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Development of scale learning tools on map based on problems to improve problem solving skills

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ABSTRACT: This study aims to describe the process of developing problem-based learning, analyze the results of the device development, describe student's problem solving with problem-based learning on the scale materials on the map. This research uses research and development (R&D) type, namely 4D-Model (Define, Design, Develop, and Disseminate). The developed learning tools are including; lesson plans (RPP), LKPD, and a problem-solving ability test (KPM). The results of the development of the scale learning device on the map is valid, practical and effective. The validity of the learning tools is as follows: the average RPP validation is 3.68 or 91.91% in the valid category; LKPD of 3.39 or 84.75% in the valid category; and the KPM test of 3.12 or 78% in the valid category. Therefore, based on the results of the assessment of the validator, problem-based learning tools can be used for learning activities. Practicality of learning tools: the ability of teachers to manage learning is 3.48 or the percentage of implementation is 87% with the category of good implementation; student activity in learning activities is 97.5%. Therefore, it could be claimed as effective. The effectiveness of learning tools: the percentage of changes in KPM of positive students is 75%; the increase in KPM gets an N-Gain score of 0.59 in the medium category, the completeness of percentage in classical learning is 90% thus, it could be claimed as complete, while the student response in positive learning is in an average score of 97 %. Based on the results of the research on the learning device scale on the problem-based map based on good criteria which is valid, practical and effective so that it can be used for learning activities.

Keywords: Learning Media; Problem-solving skills; Problem-based; Scale; Map.

Pengembangan perangkat pembelajaran skala pada denah berbasis masalah untuk meningkatkan kemampuan pemecahan masalah

ABSTRAK : Penelitian ini bertujuan mendeskripsikan proses pengembangan perangkat pembelajaran berbasis masalah materi skala pada denah, menganalisis hasil pengembangan perangkat, mendeskripsikan pemecahan masalah siswa dengan pembelajaran berbasis masalah materi skala pada denah. Penelitian ini menggunakan jenis penelitian dan pengembangan atau *research and development* (*R&D*) yakni 4D-Model (*Define, Design, Develop, and Disseminate).* Perangkat pembelajaran yang dikembangkan meliputi RPP, LKPD, dan tes kemampuan pemecahan masalah pada materi skala pada denah. Hasil pengembangan perangkat pembelajaran skala pada denah memenuhi kriteria valid, praktis dan efektif. Validitas perangkat pembelajaran sebagai berikut : rata-rata validasi RPP sebesar 3,68 atau 91,91% berkategori valid; LKPD sebesar 3,39 atau 84,75% berkategori valid; dan Tes KPM sebesar 3,12 atau 78% berkategori valid. Jadi berdasarkan hasil penilaian validator perangkat pembelajaran berbasis masalah dapat digunakan untuk kegiatan pembelajaran. Kepraktisan perangkat pembelajaran: kemampuan guru mengelola pembelajaran sebesar 3,48 atau persentase keterlaksanaan 87%

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dengan kategori terlaksana baik; aktivitas siswa dalam kegiatan pembelajaran adalah sebesar 97,5% sehingga dikatakan efektif. Keefektifan perangkat pembelajaran: persentase perubahan KPM peserta didik positif sebesar 75%; peningkatan KPM mendapatkan skor *N-Gain* 0,59 dengan kategori sedang, persentase ketuntasan belajar secara klasikal sebesar 90% sehingga dikatakan tuntas, sedangkan respon siswa terhadap pembelajaran positif dengan rata-rata skor sebesar 97%. Berdasarkan hasil penelitian perangkat pembelajaran skala pada denah berbasis masalah berkriteria baik yaitu valid, praktis dan efektif sehingga dapat digunakan untuk kegiatan pembelajaran.
Kata kunci: Perangkat pembelajaran; Kemampuan pemecahan masalah; Berbasis Masalah; Skala; Denah

INTRODUCTION

One of the challenges of education in Indonesia is building 21st century skills which we usually know as 4Cs, namely *Critical Thinking and Problem Solving, Creativity and Innovation, Collaboration, Communication* (Meilani & Tika, 2020; Trisnawati & Sari 2019) Learning mathematics in the 2013 curriculum aims to make students proficient and proficient in solving problems in everyday life. Polya (1985) states that problem solving is an attempt to find a way out of a difficulty in order to achieve a goal that is not so easy to immediately achieve. In addition, problem solving skills (KPM) are important for students to have because problem solving problems are related to everyday life. Mulyati (2016) suggests that problem-solving skills are needed to solve problems in everyday life and develop themselves. With this problem solving needs special attention starting from elementary school in the mathematics learning process.

