Problem-based learning of teaching aids Development “linear program board” in improving student learning outcomes

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Abstract. The purpose of this study is to improve student learning outcomes using PBL-based PAPROLIN teaching aids on linear program material. This research is research and development (RnD). Then the object in this study is the PAPROLIN teaching aids and the PAPROLIN teaching aids manual, lesson plans and instruments used for research. Data collection techniques in the form of student response questionnaires, product validation by experts, subject teachers and learning outcomes tests. The results of the PAPROLIN teaching aid guidebook assessment by material experts are a total score of 89 with an average value of 44.5 in the range of 74.76 < X ≤ 92.28 so that validity is categorized well, while the assessment of the PAPROLIN teaching aids manual by the subject teacher is 86 with an average value of 43 in the range of 74.76 < X ≤ 92.28 so that validity is in the good category. As for product trials that are carried out in two stages, namely small-scale trials and large-scale trials, where the results of small-scale trials are 22.22% and large-scale trials are 61.09%. So it can be concluded that PBL-based paprolin teaching aids can improve mathematics learning outcomes in LINEAR PROGRAM subjects

1. Introduction

Education is means a long-term investment in human resources that has strategic value for the survival of human civilization in the world. Therefore, almost all countries place education as something important and primary in the context of national and state development. Likewise Indonesia places education as something important and primary. This can be seen in the opening of the 1945 Constitution paragraph IV which confirms that one of the national goals of the nation is the intelligence of the nation's life. One of the fields that occupies an important role in education is mathematics. Where mathematics is a branch of all kinds of science, human life cannot be separated from mathematics. Both formally and informally, humans will always find things related to mathematics. Formal life for example, mathematics education is very necessary so that students can process and develop something about mathematics. While mathematics according to the formal world of education is one of the priority subjects in elementary schools (SD), junior high schools (SMP), senior high schools (SMA), to the level of lectures. So mathematics is very important for human life in solving problems in everyday life.

In accordance with the results of the 2011 Trends In International Mathematics and Science Study (TIMSS) Test coordinated by the international for evaluation of education achievement (IEA) on Mathematics and Science ability, Indonesia ranked 36th out of 40 countries with a score of 386 whereas in 2015 Indonesia ranked 45th out of 50 countries with a score of 397 [1]. The standard score made by TIMSS is 500 and Indonesia is still far from that standard. The results shown by TIMSS show that mathematics learning outcomes owned by students are still low. The low learning outcomes of mathematics due to lack of student activity asnd often feel bored or bored when the process of
learning mathematics in school takes place. That was caused by the lack of development of learning models and instructional media [2].

From the above table that when the initial survey the researchers requested raw data of student learning outcomes from the subject teachers concerned, obtained from 21 students who took the odd semester final exam there were 18 students who scored below the KKM and 3 students got grades above the KKM. The KKM value used by Ma Nw Praida Kroya is 75, but even though the KKM value is very affordable, students still feel the value of 75 is a very high value so that the final results of learning are still very low. So it is proven that in MA Nw Praida Kroya school there is a problem of low learning outcomes and the need for the development of learning models used by teachers in teaching and learning activities. According to researchers, because the school has used the Problem Based Learning (PBL) learning model, it is necessary to develop the learning model using learning media, which are teaching aids to facilitate teachers in communicating with students, and aim to attract students' interest in learning mathematics better and can improve student learning outcomes.

Problem based learning is a learning strategy that involves students in solving problems by integrating various concepts and skills from various disciplines science [3][4][5][6][7]. Adaptability of PBL is realized by taking into account values of the proposed coefficient of HOT skills development. The two-stage process of adaptive PBL allows guided development of HOT skills in students during study of a subject. Attention in the first stage is devoted to development of analytical HOT skills in students through personalized PBL [8] [9].

