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Development of Mathematics Learning Sets Based on Problem Solving at Two Variable Linear Equation System Topics

Alex Haris Fauzi [1 *], Firma Yudha [1]
[1] Institut Agama Islam (IAI) Ibrahimy Genteng ,Banyuwangi, Indonesia
[*]E-mail: alexharisfauzi@gmail.com

Abstract

Findings of fact in class supported by data from TIMSS and PISA survey show that limited student's ability on problem-solving in mathematics. It is because no learning model is used to increase the liveliness of students in class. One of the strategies taken by learning by teachers was to utilize based problems. The purpose of this research is to develop with the device learning problems related to the matter-based for topic system a linear two variables. The subject of study is student of VIII in MTs Hidayatul Mubtadiin for odd semester 2018/2019 academic year. Instruments that gather the data used were sheets validation device learning, sheets observation of the capability of teachers, sheets observation students, activity sheets students survey response, and tests study results. The results of this research is the learning instrument that developed is valid, pragmatic,, and effective.

Keywords: Learning instrument of mathematics, Problem-solving, System a linear two variables

INTRODUCTION

The development of technology and science has an important role in life, especially to help solve problems faced by humans. This, according to Mukhlis (2019:1) requires efforts to anticipate the challenges and problems of life in the future which are more complicated through increasing attention in the field of education and learning, especially learning Mathematics in the classroom. Mathematics is one of the subjects that has a very important position in education from kindergarten to college (Yudha, 2020).

Experts and experts in the field of learning argue that students' ability to solve problems can be formed through the knowledge taught by teachers in classroom learning activities (Wena, 2009). Arifin (2009) added that learning mathematics in the classroom was developed with one of the goals being to help humans solve problems in their lives.

Learning mathematics in the classroom, on the topic of study that aims to increase learning activity in the classroom, teachers can use a problem-solving and discovery-based learning approach (Soedjadi, 1999). Therefore, undermining the importance of problem-solving skills that must be possessed by students, the National Council of Mathematics Teachers (NCTM) provides guidelines related to learning Mathematics which are designed as a benchmark in the process of structuring Mathematics teaching and

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as a guide for writers of Mathematics textbooks in America. Union. Based on these guidelines, NCTM emphasizes that problem solving skills must be the focus of mathematics lessons at school (Arifin, 2009).

Abdiyani, et al (2019: 123) stated that based on the results of the Trend in International Mathematica and Science Study (TIMSS) survey and the Program for International Student Assessment (PISA) as well as the findings of facts in the field, it indicated that students' mathematical problem solving abilities were still low. Students still have difficulty solving math problems, especially in problem solving. In another study conducted by Arifin et al (2019: 86) showed that the low ability of students in problem solving is evidenced by the fact that students still have difficulty solving math problems in the form of story questions because of difficulties in understanding the context of the problem and determining the strategy used to solve the problem. .

These problems arise because of the lack of student activity in learning so that students feel bored with the strategies that have been used by teachers in classroom learning. Therefore, one of the efforts that can be done by teachers is to use strategies, methods, and student-oriented learning models where the teacher only acts as a facilitator (Fauzi, 2021: 2). One of the learning models that can be applied in classroom learning is a problem-based learning model.

Fauzi (2021: 4) adds that the main goal of Problem Based Learning is not only about imparting knowledge to students, but also developing critical thinking skills and problem solving abilities. Problem-Based Learning is a learning model oriented to constructivism theoretical framework.

Based on the theory of constructivism, learning activities are the process of constructing knowledge. The main purpose of the teaching process is not to transfer or transfer knowledge from teacher to student, but rather to emphasize activities that allow students to build their own knowledge (Mustaji and Sugiarso, 2005).

Furthermore, Boud and Feletti (in Rusman, 2012: 230) argue that "Problem-Based Learning is the most significant innovation in education". In addition, Margetson (in Rusman, 2012: 230) suggests that "Problem-Based Learning can help improve the development of lifelong learning skills in an open, reflective, critical, and active learning mindset". Problem Based Learning facilitates student success in problem solving, communication, group work, and interpersonal skills better than other learning models.

One of the mathematics topics in class VIII SMP/MTs is Linear Equations of Two Variables. In the material of Two Variable Linear Equations, students are required to have basic competencies to be able to solve problems related to the two-variable linear equation system. The topic of SPLDV discussion is closely related to students' daily lives because many contextual problems are found in the student environment related to the

material. Based on information from the mathematics teacher, in general, students still have difficulty solving problems in the SPLDV.

