** Ideal Assessment Category Criteria.

No.	Score Range ( <i>i</i> ) Quantitative	Qualitative Category
1.	$\bar{X} > \bar{M}_i + 1,8 SB_i$	Very good
2.	$\bar{M}_i + 0,6 SB_i < \bar{X} \leq \bar{M}_i + 1,8 SB_i$	Good
3.	$\bar{M}_i - 0,6 SB_i < \bar{X} \leq \bar{M}_i + 0,6 SB_i$	Enough
4.	$\bar{M}_i - 1,8 SB_i < \bar{X} \leq \bar{M}_i - 0,6 SB_i$	Less
5.	$\bar{X} \leq \bar{M}_i + 1,8 SB_i$	Very less

### 3. Result and Discussion

At define stage reference studies were carried out from various sources, discussions with lecturers about the potential and problems in developing Mobile Learning. At this stage, reference studies were carried out from various sources, both from the internet and print media regarding the information used in developing Mobile Learning.

Then in the design stage, curriculum analysis is carried out by looking at the subject matter and learning experience of the material set, then the competencies that must be possessed by students, compile a map of Mobile Learning needs which is a diagram of writing Mobile Learning material and to determine the amount of material to be written, and determine learning activities in Mobile Learning that have been developed, using Discovery Learning methods.

Mobile Learning applications that are developed have characteristics, including the contents of Mobile Learning are adjusted to core competencies and basic competencies that are developed based on the curriculum 2013, using simple language, and Mobile Learning uses pictures and illustrations that are in accordance with the material. Some menu functions in the Mathematics Mobile Learning application, including (1) Understanding, so that students understand the meaning or meaning contained in the understanding of the set, (2) Notation, allows students to look at symbols or symbols that describe a set, (3) Declare a set, so that students are able to understand three ways of expressing a set, (4) Set of numbers, so that students are able to explain the number of types of numbers, (5) Types, making it easier for students to understand the many kinds of sets, (6) The subsets, making it easy for students to understand a set that is contained in another set, (7) Set Questions, contains daily life problems with Discovery Learning methods, (8) Posttest questions, training student's understanding of the set material that contains 10 Multiple Choice questions.

Mobile Learning applications that have been created are then tested to 16 students of class VII SMP Muhammadiyah 1 Kalasan, Sleman Regency which are randomly selected. The products that have been made are promoted online which can be downloaded via the following link. [https://drive.google.com/open?id=1nc\\_4vtRSq4CDEIVjMHIRyW48MV74Me\\_4](https://drive.google.com/open?id=1nc_4vtRSq4CDEIVjMHIRyW48MV74Me_4)

Student's responses to the developed Mobile Learning Mathematics application are known based on the results of questionnaires given and filled out by students during the trial. The results of the student response questionnaire calculation can be seen in Table 2.

**Table 2.** Student Response Questionnaire Results.

No.	Criteria Item Statement	Ideal Maximum Score	Amount of Score Obtained	Average Amount of Score Obtained	Percentage
1.	Usefulness	32	429	26,81	83,79%
2.	Ease of Use	44	589	36,81	83,66%
3.	Ease of Learning	16	224	14,00	87,50%
4.	Satisfaction	28	386	24,13	86,16%

Seen in the table above that the quality of the Mobile Learning mathematics application from the trial at the research location with details for usefulness criteria (obtained) obtained an average score of the questionnaire calculation results of 26,81; ease of use criteria (ease of use) obtained an average score of the results of the questionnaire calculation 36,81; ease of learning criteria (ease of learning) obtained by an average score of the results of questionnaire calculation 14,00; and the criteria of satisfaction (satisfaction) obtained an average score of the results of questionnaire calculations 24,13. Acquisition of each student questionnaire response results are in the validity criteria shown as in Table 3.

