Development of *Problem-Based Learning* (PBL) with the Use of *E-Modules* to Increase Curiosity and Problem-Solving Ability of Gelanggang Theory Material

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Abstract

This study aims to determine the results of the ability of problem-based learning (PBL) mathematics with the use of *e-modules* on the material of gelanggang theory can increase curiosity and problem-solving skills. This research is a type of development research through the *ADDIE* approach model. The development validation process was carried out by expert lecturers. While the research data was obtained through field trials. The source of data was taken from Tadris Mathematics students of IAIN Sheikh Nurjati Cirebon who took the Gelanggang Theory course which was divided into experimental and control class groups. The development results show that the developed product meets the valid criteria. According to the findings, this development research also meets the practical and effective criteria indicated by the high acquisition of student curiosity results which resulted in improving student problem-solving skills.

Keywords: Mathematics Learning, Problem-Based Learning (PBL) Model, Electronic Module (*E-Module*), Curiosity, Problem-Solving Ability

1. Introduction

Change is something that cannot be avoided, so the demands for progress must continue to increase and develop in various sectors. Entering the era of globalization, especially after the emergence of the covid-19 virus, various upheavals and resolutions were carried out, as well as in the education sector. Maskur, Nofrizal & Syazali (2017) state that education is a complex, broad-dimensional activity, and is also influenced by many variables.

One of the sciences studied in the world of education is mathematics. Mashuri (2019) revealed that mathematics is a universal science that has several dominant roles in various disciplines including the development of one's thinking power and underlying the development of modern technology. Learning that can channel and foster this development is *problem-based learning (*Amir, 2016). The *problem-based learning* (PBL) model according to (Sanjaya, 2006) isa series of learning activities that emphasize the problem-solving process by encouraging students to actively think, find, communicate, and conclude a problem through a scientific thinking approach. Sutrisno (2019) added that the learning process is inseparable from various supporting tools in it or what is commonly called learning media. Electronic modules or *e-modules* are one of the means of teaching media supporting learning that is systematically designed to contain material, methods, limits, and ways to evaluate to achieve competencies with a level of complexity electronically (Wibowo & Pratiwi, 2018). *E-modules* can be used as one of the teaching media to achieve a desire to find and understand something new or common called curiosity (Samani & Hariyanto, 2012). Meanwhile, problem solving ability as cited by Nafi'an (2019) is one of the components that cannot be separated from mathematics because it is important in learning mathematics. Problem-solving ability is one of the important things to mastering cognitive, psychomotor, and social abilities.

However, the fact shows that there are still many students who lack curiosity and low learning problem-solving skills. Sudianto, Dwijanto & Adhi (2018) mentioned that the lack of mathematical ability is caused by the inability to solve problems by some students in the use of methods, strategies, and approaches. The appropriate learning in the mathematics learning process carried out is the *problem-based learning* (PBL) model. While teaching media that is considered appropriate for the application of *problem-based learning* (PBL) using *e-modules*. This is in line with research conducted by Sutrisno (2019) that interactive math *e-modules are* feasible and ready to be used as learning media with the acquisition of a value of 0.38 with effectiveness criteria, namely moderate. Departing from this, research on the development of *e-modules* through *problem-based learning* (PBL) can increase students' curiosity and problem-solving abilities in gelanggang theory material.

1.1 Research Problem

Based on the research background that has been described previously, the researcher formulated a research question. Thus the description of *problem-based learning* (PBL) through the use of *e-modules* of gelanggang theory material meets the criteria of valid, practical, and effective to increase the curiosity and problem-solving skills of 6th-semester mathematics tadris students at IAIN Syekh Nurjati Cirebon.

1.2 The Object of the Study

This study aims to describe the description of *problem-based learning* (PBL) through the use of *e-modules* of gelanggang theory material that meets the criteria of valid, practical, and

effective to increase curiosity and problem-solving skills of 6th-semester mathematics students at IAIN Syekh Nurjati Cirebon.

2. Review of Related Theories

This study covers various relevant theoretical studies that serve as the theoretical basis for this development research, including (1) mathematics learning (2) *problem-based learning* (PBL) model (3) electronic module (*e-module*), (4) curiosity, (5) problem solving ability.

2.1 Math Learning

Learning is an accumulation or collection between two concepts, namely the concepts of learning and teaching, whose emphasis lies in the adjustment between the two (Suardi, 2018). Mashuri (2019) states that mathematics is a universal science that has several dominant roles in various disciplines including the development of one's thinking power and underlying the development of modern technology. Kamarullah (2017) also added that mathematics is a science that always develops following the demands of human needs for technology. It can be concluded that learning mathematics is a teaching and learning process carried out to develop the thinking power and various abilities possessed by students related to numbers.

2.2 Problem-Based Learning (PBL) Model

Problem-based learning (PBL) according to Ali (2019) is learning through problems that encourage mastery of principles and concepts that are complex and open to students. Amir (2016) adds that problem-based learning (PBL) can help foster students' skills in communicating and solving-problems. Problem-based learning can also be said to be learning that can encourage students to understand a concept, theory, or practice by developing solutions to solve problems (Santoso, 2021). Maryati (2018) added that there are 5 phases in this learning, namely, 1) orient students to the problem, 2) organize students for study, 3) assist independent and group investigation, 4) develop and present articles and exhibits, 4) analyse and evaluate the problem-solving process. So it can be concluded that the problem-based learning model is a learning model that focuses entirely on students through the completion carried out by aligning the knowledge and understanding they learn through a problem presented.