The purpose of this study was to determine the process and results of the development of problem-solving-based learning tools on the material of a Two-variable Linear Equation System. The learning tools developed in this research is Rencana Pelaksanaan Pembelajaran (RPP), Lembar Kerja siswa (LKS), dan Tes Hasil Belajar (THB).

METHOD

The type of research carried out is development research which aims to develop learning tools which include the Rencana Pelaksanaan Pembelajaran (RPP), Lembar Kerja siswa (LKS), dan Tes Hasil Belajar (THB). The development model used in this research is the Plomp learning development model which consists of five phases, namely: Initial Investigation Phase; Design/Design Phase; Realization/ Construction Phase; Test, Evaluation, and Revision Phases; and Implementation Phase.

The subjects of this study were students of class VIII MTs Hidayatul Mubtadiin Balak Songgon. In development research, good quality learning tools must have the following criteria: validity, practicality, and effectiveness (Fauzi, 2021: 37). The research method used in this research is literature study, test, questionnaire, and observation. The instruments used to collect data are learning device validation sheets, teacher ability observation sheets, student activity observation sheets, student response questionnaire sheets, and learning outcomes tests.

RESULT AND DISCUSSION

a. Plomp Model

The development model used in this research is the Plomp model. The processes carried out and the results obtained in each phase are described as follows:

1. Initial Invertigation Phase

In this phase, the initial investigations carried out was:

i. Curriculum analysis

The curriculum used at MTs Hidayatul Mubtadiin is Curriculum 2013 (K13) which provides an overview to researchers that to improve student-centered learning activities, one of the learning models that can be used is problem-based learning.

ii. Student analysis

At this stage, student analysis is needed to match the learning tools developed with the characteristics and background of students' abilities. From the results of the study, it was found that several characteristics of class VIII students of Mts Hidayatul Mubtadiin had moderate and low academic abilities. This is also reinforced by the results of interviews with mathematics teachers.

Based on the results of the student's analysis, an alternative learning is needed that can accommodate the diversity of students' academic abilities, communicate ideas, and have difficulty mastering the concepts being taught. One alternative suitable learning model is problem-based

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learning, because in this learning model there are stages that encourage students to be actively involved individually or in groups in learning activities, communicate their ideas, and construct their own knowledge.

iii. Material/ topic analysis

Material/topic analysis is used to systematically compile the material to be studied by students.

iv. Task analysis

Referring to the material analysis of the two-variable linear equation system, the task analysis that can be observed is to arrange the steps that will be used to solve the two-variable linear equation system by using the method of elimination and substitution, then apply them in everyday problems.

2. Design Phase

In this phase, the design of learning sets was produced, namely:

i. Lesson plan (RPP)

RPP designed for 2 meetings, with a time allocation of 2 x 40 minutes for each meeting

ii. Student worksheet (LKS)

Student worksheets are designed for 2 meetings.

iii. Learning outcomes test (THB)

The design of the learning outcomes test consists of a grid of learning outcomes tests and learning outcomes tests in the form of description questions.

In this design phase, research instruments were also designed which included validation sheets for learning devices, observation sheets for teacher's ability to manage learning, student activity observation sheets, and student response questionnaires.

3. Construction Phase

The activities carried out in this phase are a continuation of the design phase. After the design of learning devices and research instruments was produced in the previous phase, the results of the design were reviewed and then tested for validity by experts/validators.

4. Test, Evaluation and Revision Phase

Furthermore, in the test, evaluation, and revision phases, the learning tools were validated, readability test, and then tested in the field. The results of the validation data analysis carried out by the validator are used to revise the learning tools that have been developed. The readability test on the LKS was carried out to determine whether the LKS could be read clearly and understood by students. Furthermore, the results of trials were carried out in the field to obtain data about the practicality and effectiveness of these learning devices.

5. Implementation Phase

This phase is the last phase in the development of the device with the Plomp model. The purpose of the implementation phase is to describe the effectiveness of the problem-based learning model on the material of the Two-variable Linear Equation System in class VIII.

b. Development of Learning Sets

1. Lesson Plan (RPP)

Lesson Plan (RPP) is something that is essential in learning activities in the

classroom. In the process of learning and teaching in the classroom, RRP serves as a reference and guide for teachers. In this study, mathematics learning tools were developed for 2 meetings, where each meeting used a time allocation of 2×40 minutes according to the content standards of the junior high school curriculum.

In the 1st lesson plan, the material taught includes the use of elimination and substitution methods to solve a system of two-variable linear equations. While in the 2nd lesson plan, the material taught includes looking for problems in everyday life related to a system of linear equations of two variables.