This strategy includes gathering and uniting information, and presenting findings. While teaching aids according to [10] are teaching media that contain or carry the characteristics of the concepts being studied. Mathematical teaching aids are a set of concrete objects that are designed, made, collected or intentionally arranged which is used to help install or develop concepts or principles in mathematics. Especially in linear program material, many students have difficulty in determining which areas are shaded and not shaded areas. To help students the need for learning media in the form of teaching aids that are in accordance with the linear program material that is props paprolin (linear program boards) [11]. Where paprolin props are one of the teaching aids or learning media used to determine the settlement area of the linear program inequality system. This tool is used to facilitate students in determining the settlement area indicated by the area that is not illuminated by lights.

These props are made of wood and melamine which are formed so that they become a coordinate board. This research is in accordance with conducted by [12] entitled "the influence of problem based learning models on student learning outcomes in mathematics learning in class v" there is a significant increase in learning outcomes, that there is an increase in student learning outcomes by using problem based learning models. The use of problem based learning models is expected to be able to improve student learning outcomes and teaching aids are also able to increase learning activeness for students [13]. Therefore, researchers want to develop a model of problem based learning by using teaching aids. So that researchers provide a solution that is by making the research title "the development of PBL-based paprolin props in improving mathematics learning outcomes. This study aims to determine the presence or absence of development using visual aids based on Problem based learning and without using visual aids based on problem based learning. This research will be carried out in Ma Nw Praida Kroya because according to the results of observations in this school still has very low learning outcomes.

2. Method

The development model used in this study there are ten stages carried out, namely: potential and problems, data collection, product design, design validation, design revision, product testing, product revision, trial use, product revision, mass product. But the mass product stage was not carried out due to time and cost limitations. [14][15][16]. This research was conducted at MA Nw Praida Kroya on March 05 until March 28, 2019 in the 2018/2019 study year. The subject of this study was class XI odd semester at Ma Nw Praida Kroya 2018/2019 academic year. The total number of field trial subjects was 21 students. Small-scale trial subjects consisted of 9 students, and large-scale trial subjects consisted of 12 students. The instruments used for data collection in this study were questionnaires and achievement test. The type of test used to determine student learning outcomes is in the form of objective tests with 20 items of questions, while the instrument to determine student
responses to teaching aids used in the form of a questionnaire (questionnaire). The questionnaire reliability test used was alpha cronbach and to test the reliability of the test using the Kuder-Richardson formula (K-R 20) [17] [18].

3. Results and discussion

This research was conducted at MA NW Praida Kroya, this study used RnD research according to Sugyono, while the product trials conducted in this study were in two stages, the first was a small scale trial phase consisting of 9 students, while the second was using a trial a large scale with 21 students. The results of the percentage of completeness in small-scale trials is 22.22% with a minimum completeness criteria (KKM) of 75, while students who complete the small-scale trial are as many as 2 students, and incomplete reaches 7 students, the number of small-scale trials namely as many as 9 students, this means that students' completeness has not been achieved in accordance with the curriculum. This happens because students when doing the learning process do not use appropriate teaching aids, so when learning takes place it is not effective.

Learning in large-scale trials, carried out improvements from deficiencies that occur during small-scale trials, so the results of mastery learning also increased, it was proven by the percentage of mastery learning reached 61, 90% and the results of student satisfaction with paprolin props reached 85% with many students completing 13 students and 9 students not completing 9 students, the number of students taking the small scale trial is 21 students so that the PAPROLIN teaching aids can be well received by students of class XI IPA Ma NW Praida Kroya. The results of data analysis on the assessment of the PAPROLIN teaching aids manual along with the questionnaire of students' responses to the teaching aids products by the media expert and subject teacher were stated to be good. The response of students to PAPROLIN teaching aids by students of class XI IPA Ma NW Praida Kroya received very positive responses so that the use of PBL-based PAPROLIN teaching aids can improve student learning outcomes, it is because when the learning process takes place students become active and the tool is very helpful to students in completing DHP in linear program material.

