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Development of mathematics learning tools for PBL model to teach numbers pattern material

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Abstract
The purpose of this study is to produce mathematical learning tools model of problem based learning to teach material number patterns, which meet the criteria of valid, practical, and effective. This research method is categorized as development research. The sample in this study was taken by eighth grade students of SMP Negeri 3 Tondano. In this research the RPP, LKPD, and EHB developed using the problem based learning model on material number patterns. The results of this study stated that the products developed met valid, practical, and effective criteria. Learning devices are feasible to use based on the evaluation of learning tools by the validator with an average score of 3.9 with valid criteria. The practicality results of the learning tools were obtained from the student response questionnaire which showed a score of 23 included in the practical criteria. The effectiveness of the learning device is obtained from the evaluation of student learning outcomes which shows the completeness of student learning above 70 so that it can be concluded that the learning device is effectively used in learning.

Keywords: PBL, development, learning tools, number patterns

1. Introduction
Education in the times has always provided innovations that can create an interesting learning process. One of the developments in the world of education is curriculum change, in which there are four substantial curriculum development goals: (1) reconstructing the previous curriculum, (2) innovating, (3) adapting to social change (the positive side), (4) explore knowledge that still hidden based on national education goals that have been formulated.
From the curriculum development, it must be rooted, but it must also be tall, tall, leafy and leafy. To be rooted means to stick to the nation's philosophy and soaring means following the changes and developments of the times (Syamsul, 2011).
The learning process in the 2013 curriculum emphasizes the principle of active student learning. In a learning activity, active students mean that there is something that makes them interested in learning [1].
Mathematics is one of the subjects that must be studied in schools that can equip students with the ability to think logically, analysis, systematic, critical and creative as well as the ability to cooperate. Problem solving in mathematics is certain, so it serves as a learning goal to measure students' mathematical problem solving abilities.
Indicators of mathematical problem solving students according to the 2013 curriculum include: (1) understanding the problem, (2) organizing data and selecting relevant information in identifying problems, (3) presenting a mathematical problem formulation in various forms, (4) choosing an approach and strategy appropriate for solving problems, (5) using or developing problem solving strategies, (6) interpreting the results of answers obtained to solve problems, (7) solving problems.
However, mathematics itself is often shunned or hated for reasons of using too many formulas, also learning that does not make students interested which results in low student learning outcomes because they answer carelessly or do not answer. Meanwhile, the development of technology now cannot be rejected, so every individual inevitably has to follow trends. Likewise students, students prefer something instant and fast without going to bother or try first.
As a teacher, it is a big challenge in creating creative and fun teaching and learning activities. The behavior of students in class who are busy with their own activities while in math class is found, so students look less active and less enthusiastic, and learning is not considered a fun activity, this has an impact on low learning outcomes. In addition, based on a survey in SMP Negeri 3 Tondano, there were 210 students and only 2 mathematics teachers. There are 7 classes with class divisions VII and IX each have 2 classes so that each teacher holds 4 classes for mathematics.
From the series of learning tools used by teachers include: Syllabus, RPP, Annual Program, Semester Program, KKM, KD Mapping, SKL, Value List, KI-KD Analysis, Gender Education, and so on. Another reason is the number of teaching hours, there are also activities that are not scheduled, so that teachers are to complete the learning kit immediately, done by copy-paste from the previous curriculum learning kit, and the phases follow the existing examples.
While this learning tool should be arranged as well as possible by the teacher based on the situation and conditions in the classroom, and even then the activity may not be run properly. But because the condition of the teacher is only 2 people this naturally makes the teacher overwhelmed. So in this case the learning device is really not modified, so the learning style is just like that. Even today the development of learning tools can be easily obtained even some are making it a business.
Especially the Learning Implementation Plan (RPP) and Student Worksheet (LKPD) not many teachers have developed it, most use the RPP and LKPD that are already on the internet so they just need to download it, some develop it only when they need supervision or to follow

activities that require using RPP. There are 3 learning models used in the 2013 Curriculum.