Before being used, the lesson plans are validated by experts or validators. The results of the validation are used as the basis for revising the learning tools, which are then applied in learning.

2. Student Worksheet (LKS)

Student worksheet (LKS) presented as part of the learning toolkit. The 1st LKS contains students' activities using the method of elimination and substitution to solve a system of linear equations with two variables. Furthermore, the 2nd LKS contains student activities related to solving everyday problems related to a system of linear equations of two variables.

Before being used, the worksheets are validated by experts or validators. The results of the validation are used as the basis for revising the learning tools, which are then applied in learning.

3. Learning Outcomes Test (THB)

Learning outcomes test (THB) compiled in the form of descriptive questions related to students' understanding in solving problems related to a two-variable linear equation system.

Before use, THB is validated by an expert or validator. The results of the validation are used as the basis for revising the learning tools, which are then applied in learning.

c. Achievement of Learning Sets Criteria

The criteria for achieving learning device criteria are described as follows:

1. Validity

i. Learning sets validity

Based on the results at the expert validation stage, it showed that problem-based learning tools were categorized as good and could be used with a few revisions. At the readability test stage, the students stated that there was no difficulty in understanding the LKS. Students also found a text typing error in the worksheet. After all the devices have received valid criteria and minor revisions have been made, then the learning tools are then tested in the test class.

At the trial stage, information was obtained about student activities in effective learning, the teacher's ability to manage learning was in good category, student responses to learning were categorized as positive, and THB was declared valid and reliable.

ii. Thus, based on the results obtained at the expert validation stage and the readability test, a learning device was produced that already met the criteria for a good learning device for problem-based

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learning in a two-variable linear equation system, so that it was ready to be used in the implementation phase.

iii. Learning outcomes test validity

Calculation of the validity and reliability of each test item using the SPSS application. From the results of the SPSS output, it can be analyzed that all test items are categorized as valid and the Cronbach Alpha value of 0.74 means that it is categorized as reliable

2. Practicality

Based on the results of descriptive statistical analysis, it can be seen that the average value of the teacher's ability to manage learning is in the good category. Teacher activities in learning begin by orienting students to the problem, namely by reminding students about the previous material, conveying learning objectives, motivating students, and conveying the problems to be studied.

In the core activity, the teacher forms groups with group members who have diverse abilities, presents problems in worksheets, guides discussions, and provides assistance to students or groups who are having difficulties.

At the end of the activity, the teacher asks students in groups to present the results of their group discussions and gives opportunities for other groups to respond. The teacher also guides students to make conclusions or summaries of what has been learned in learning activities.

Figure 1. The teacher provides assistance to groups experiencing difficulties

Based on the results of the analysis, the average value of the teacher's ability level was 4.14 at the 1st meeting and 4.29 at the 2nd meeting. This shows that the average Teacher Ability Level for each aspect is in the very good category.

Observation of student activities during learning activities using student activity observation sheets. Student activities were observed by an observer on 4 students consisting of 1 high-ability student, 2 medium-ability students, and 1 low-ability student. Observations of student activities are carried out from the beginning to the end of learning.

Based on the descriptive analysis, it was concluded that the students' activities in learning were effective. This shows that the application of learning tools with problem-based learning models can increase student activity, so that teacher dominance in the learning process is reduced. The dominant student activity in learning is discussing problem solving in groups and asking friends or teachers. This is due to the reduced dominance of teachers in learning activities.

3. Effectiveness

The results of the descriptive analysis of student responses regarding the learning process using the problem-based learning model showed the number 77.99% on the Likert scale. This shows that the student's response to learning is positive.

Students feel happy to participate in learning activities because they are actively involved in group discussions. Students who are less able to understand the problem can directly ask friends in the group or the teacher.

Positive responses from students indicate that students feel they understand more about the system of linear equations of two variables because they carry out activities that lead to the material being discussed. They also feel happy with the activities during learning, namely discussing with friends in groups. So it is expected that student learning outcomes can increase.

Based on the KKM determined for mathematics by the school, students are declared complete individually if student learning outcomes are equal to or more than 70. From the test data for learning outcomes, there are 26 of 32 students who are declared complete individually (70). This means that classical mastery in class is 81.25%, so it can be stated that classical mastery has been achieved (≥ 80%).

