Effectiveness of Interactive Physics Mobile Learning Media with Scaffolding Approach to Improve Students' Tolerance and Students' Self-Regulated Learning

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***Abstract*— Research has been conducted which aims to determine the effect of the use (IPMLM) with the scaffolding approach to improve students' tolerance and students' self regulated learning in the Bima city and Pontianak city. The study was conducted using Pretest-Posttest Control Group Design. XI grade students in Bima city that is spread in three schools, and X grade students in the Pontianak city that are also spread in three schools used as research subjects. The subjects were selected by purposive sampling technique. The study was conducted in the second semester of the 2018/2019 academic year. The data were obtained through the questionnaire regarding the tolerance and self regulated learning. the results showed an increase in the students' tolerance and students' self regulated learning, This is proven by the gain score for students tolerance in the experimental class of 0.19. This value is higher than the gain score in the control class which is only 0.08 but the results in both classes are included in the "low" category. Furthermore, the gain score for self regulated learning the experimental class are also higher by 0.35 included in the category of "medium", while the gain score in the control class is only 0.15 included in the "low" category.**

Keywords: mobile learning, scaffolding approach, tolerance, self-regulated learning

I. INTRODUCTION

Technological advances attract the attention of researchers and educators to apply technology-based learning [1] Several studies have shown the advantages of using technology as a supporter of the learning process, for example to increase students' positive attitudes [2], increase students' interest in learning new material, increase students' enthusiasm and motivation to learn [3,4,5]

Technology also influences 21st century learning goals. 21st-century learning requires the use of technology and the "four C" element to support the learning process. These elements include critical thinking, communication, collaboration, and creativity. That way teachers can develop students' skills, such as, problem-solving, critical thinking, and scientific communication that students need to face global challenges (P21). Therefore, the learning process in the classroom must be integrated with 4C elements and technology as a learning medium.

21st-century learning must also be integrated with the applicable curriculum in Indonesia, the 2013 curriculum. The objective of 2013 curriculum implementation is students do not only need to develop thinking skills but also need to be accompanied by developing positive students attitudes [6] However, the media and teaching materials to improve students' thinking abilities and attitudes simultaneously are still relatively rare. From the results of observations that are conducted at several schools in Bima and Pontianak city, it shows that the teacher still uses the question and answer learning method, the LCD installed in each class has not been maximally utilized, learning is also not integrated with 4C elements.

The utilization of technology, especially in physical material is necessary because physics material contains quite a number of formulas and concepts, so that by visualizing material using interesting ICT technology, students can learn physics

material well. In addition, Android media is appropriate to be used in learning [7] and it can improve the achievement of creativity, cognitive [8].

This research uses interactive physics mobile learning media (IPMLM) as a teacher's effort in utilizing technological advancements to deliver material to make it more interesting that can be easily understood by students. IPMLM application contains physics material (wave characteristics, impulses and momentum), Students' worksheet, and questions for the assessment of learning outcomes. In addition by using IPMLM as a support to the learning process, the use of innovative approaches needs to be done to maximize students' learning outcomes. One learning approach that can be used is scaffolding.

Each student has a different level of understanding development in the learning process. This level of development of understanding is called the zone of proximal development (the closest development zone). The zone of understanding development consists of the zone of actual understanding and zone of potential understanding. The zone of actual understanding development can be increased to reach the zone of potential understanding by using the scaffolding approach.

The scaffolding approach is applied by giving assistance to students by teachers or friends who have a higher level of understanding to students who have a lower level of understanding. The assistance is in the form of treatment given to students in accordance with the level of scaffolding, then the assistance is reduced gradually until students can take responsibility independently.

Several levels (scaffolding) that can be applied in the learning. That level consists of: (1) environmental provisions, (2) explaining, reviewing and restructuring, (3) developing conceptual thinking adapted from Anghileri [9]. Environmental provisions are coding the learning environment. This level is conducted by arranging classrooms such as arranging seats and making groups. Explaining is conducted by explaining the basic concepts of the material to be taught which includes pointing and telling activities. Reviewing can be conducted by asking students to: (1) see, touch, and verbalize what they see and think; (2) interpreting students's actions and conversations; (3) use questions that are encouraging and probing; (4) parallel modeling; and (5) ask students to explain and give reasons. While restructuring or restructuring in learning activities is carried out through activities: (1) providing a meaningful context for abstract situations; (2) simplifying students' problems or assignments; (3) repeating student conversations; and (4) negotiating meaning. Then, the level of developing conceptual thinking can be conducted by providing developing representational tools, constructing connections, and generating conceptual discourse (generating conceptual discussion). The scaffolding approach is proven to help students to have problem-solving skills in groups, and improve understanding of concepts [10, 11].