One of the mathematics learning at the elementary level is the scale material on the floor plan. This material is taught to class V students. In learning the scale material on the floor plan students are only asked to solve a number of questions without being introduced to the stages in problem solving. Lectures and questions and answers include favorite methods and then the teacher gives assignments in the form of working on the questions in the student book. In addition, during the Covid-19 pandemic in online learning, students are asked to read textbooks and the teacher only gives assignments and then they are collected through theapplication *Google Classroom* and if there are questions or things that are not clear, students convey them through theapplication *WhatsApp*. Based on observations during observation, it was found that the learning steps in the Learning Implementation Plan (RPP) have not been able to activate students in the learning process and construct their own knowledge to improve KPM. The Student Worksheet (LKPD) used has not trained KPM. The activity steps in the LKPD have not guided students to solve problems independently. The questions presented are to practice numeracy skills and are rarely in the form of story questions that relate math problems to the participants' daily lives and construct their own knowledge. In conclusion, the RPP and LKPD used by the teacher need improvement and refinement, so that the mathematics learning tools need to be revised and developed in accordance with the problem-solving steps. The problem-solving steps used in this study are in Polya's opinion, namely understanding the problem, making a settlement plan, implementing a settlement plan, and checking again.

Relevant research related to the development of BASISMAS learning tools in improving KPM in fractional material was written by Azizah (2019). Another study was conducted by Hendriana, Johanto & Sumarmo (2018) about the role of PBL in improving students'

mathematical problem solving abilities and self-confidence. Another research, namely Kusna (2020) that the application of online-based PBL can improve studentbusiness materials and simplejunior high school students

learning outcomes formachines for. Problem-based is not just about solving problems, but using appropriate problems to increase knowledge and understanding. In addition, with problem-based mathematics learning tools students can get a learning experience in investigating, and solving problems, especially those related to everyday life so that students are intrinsically motivated, namely their own interests, challenges and satisfaction (Hmelo-Silver, 2004), developing and maintain self-study skills (Malan and Ndlovu, 2014). Arends (2012) suggests that in PBL the teacher presents a problem situation to students and then students investigate and find their own solutions. PBL syntax consists of five stages (Arends, 2012): 1) Problem orientation; 2) Organizing students to learn; 3) guide group and individual investigations; 4) Develop and present works; 5) Analyze and evaluate the problem solving process.

Based on this description, researchers are interested in developing problem-based learning tools in the hope of increasing students' KPM, while the difference between this study compared to previous research is that learning is carried out online (in a network) or virtual by utilizing several applications including *zoom meetings, whatsapp groups, office forms* and*teams*. There are no researchers who have developed learning tools within the scope of elementary school scale material on the floor plan. Based on this, the researchers took the title "Development of scale learning tools on a problem-based floor plan to improve the problem-solving abilities of fifth grade students".

Based on this background, the formulation of the problem in this research is how the process ofsoftware development problem-based learningscale in plan ?, matter how the results of the development of problem-based learning tools are of good quality to enhance the problem solving fifth grade students in the material scale in plan ?, and how is the problem solving ability of students with problem-based learning on the scale material on the floor plan.

METHOD

Type of Research

This research uses *research and development* (*R&D*) type, which is a research method conducted to test the effectiveness or develop the resulting product (Sugiyono, 2008). The development of learning tools in this study uses development research developed by Thiagarajan (1974), namely the 4D-Model (*Define, Design, Develop, and Disseminate).* The products produced in this study are Learning Implementation Plans (RPP), Student Worksheets (LKPD) and problem-solving ability tests (TKPM).

Time and place of research

The research was carried out in semester 2 of the 2020/2021 academic year. The place of research is SDN Menur Pumpungan Surabaya.

Subjects of Research

Subjects of this study were students of class V/b totaling 20 students consisting of 10 male students and 10 female students.

Research procedure

This research uses a 4D model, namely Define, Design, Develop, and Disseminate. In the define stage, the researcher conducts initial-late analysis, student analysis, concept analysis, task analysis, and determines learning objectives. The next stage is the design stage which consists of the preparation of criteria-based tests, media selection, format selection, initial design. The third stage is the development stage, namely expert validation and development testing. The last stage is the disseminate stage where the learning device products are disseminated and socialized to fifth grade teachers.