In the handbook of the teacher in the lesson plan is also found to include the use of learning models, with the aim that there is innovation in learning activities. In fact the use of learning models is only included in the lesson plan, in the process it returns to the way of teaching and learning in one direction.

The subject of number patterns is one of the subjects studied in class VIII of junior high school. This material is the easiest material for some people, but at the level of junior high school students the reality is that they still have difficulty in solving questions on the subject of number patterns. This material can use problems in the real world so that it fits with the learning model that links a learning activity based on problems from the real world, so students will better understand and will not be confused anymore to solve the material problems of number patterns.

Therefore, in order to help students overcome these problems, the authors are interested in developing learning tools in the form of RPP, LKPD, and Evaluation of Learning Outcomes (EHB) that can make mathematics learning a fun learning and can foster student interest in learning. One way to attract students' interest in learning is to use examples or problems in the real world that are close to their lives, so that they will indirectly think and be interested in the topics discussed.

Problem Based Learning is one of the learning models that brings real world problems into the learning process and allows students to learn in groups and can see their interactions in the group, so that it can activate the function of peers for students who are ashamed to ask the teacher, also can be assessed how the ability of students to convey information to their group friends.

Student success depends on 21st century skills, so students must have it. Those skills include problem solving skills, critical thinking, collaboration, and communication skills. All of these skills can be possessed by students if the educator is able to develop a learning plan that contains activities that challenge students to think critically in solving problems.

Activities that encourage students to work together and communicate must be seen in every lesson plan they make (Rafianti, 2018). One solution to improve the quality of mathematics learning is that teachers can prepare and develop appropriate learning through the use of Problem Based Learning (PBL) models that are applied to the development of learning tools such as RPP, LKPD, and EHB in accordance with the stages of the PBL model[2].

PBL is an instructional method that challenges students to learn to learn, work together in groups to find learning with real-world problems. (Amir, 2010: 98). By using the PBL model a learning tool will be developed that can attract students' interest to learn, also students can arrange their own concepts and better understand the lesson in their own way which will affect their learning outcomes later.

In addition, learning tools with the Problem Based Learning model on the subject of number patterns for Class VIII students that are in accordance with the 2013 curriculum have not been developed. So that in this study LKPD was developed based on the aspects of content eligibility, presentation, graphics and language. While the RPP will be developed based on the principle of developing the RPP as stated in Permendikbud number 69 of 2013.

In connection with the learning tools that must be prepared by the teacher when teaching in class, the research developed was a learning device to develop the concept of number patterns using problem based learning models in class VIII students including RPP, LKPD, and EHB.

1. Research Methods

This research method is a type of Research and Development research because in this study developed learning tools in the form of RPP, LKPD, and EHB.

2. Result and Discussion

Validity

Validity of RPP

The RPP that has been developed is validated by the validator. This validation is done to determine the validity of the lesson plan before the simulation and trial. The RPP is validated by three expert lecturers and one mathematics teacher. Based on the assessment of the validator, the average total analysis result of the RPP assessment is 3.83 which means it is very valid.

Validation of LKPD

LKPD that has been developed is validated by a validator. This validation was conducted to determine the validity of the LKPD prior to the simulation and trial. LKPD was validated by three expert lecturers and one mathematics teacher. Based on the assessment of the validator, the average total analysis result of the RPP assessment is 3.80, which means it is very valid.

Practicality

Student Response Questionnaire

Based on data from the student response questionnaire that has been filled out by 24 students after participating in learning activities for material number patterns with a problem based learning model, it can be said that student responses to all aspects are above 80%. Then every aspect responded positively by students.

Table 1: Analysis of Student Response Questionnaire

Description	Happy		New	
	Frequency	Percentage (%)	Frequency	Percentage (%)
What do you think about: Subject matter LKDP Learning Atmosphere Ways Teachers Teach	22 23 22 21	91.67 95.83 91.67 87.50	21 22 23 22	87.50 91.67 95.83 91.67
	Average	91.67	Average	91.67
Description	Agree			
	Frequency		Percentage (%)	
1. Your opinion if the next subject uses learning like this 2. Your opinion if all subjects use learning like this	22 20		91.67 83.33	
	Average		87.50	

Ability of the Teacher to Manage Learning

Based on the ability criteria of the teacher managing

learning, the average total result of the analysis of the ability assessment of the teacher managing learning is 3.71 and reaches the "good" category, located at intervals $3 \leq P < 4$.