There are many positive behaviors that students must develop in accordance with the objectives of the 2013 curriculum, two of which are tolerance and self regulated learning Tolerance is defined as a measure of difference, accepting differences in views and beliefs held by others that conflict with oneself without coercion [12], and as an expression of respect for the opinions of others [13].

The students' tolerance attitude in Indonesia is generally still relatively low, one example is shown from observations conducted by Ezi Apino [14] in MAN 3 Yogyakarta. The results of these observations indicate that a lot of students are picking on groupmates when the teacher gives them the freedom to choose groupmates. The selection is based on proximity and intellectual similarity. This proves that the students' tolerance is still relatively low.

The tolerance attitude referred to in this study is the attitude of respect among students, especially students who have a higher level of understanding to students whose level of understanding is quite low. This attitude of appreciation then raises a sense of intention to help in learning activities. Provision of assistance is carried out in accordance with the scaffolding approach as described previously.

This research is an advanced study from the previous year, namely the development of IPMLM applications that have succeeded in increasing HOTS and student self-efficacy [15].

II. MATERIAL & METHODOLOGY

A. Research Type

This type of research was an experiment that has an objective to determine the effect of the use of interactive physics mobile learning media (IPMLM) with the scaffolding learning approach towards tolerance and studentd' self regulated learning. the material used was the characteristics of mechanical waves, impulses and momentum.

B. Research Time and Setting

The study was conducted in two cities, they are in the Bima and Pontianak city. IPMLM application with scaffolding approach on material characteristics of mechanical waves was carried out in three schools in the city of Bima, they are SMAN 1 of Bima City, SMAN 2 of Bima City, and SMAN 4 of Bima City. The application of IPMLM with a scaffolding approach to impulse and momentum material was carried out in three schools in Pontianak, they are in SMAN 1 Potintanak, SMAN 3 Pontianak, and *SMA Koperasi Pontianak.* The study was conducted in the second semester of the 2018/2019 academic year.

C. Targets/Research Subjects

The subjects to determine the effect of IPMLM products with a scaffolding approach in this study were 86 students of XI grade in the control class and 95 students of XI grade in the experimental class spread over three different schools in the Bima city. In addition, subjects to determine the effect of the

IPMLM product with a scaffolding approach in this study were 81 students in X grade in the control class and 76 students in the experimental class spread over in three schools in Pontianak. The selection of research subjects was conducted by using simple random sampling, probability sampling technique type.

D. Research Procedure

The form of research used was Pretest-Posttest Control Group Design as shown in table 1

TABLE I. RESEARCH DESAIN

Class	Pretest	Treatment	Posttest
Experiment	O_1	X_1	O_2
Control	O_3	X_2	O_4

Keterangan :

O_1: Pretest results of experiment class

O_3: Pretest results of control class

O_2: Posttest results of experiment class

O_4: Posttest results of control class

X_1: Using IPMLM

X_2: Using lecture method and Power Point

IPMLM products were applied in the experimental class, while the control class used the product commonly used by the teacher, PowerPoint. The research began with: 1) a preliminary study, carried out by observing the learning process in the field and synthesizing related articles as supporting research material. 2) assessed the students tolerance and students' self regulated through a questionnaire given at the beginning of learning (pre-test). 3) prepared an IPMLM product consisting of learning instruments as explained earlier. 4) learning to use IPMLM applications in class was conducted at the scaffolding environment provision stage until the restructuring stage. Then, it proceeded with the lab work activities and discussion at the scaffolding developing conceptual thinking stage. 5) assessed the students' tolerance and students' self regulated learning after learning (post-test) by using the IPMLM application with the scaffolding learning approach.

III. DATA ANALYSIS

Data collected in the form of results from the questionnaire assessment of tolerance and self regulated learning provided at the beginning of learning (pretest) and at the end of learning (posttest). The questionnaire used is an assessment using a rating scale in the statement column in accordance with the experiences experienced by students during before and after the learning process. Data analysis is performed through the calculation of the proportion of categories based on the average value obtained by students in each aspect that is assessed, both aspects of the students' tolerance and aspects of the attitude of student self regulated learning. The average value obtained is then used to determine the achievement criteria using the Gain score equation.

$$\text{N-gain} = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \quad (1)$$

The results of the calculation of the value of tolerance and students' self regulated learning learning are then interpreted in table II.

TABLE II. CLASSIFICATION OF GAIN SCORE

Interval	Category
(g) ≥ 0,7	High
0,3 ≥ (g) <0,7	Medium
(g) < 0,3	Low

IV. RESULTS AND DISCUSSION

This study uses the IPMLM product with a scaffolding learning approach to determine the effect on tolerance and students' self regulated learning. The IPMLM product used has been developed first. IPMLM products consist of learning tools (teaching materials, Students' worksheet, and learning outcome assessment questions). Examples of displays in the IPMLM products used are shown in Figure 1 and Figure 2.