In the validity assessment of PAPROLIN teaching aids and PAPRLOLIN teaching aids can be seen from the assessment questionnaire by material experts, media experts and subject teachers. While the assessment of student responses can be seen from the student response questionnaire by students. The results of validation by media experts can be seen in Table 1. The following:

| Aspect                        | Score Component | Average score Component | criteria |
|-------------------------------|-----------------|-------------------------|----------|
| Component of language eligibility | 41              | 3.14                    | good     |
| Component of presentation eligibility | 48              | 4                       | good     |
| Total score                   | 89              | 7.14                    |          |
| Average total score           | 44.5            | 3.57                    | good     |

Based on the total score of 89 with an average value of 44.5 in the range of 74.76 <X ≤ 92.28 so that validity is in the good category. Data sheet of assessment results of paprolin teaching aids manual for grade XI students by material expert lecturers.

Paprolin teaching aids handbook assessment is not only assessed by the material experts but also assessed by the mathematics subject teachers who are included. The results of the assessment by subject teachers can be seen in table 2 as follows:

| Aspect                        | Score Component | Average score Component | criteria |
|-------------------------------|-----------------|-------------------------|----------|
| Component of language eligibility | 38              | 3.8                     | good     |
| Component of presentation eligibility | 48              | 3.8                     | good     |
| Total score                   | 86              | 7.6                     |          |
| Average total score           | 43              | 3.8                     | good     |
Based on a total score of 86 with an average value of 43 in the range of 74.76 < x ≤ 92.28 so that validity is in the good category. Data sheet assessment results of paprolin teaching aids manual for class xi students by subject teachers.

The results of the PAPROLIN teaching aid validity assessment were assessed by media experts and subject teachers as well as by students in the form of student response agent. Not only that to find out whether PBL-based teaching aids are able to improve student learning outcomes. Researchers conduct tests of learning outcomes, its function is to determine whether there are changes to students when using PBL-based PAPROLIN teaching aids and without using PBL-based PAPROLIN teaching aids. The results of the PBL-based PAPROLIN teaching aid assessment by media expert lecturers, with a total score of 61 with an average score of 4.06, are in the range of 51 < X ≤ 63 so that the validity is good. Data sheet of PAPROLIN teaching aid assessment results for grade XI students by media expert lecturers can be seen in Appendix E.2, while the results of the PAPROLIN teaching aid assessment based on PBL by subject teachers namely with a score of 52 with an average value of 3.4 are in the range 51 < X ≤ 63 so validity is in the good category.

Assessment of student learning outcomes whether improved or not can be seen from the student learning achievement test. As for the assessment of student learning outcomes tests of 21 students with 13 students who completed as many as 9 students who did not complete as many as the success rate which reached 61.09%. Data on the results of the student learning test assessment sheet can be seen in Appendix E.7, while the results of the assessment of student satisfaction in the form of student questionnaire responses reached 85%.

4. Conclusions

The development of PBL-based paprolin props uses 10 development models, namely: potential and problems, data collection, product design, design validation, design revision, product trial, product revision, trial use, product revision, mass product. The validity of paprolin props was assessed by media experts and subject teachers, while the results of the assessment of paprolin props were as follows: The validity of paprolin props was assessed by media experts with a total score of 61 with an average rating of 4.06 in the range of 51 < X ≤ 63 so that paprolin props are in good category with a range. The validity of paprolin props was assessed by subject teachers with a percentage of 69.3% so that paprolin props were categorized as very good with a range of X> 63 in all components. The validity of the paprolin props handbook was assessed by the subject matter experts and subject teachers, while the results of the paprolin props assessment were as follows: The validity of the paprolin props handbook was assessed by the material experts with a total score of 89 with an average score of 44.5 being at range74.76 <X ≤ 92.28 so validity is in the good category. The validity of the paprolin props handbook was assessed by subject teachers with an average score of 82.72 so that paprolin props were categorized very well with a range of X> 92.28 in all components.

The learning achievement test is tested in two stages, namely small-scale trials and large-scale trials, where the results of small-scale trials are worth 22.22% so that the paprolin props have not been effectively used, therefore researchers conducted the second trial, namely the trial large scale. Large-scale trials have an increase of 61.90% while student satisfaction with paprolin props reaches 85%, so these props are worth using.

5. References

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