Effectiveness

Student Activity

From the results of observations on student activities during learning activities it appears that student activities during learning are within the criteria of effectiveness limits, and it can be said that student activities while participating in learning are good.

Mastery of Student Learning Outcomes

Table 2: Completeness Analysis of Student Learning Outcomes

The number of students	Number of Students Completed	Completion Percentage (%)	Number of students who did not complete	Percentage of Inaction (%)
24	21	87.5	3	12.5

Based on the table above, it can be seen that the percentage of the number of students who reach completeness is included in the very good criteria with a percentage of 87.5%. This shows that learning tools developed after effective use in learning activities.

Analysis of Learning Outcomes Evaluation Data

The EHB trial aims to obtain data on the validity of the items, the reliability of the questions, and the sensitivity of the items which will determine whether the evaluation questions developed need to be revised or not. The results of the analysis of the three indicators are as follows.

Validity

Based on the product moment correlation formula, the validity of each item is obtained:

Table 3: Results of Analysis of Validity of Problem Items

No. Question	r_{xy}	Validity Level	No. Question	r_{xy}	Validity Level
1	0.62	Valid	5	0.79	Valid
2	0.60	Valid	6	0.79	Valid
3	0.65	Valid	7	0.66	Valid
4	0.61	Valid	8	0.71	Valid

Based on the table above, the level of validity of each test item is in the "high" category. Then all test items can be said to be valid.

Reliability

Based on the calculation results, the reliability coefficient $\alpha = 0.833$ was obtained. From the results obtained, the reliability of the learning outcomes evaluation instrument developed is included in the "high" category, and the instrument can be said to be reliable.

Sensitivity

The results of the calculation of the item sensitivity values are as follows.

Table 4: Results of the Item Sensitivity Analysis Results

Question Number	1	2	3	4
Sensitivity Index	0.51	0.50	0.55	0.55
Question Number	5	6	7	8
Sensitivity Index	0.73	0.63	0.65	0.66

Based on the criteria of the test items it is said to be good if the sensitivity of the test items is between 0 and 1, and an item said to be sensitive to learning if sensitivity is greater or equal to 0.30 ($S \geq 0.30$). This means that from all items of evaluation of learning outcomes, questions developed are considered sensitive to learning. Thus, from the table all items can be said to be sensitive.

The learning tool developed "Valid" based on expert validation, said "Practical" if it was easy and the management of learning could be carried out by teachers who were categorized well and questionnaire responses of students towards positive learning. "Effectiveness" of learning tools is obtained through evaluating the results of learning mathematics given to students, based on an analysis of learning outcomes seen that the percentage of students who reach completeness is included in the criteria either.

Thus, mathematics learning tools model of problem based learning has been produced to teach the material of number patterns in class VIII of SMP Negeri 3 Tondano. The learning tools produced include RPP, LKPD, and EHB.

Conclusion

1. Mathematical learning tools model of problem based learning to teach the subject of number patterns was developed using a modified 4-D development model, resulting in a valid learning tool for material number patterns in the problem based learning model. The learning tools developed include the implementation plan of learning, student activity sheets, and evaluation of learning outcomes.
2. Learning tools are said to be practical for teaching the subject of number patterns using problem based learning models, this is shown from the observation of the ability of teachers to manage learning and student responses to positive learning.
3. Mathematics learning uses problem based learning models to teach the subject of number patterns in class VIII of SMP Negeri 3 Tondano can be said to be effective, this is shown by the analysis of student activities categorized as good and student learning outcomes are complete.
4. Mastery learning students at EHB shows the percentage of students who complete> 80%, students complete individually.
5. The response of students also in learning is positive.

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