Based on this description, in general it can be said that problem-based learning tools for the material of a two-variable linear equation system meet good criteria which include valid, practical and effective. The following is a table of achievement of learning sets criteria in table 1:

Table 1. Achievement of Learning Tool Criteria

Criteria	Description
Valid	a. The average value given by the validator on each criterion of the learning device developed is in the valid category. b. The learning outcomes test met the criteria of sufficient validity, moderate reliability, and sensitive to learning.
Practical	a. The ability of teachers to manage learning is very good b. Effective student activities.
Efectiveness	a. Respon siswa terhadap pelaksanaan pembelajaran positif. b. Hasil belajar siswa tuntas.

CONCLUSION

Based on the results and discussion and analysis in the study, the following conclusions were obtained:

1. **Development of problem-based mathematics learning tools on SPLDV material using the Plomp development model which consists of 5 phases, namely the Initial Investigation Phase; Design/Design Phase; Realization/Construction Phase; Test, Evaluation, and Revision Phases; and Implementation Phase. In the last phase, namely the implementation phase by producing a final product in the form of a mathematics learning device consisting of Rencana Pelaksanaan Pembelajaran (RPP), Lembar Kerja Siswa (LKS), dan tes Hasil Belajar (THB).**
2. **Mathematics learning tools in the SPLDV material have a high level of validity, practicality, and effectiveness. Thus the mathematics learning tools that have been developed meet the valid, practical, and effective criteria so that these tools can be used by other teachers and can be widely applied to VIII SMP students in SPLDV material.**

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REFERENCES

Abdiyani, dkk. (2019). Profil Kemampuan Pemecahan Masalah Siswa SMP Berdasarkan Langkah-langkah Polya Ditinjau dari Adversity Quotient. Al-Khawarizmi: Jurnal Pendidikan Matematika dan Ilmu Pengetahuan Alam, 7(2) 123-134. Retrived from https://ejournal.iainpalopo.ac.id/index.php/al-khwarizmi/article/download/774/797

Arifin, dkk. (2019). Analisis Kemampuan Pemecahan Masalah Pada Model Problem Based Learning Disertai Remedial Teaching. EduMa, 8(1) 85-97. Retrived from Abdiyani, dkk. (2019). Profil Kemampuan Pemecahan Masalah Siswa SMP Berdasarkan Langkah-langkah Polya Ditinjau dari Adversity Quotient. Al-Khawarizmi: Jurnal Pendidikan Matematika dan Ilmu Pengetahuan Alam, 7(2) 123-134. Retrived from https://ejournal.iainpalopo.ac.id/index.php/al-khwarizmi/article/download/774/797

Arifin, Z. (2009). Membangun Kompetensi Pedagogis Guru Matematika (Landasan Filosofi, Histori, dan Psikologi). Surabaya: Lentera Cendekia

Fauzi, A.H. (2021). Implementasi Pembelajaran Berbasis Masalah Pada Materi Kubus dan Balok. Bandung: Media Sains Indonesia.

Mukhlis, Mohammad. (2019). Instrumen Pengukur Creativity And Innovation Skills Siswa Sekolah Menengah di Era Revolusi Industri 4.0. Indonesian Journal of Mathematics and Natural Science Education. Vol. 1 hal. 65-73

Hobri. (2010). Metodologi Penelitian Pengembangan (Aplikasi Pada Penelitian Pendidikan Matematika). Jember: Pena Salsabila.

Mustaji dan Sugiarso. (2005). Pembelajaran Berbasis Konstruktivistik, Penerapan Dalam Pembelajaran Berbasis Masalah. Surabaya: Unesa University Press.

Riduwan. (2010). Skala Pengukuran Variabel-variabel Penelitian. Bandung: Alfabeta.

Rusman. (2012). Model-model Pembelajaran, Mengembangkan Profesionalisme Guru. Jakarta: PT. Raja Grafindo Persada.

Soedjadi, R. (1999). Kiat Pendidikan Matematika Di Indonesia. Jakarta: Dirjen Dikti Depdiknas

Wena, M. (2009). Strategi Pembelajaran Inovatif Kontemporer Suatu Tinjauan Konseptual Operasional. Jakarta: Bumi Aksara

Yudha, F. . (2020). Penerapan Metode Jarimatika Materi Perkalian Pada Siswa Kelas 4 MI Hidayatul Mubtadiin Balak Songgon. Biormatika : Jurnal Ilmiah Fakultas Keguruan Dan Ilmu Pendidikan, 6(1), 32–40. https://doi.org/10.35569/biormatika.v6i1.681

BRIEF PROFILE

Alex Haris Fauzi, M.Pd. and Firma Yudha, M.Pd., are lecturers at the Faculty of Tarbiyah and Teacher Training at the Ibrahimy Genteng Islamic Institute of Banyuwangi in the field of mathematics education expertise.