Data analysis instruments and techniques

This research uses observation, tests, and questionnaires to collect data. The instruments of this research are: (1) learning device validation sheet, (2) teacher ability observation sheet to manage learning, (3) student activity observation sheet, (4) student response questionnaire sheet, and (5) problem solving ability test (TKPM).).

The data analysis techniques are analysis of the validity of the device, analysis of the practicality of the device, analysis of the effectiveness of the device and analysis of problem solving ability tests.

The development of good quality learning tools if it meets the elements of being valid, practical, and effective. The validity of the learning tools assesses the quality of the learning tools developed, including: RPP, LKPD, and TKPM. The device is said to be valid if the assessment category is at least good. If the implementation of learning tools is at least in good category and the obstacles that arise can be handled properly, the learning tools meet the element of practicality. The device is said to be effective if classically the problem solving ability test (TKPM) of students is complete and students respond positively.

RESULTS AND DISCUSSION

development of learning tools in this study uses a 4-D model (the Tiagarajan model, et al) including the *define*stage, the *design*stage, thestage *develop*, and thestage *desiminate.* Process Learning tools that will be developed in this research are lesson plans, LKPD, and problem-solving ability tests. In detail, the process will be explained as follows:

1. **Define Phase (definition)**
   a. Initial-End Analysis

      The observations obtained are that there are problems in the mathematics learning process. The teacher applies the conventional method, namely explaining the material and conducting questions and answers, then the teacher gives assignments in the form of working on the questions in the student book. In online learning, students are asked

to read textbooks and the teacher only gives assignments, then they are collected through the Google Classroom application and if there are things that are not clear, the students convey through the WhatsApp group application. Students are not directed to practice problem-solving skills, but are more directed to work on problems and arithmetic.

b. Analysis Student

Students in this test area have heterogeneous academic abilities, namely with high, medium, and low levels of ability. Each student has a different absorption of mastery of the material. This is used as a guide in group selection.

c. Concept Analysis

In the concept analysis stage, researchers identify concepts and systematically arrange materials related to the scale on the floor plan.

d. Task analysis

Based on the analysis of the scale material on the floor plan, this task is related to the problem solving steps according to Polya including understanding the problem, making a settlement plan, implementing a settlement plan, and re-examining.

e. Analysis of learning objectives

Based on the basic competencies of the scale material on the floor plan in the 2013 curriculum, the following learning objectives are arranged:

1) Through group discussions about solving problem solving problems, students are able to solve problems related to the scale on the plan in determining the scale on the map correctly
2) Through group discussions about problem solving problem solving, students are able to solve the problems associated with scale in plan in determining the actual distance to the right
3) through a group discussion on problem solving problem solving, students are able to solve problems related to the scale of the plan to determine distances on a map with the exact

2. Stage Design (design)

a. Preparation of tests

Problem solving ability test (TKPM) in the form of *pretest* and *posttest*. The completion of the problem-solving ability test is based on the problem-solving steps, namely understanding the problem, making a resolution plan, implementing a settlement plan, and checking the results.

b. Selection of media

The media used is a student worksheet (LKPD) and is arranged based on achievement targets in accordance with KD. The steps for solving the problem on the LKPD follow the troubleshooting steps, other media are in the form of learning videos and the videos are uploaded on youtube.

c. The selection of the format

Learning Implementation Plan Format (RPP)used is adjusted to the 2013 curriculum and problem-based learning steps. Format worksheets learners (LKPD) and test the ability of solving problems created pictorial and color but it also contained a box provided for the answer in each of these steps to solve the problem on each question

d. Designing beginning

Devices learning compiled Among them is the RPP, LKPD , and the Problem Solving Ability Test (TKPM).

3. Develop stage (development)

a. Expert validation

The results of the RPP validation from the two expert validators with an average score of RPP-1, RPP-2, and RPP-3 of 3.68 or the percentage of validation results of 91.88% of the score obtained can be said that the RPP developed has very good criteria. The results of LKPD validation by two expert validators are 3.39 or the percentage of validation results is 84.75%. From the results of the validator's assessment, it can be said that the LKPD developed has good criteria. The results of the validation of the problem-solving ability test (TKPM) by the validator are an average score of 3.12 or the percentage of validation results is 78% of the score obtained, it can be said that the TKPM developed has good criteria. The following are the results of the validation of learning devices presented in Figure 1