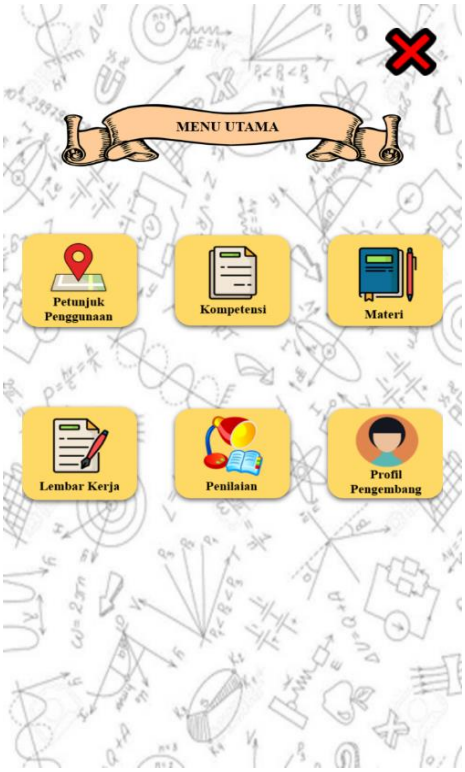

Fig. 1. Display of Main Menu in IPMLM Products

Figure 1 shows the main menu display in the IPMLM application. The menus consist of instructions

for use, competencies, teaching materials, worksheets, assessments, and developer profiles.

Fig. 2. Display Student Worksheets in the IPMLM Application

Figure 2 shows the appearance of worksheets and discussion sheets that must be done by students in the experimental class in groups.

Data on the results of assessing students' tolerance for each aspect are shown in Table III.

TABLE III. DATA RESULTS OF STUDENTS' TOLERANCE

Aspect	Value			
	Experiment Class		Control Class	
	Pretest	*posttest*	*pretest*	*posttest*
Give equal treatment to all class members	46,88	64,75	58,94	60,75
Capable to work in heterogeneous groups	64,83	78,98	64,73	73,95
Respect for others	55,75	73,85	53,81	59,68
Focusing on similarities, not differences	50,95	76,97	51,55	68,83
Average	57,41	65,77	54,61	73,95

The results of assessing students' self regulated learning for each aspect are shown in Table IV.

TABLE IV. DATA RESULTS OF STUDENTS' SELF REGULATED LEARNING

Aspect	Value			
	Experiment class		control class	
	Pretest	*posttest*	*pretest*	*posttest*
Responsible and disciplined	71,4	82,1	72,1	76,4
Confidence	67,1	81,9	73,4	75,5
Initiative	69	78	54,1	54,9
Motivation	67,1	78,5	70,9	72
Inquiry	68	78	58,6	71,3
Problem solving	65,1	78,5	64,2	70,5
self evaluation	69,7	78,3	66,3	74,3
Average	68,2	79,3	65,7	70,7

Table III and Table IV show the differences in the students' and students' self regulated learning for each aspect of assessment, both in the control class and in the experimental class. The average value of students in the control class and the experimental class for the students' tolerance and students' self regulated learning is used to calculate the value of the gain scorebetween pre-test and post-test using equation 1. Gain score of students' tolerance and students' self regulated learning are shown in Table V.

TABLE V. DATA RESULTS OF STUDENTS' SELF REGULATED LEARNING

Test	Gain Score of Tolerance	Gain Score of Self Regulated Learning
Experiment	0,19	0,35
control	0,08	0,15

The results of the calculation of the gain score in Table V show an improvement in students' tolerance, however, the improvement in students' tolerance in the experimental class is higher than the improvement in students' tolerance in control class. The improvements also occurred in students' self regulated learning, but the improvement in the experimental class is higher than the improvement in the control class. These results prove that the use of IPMLM products with the scaffolding approach has an effective effect in learning physics for improving students' tolerance and students' self regulated learning.

V. CONCLUSION

Based on the results of research conducted, it is concluded that the use of IPMLM products with a scaffolding learning approach had a good or effective effect to improve students' tolerance and students' self regulated learning. This is proven by the gain score for student tolerance in the experimental class of 0.19. This value is higher than the gain score in the control

class which is only 0.08 but the results in both classes are included in the "low" category. Furthermore, the results of the gain score for students' self regulated learning in the experimental class are also higher by 0.35 included in the category of "medium", while the gain score in the control class is only 0.15 included in the "low" category.

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