**Table 3.** Criteria for Ideal Assessment Category of Student Response.

No	Quantitative Score Range					Qualitative Category
	Usefulness	Ease Of Use	Ease of Learning	Satisfaction	Total	
1	$\bar{X} > 27,2$	$\bar{X} > 37,4$	$\bar{X} > 13,6$	$\bar{X} > 23,8$	$\bar{X} > 102$	Very good
2	$22,4 < \bar{X} \leq 27,2$	$30,8 < \bar{X} \leq 37,4$	$11,2 < \bar{X} \leq 13,6$	$19,6 < \bar{X} \leq 23,8$	$84 < \bar{X} \leq 102$	Good
3	$17,6 < \bar{X} \leq 22,4$	$27,5 < \bar{X} \leq 30,8$	$8,8 < \bar{X} \leq 11,2$	$15,4 < \bar{X} \leq 19,6$	$66 < \bar{X} \leq 84$	Enough
4	$12,8 < \bar{X} \leq 17,6$	$17,6 < \bar{X} \leq 27,5$	$6,4 < \bar{X} \leq 8,8$	$11,2 < \bar{X} \leq 15,4$	$48 < \bar{X} \leq 66$	Less
5	$\bar{X} \leq 12,8$	$\bar{X} \leq 17,6$	$\bar{X} \leq 6,4$	$\bar{X} \leq 11,2$	$\bar{X} \leq 48$	Very less

From the table above, the Mobile Learning mathematics application developed for usefulness criteria and ease of use is in a good category, while for the criteria of ease of learning and satisfaction are in the excellent category.

From the experiments conducted can be obtained the calculation results of the average overall criteria for student response questionnaires of 101,75. These results indicate that  $84 < \bar{X} \leq 102$ , so that the quality of the Mobile Learning mathematical application of set material for students of class VII SMP/MTs through the Discover Learning method developed is included in the criteria of good and feasible to be used in the learning process.

Mathematics learning media that has been tested on students, then distributed. Here are some descriptions of the results of the development of the Mobile Learning application of the mathematical set material.



Figure 1. Display menu of the Mobile Learning mathematics application.

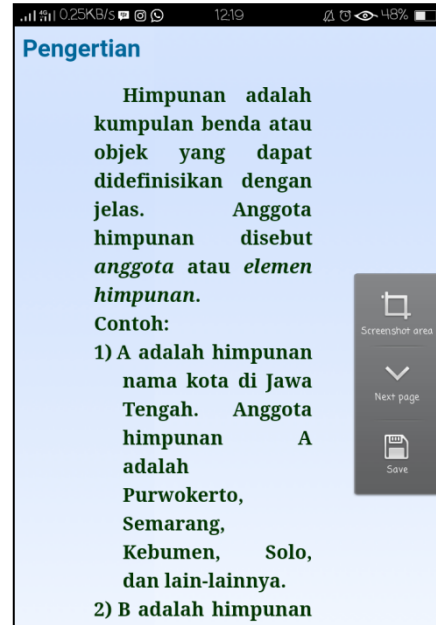


Figure 2. Display the contents of the Mobile Learning mathematics application.



Figure 3. Display contents of the Mobile Learning mathematics application.

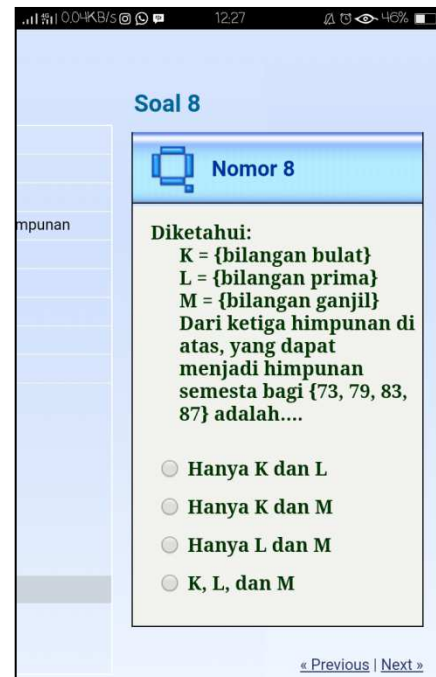


Figure 4. Display questions about the Mobile Learning mathematics application.

## 4. Conclusion

After the Mobile Learning Mathematics application, the set material was developed, then a trial was conducted to find out the student's response to the Mobile Learning mathematics application through the Discovery Learning method developed. Based on these assessments, it can be concluded that in general the developed Mobile Learning mathematics application is included in the good category. Thus, the Mobile Learning mathematical application of set material for class VII students of SMP/MTs through Discovery Learning methods is appropriate to be used by teachers to teach and students to study independently at school or outside the school.

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