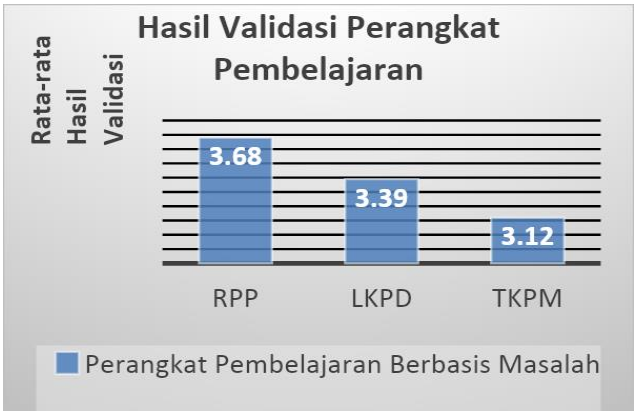

Figure 1: Results of validation of learning devices

b. Readability test

This readability test is carried out online using *whatsapp*. The results of the readability test on the LKPD and KPM tests that students understand the instructions for work but there is a picture that is not clear in question number 2, finally the researcher revised so that the picture looks clearer. The results of the readability test on the teacher that there are obstacles, namely the teacher does not have aaccount *zoom meeting pro* and is unable to do group work through thefeature *breakout room* so that researchers explain and practice using the breakout room feature to class teachers, while the *zoom meeting pro* account can use a researcher account.

c. Field trial

This trial was carried out using the *One Group Pretest Posttest Design research design* and was practiced on 20 students. The tools being tested were lesson plans, LKPD, and the problem solving ability test (TKPM).

1) Data on the ability of teachers to manage learning

Table 1 Observations of Teacher Ability to Manage Learning

No.	Learning to	Total score	Average	Percentage
1	Learning 1	57	3.16	79%
2	Learning 2	64	3.56	89%
3	Learning 3	67	3.72	93%
Average average		62.67	3.48	87%

Based on the table above, it can be seen that the average value is 3.48 or 87% the percentage of RPP implementation and is in the good category.

2) Student activity data

Figure 2: Results of observation of student activities

Based on recapitulation The results of observing student activities in the data above indicate that student activities in each meeting at each lesson plan are in the well-executed category, meaning that the learning device is said to be practical

3) Student response data

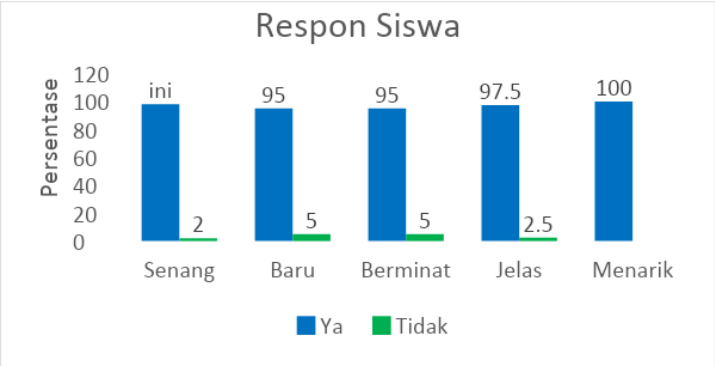

Figure 3: Results of student responses to learning Student responses to problem-based learning on scale on a positive floor plan

4) Problem solving ability test data

The results of the student's problem solving ability test show that the ability problem solvingwith an *N-Gain* ladyaverageof 0.59 which is included in the

medium category. At the *pretest* of 20 students there were only 3 students or 15% of students completed, while at the *posttest* there was an increase in test results as many as 18 students or 90% of students completed the test.

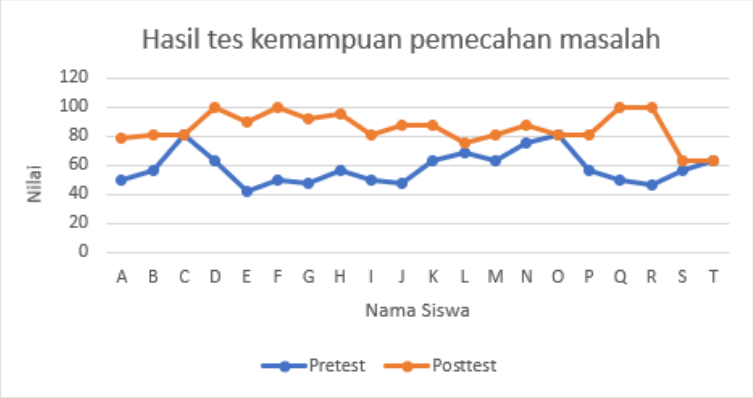

Figure 4:problem solving ability test results

problem solving ability test results The improvement inshows that the learning tools developed by researchers can improve students' problem solving skills on the scale material on the floor plan. The percentage of classical learning completeness is 90% so that it is said to be complete. The validity and reliability of the problem-solving ability test items can be seen in tables 1 and 2.