2.3 Electronic Module (*E-Module*)

Sutrisno (2019) states that electronic modules or *e-modules* are book formats that are presented in electronic form containing information displays using computers or other electronic reading devices that are stored and can be accessed via hard drives, diskettes, CDs, flash dish or internet access. *E-modules* are systematically designed learning tools or facilities that contain material, methods, limits, and ways to evaluate (Fausih, 2015). Wulandari (2019) added that the learning process using *e-modules* can be done not only in the classroom. There are 3 techniques for developing teaching media in the form of modules (Wijayanti &

Sungkono, 2017; Sutrisno, 2019), including: 1) starting from scratch, 2) information repackaging, and 3) compilation. *It* can be concluded that an electronic module or commonly called an *e-module* is a set of learning media that is arranged in a systematic and structured manner that is used for self-study by students using non-print or digital devices.

2.4 Curiosity

Curiosity is a desire to investigate and seek understanding of something new that is happening, both natural secrets and social events (Samani & Hariyanto, 2012). Mustari (2011) adds that curiosity can be interpreted as an attitude and action taken to broaden and deepen something, whether it is seen, heard, or learned. There are 4 indicators of curiosity (Ministry of Education, 2010), including: 1) asking about things that are not understood, 2) reading other sources of reference, 3) discussing things that have just been obtained, 4) asking about something that is not understood or odd. Yaumi (2014) added that the characteristics of curiosity are 1) asking questions, 2) feeling curiosity, 3) digging, exploring, and investigating, 4) being interested in things that have not yet found the answer, 5) lurking, peeking, and unpacking various things that are still vague. Based on these things, it can be concluded that curiosity is a feeling, attitude, and action that arises solely to know more deeply and widely about what he has learned, seen, and heard.

2.5 Problem-Solving Ability

Problem-solving ability is one of the components that cannot be separated from mathematics because it is important learning (Nafi'an, 2019). Schoenfeld added (Aljaberi& Gheit, 2016; Astutiani, 2021) that problem-solving ability in mathematics is an ability that can be obtained by trying, exerting effort, and effort to achieve an expected result. There are 4 stages of problem-solving implementation 1) *understand the problem*, 2) *devise a plan*, 3) *carry out the plan, and* 4) *looking back.* (Polya, 1973; Astutiani, 2021). Based on some of this explanation, it can be concluded that problem solving ability is an important process in learning that is carried out to get a certain solution to a problem which includes several core factors including basic abilities in learning.

3. Research Method

This research is a research and *development* (R&D) using the *ADDIE* (*Analyse, Design, Develop, Implement, and Evaluate*) development model. The development validation process is carried out by expert lecturers who are experienced in their fields and have at least 5 years of experience. Meanwhile, research data were obtained through field trials. The source of data was taken from Tadris Mathematics students of IAIN Sheikh Nurjati Cirebon who attended the course of Gelanggang Theory which was divided into 2 class groups. 114 students from classes 6A, 6B, and 6C were grouped into experimental classes (i.e., classes treated through the implementation of problem-based learning (PBL) with the use of *e-modules*), and 70 students from classes 6D and 6E were grouped into control classes (i.e., classes treated with conventional

learning). Data were collected and compiled through the distribution of questionnaires and learning outcomes ability tests which were then analysed and interpreted.

4. Discussion

In the early stages of the development research process, several validation tests were conducted to determine the feasibility of the *e-module* being developed. Nieveen & Flomer (2013) state that the quality of learning media development results can be seen from 3 criteria, namely valid, practical, and effective. The final validation results of both media and material experts showed very feasible criteria. The results of the media expert validation test showed an average result of 4.3 and an overall percentage of 87%, while the results of the material expert validation test showed an average result of 4.4 with an overall percentage of 89%. This shows that *problem-based learning* with the use of *e-modules* is feasible to be tested on students.

E-modules that have been field-tested using a *problem-based learning* model show the acquisition of student questionnaire response validation with an average score of 4.1 with a percentage value of 81%. The results show that the *e-module* developed in the *problem-based learning* process is valid.

E-modules also show effective results, this can be seen from the value of assignments and learning ability tests by comparing the scores obtained from experimental and control classes. The acquisition of these values is shown in the table below.

Table 1. Experimental and Control Class Assignment and Study Skills Test Results

	Assignment Grade		Study Skills Test	
	Experiment Class	Control Class	Experiment Class	Control Class
Average	83.7	64.7	74.6	52.0
Σ Percentage (%)	84%	65%	75%	52%
Description	A-	B-	B+	C-
Criteria	Very good	Good	Good	Simply

Based on the results of the table, it shows that the acquisition of experimental class scores is better than the control class from various aspects seen, both from the aspect of task values, learning outcomes ability test scores, and the overall average value obtained. The overall value can be seen in the following table.

Table 2. Combined Results of Overall Mean Values of Experimental and Control Class

	Assignment Grade	
	Experiment Class	Control Class
Average	83.7	64.7
Σ Percentage (%)	84%	65%
Description	A-	B-
Criteria	Very good	Good

Table 2 regarding the acquisition of the average value above shows that the average acquisition of student learning ability test scores in the experimental class is much better than the control class with an average value of 83.7 and 64.7. This is reinforced by the results of the analysis test which shows a significance value of 0.000. These results state that the significance level of 0.000 <0.05 or 5% which means H_0 is rejected. So it can be concluded that there are differences in the results of the learning ability of classes treated with *problem-based learning* (PBL) with the use of *e-modules is* better than those without, which means that the developed product is practical and effective to use.

5. Conclusion

Based on the results of the analysis of research findings, shows that *problem-based learning* (PBL) with the use of *e-modules* meets the criteria of valid, practical, and effective to increase students' curiosity and problem-solving skills on the material of gelanggang theory.

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