Table 1: The results of the validity of the KPM test items

No. Question	r table	r calculate the	description of	criteria
1	0.444	0.96	valid	Very high
2	0.444	0.98	Valid	Very high
3	0.444	0.92	valid	Very high

Table 2: The results of the reliability of the KPM test items

No. Question	Variance	Total variance	Variance Total	reliability	Criterion
1	3.85	10.30	28.26	0.95	Very high
2	3.46				
3	2.99				

4. Stage Desseminate (Dissemination)fifth
   Distribution is carried out tograde teachers through whatsapp groups by providing links to learning tools that have been uploaded on *google drive.*

DISCUSSION

The process of developing problem-based learning tools by researchers goes through 4 stages, namely *define, design, develop, and disseminate*. The learning tools developed in this research are lesson plans, LKPD, and TKPM.

To determine the quality of learning tools using the criteria proposed by Nieeven (1999) which include validity, practicality and effectiveness. There are two types of validity, namely: content validity and construct validity. The product produced in this study can be said to have fulfilled the content validity aspect because in the development process it has been adapted to the Tiagarajan development procedure and has been in accordance with the characteristics of BASISMAS learning. Construct validity, seen based on the interrelationships between the various components that make up the product, by two experts, was also declared to have met the requirements.

Judging from the practicality of developing this learning device, it has met the practical quality because the teacher's ability to manage learning has also been carried out well, student activity in learning activities has increased. This finding is in line with Mufidah, Effendi, & Purwanti (2013) which states that student learning activities can be improved, one of which is teamwork. This shows that the learning tools developed meet the practical criteria.

The effectiveness of these learning tools is determined by looking at how capable these learning tools are to improve students' KPM. The effectiveness of problem-based learning tools to train problem-solving skills on the scale material on the floor plan of class V students is as follows: the percentage change in the problem-solving ability of students is positive by 75%; increasing problem solving ability to get anscore *N-Gain* of 0.59 in the medium category, the validity of the KPM test items are 0.96, 0.98, and 0.92 respectively with very high validity criteria while the reliability of the items is 0.95 with a very high category, the percentage of classical learning completeness is 90% so that it is said to be complete, while the student response to problem-based learning is positive with an average score of 97%. This is in accordance with Kusna's (2020) opinion, which states that student KPM can be increased by using an online-based PBL model.

The effectiveness of problem-based learning tools to train problem-solving skills on the scale material on the floor plan of class V students is as follows: the percentage change in the problem-solving ability of students is positive by 75%; increasing problem solving ability to get anscore *N-Gain* of 0.59 in the medium category, the validity of the KPM test items are 0.96, 0.98, and 0.92 respectively with very high validity criteria while the reliability of the items is 0.95 with a very high category, the percentage of classical learning completeness is 90% so that it is said to be complete, while the student response to problem-based learning is positive with an average score of 97%.

CONCLUSION

The process of developing BASISMAS learning tools carried out by researchers through 4 stages, namely defining, designing, developing, and distributing. The learning tools developed in this research are lesson plans, LKPD, and KPM tests. The validity of learning tools: the average validation of the lesson plans is 3.68 or 91.91% in the valid category; LKPD of 3.39 or 84.71% is categorized as valid; and the KPM test of 3.12 or 78% in the valid category. Practicality of learning tools: the ability of teachers to manage learning for 3 meetings is 3.48 or the percentage of implementation is 87% with the category of good implementation;

student activity in learning activities is 97.5%. The effectiveness of learning tools: the percentage of changes in the KPM of positive students is 75%; an increase in KPM gets anscore *N-Gain* of 0.59 in the medium category, the validity of the item with very high validity criteria while the reliability of the item is 0.95 in the very high category, the percentage of classical learning completeness is 90% so it is said to be complete, while the student response towards positive BASISMAS learning with an average score of 97%. Students' problem solving abilities can be trained with problem-based learning. When carrying out the stage of guiding individual and group investigations to enter the *breakout room* in theapplication, *zoom meeting* students still need guidance and practice before conducting research.

Students are not used to writing the fourth problem-solving step, namely checking the results. Some of them did not write it down, but immediately checked the results of their work when they were in the third step. The teacher's role is very important to provide guidance and understanding of the importance of carrying out the fourth step.

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