

The Development of LKS with an open-ended approach for learning mastery of mathematical concepts of grade V students

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Abstract: The research was motivated by various problems that arise in learning in elementary schools, especially mathematics learning. The problem is still low reasoning and problem-solving ability in mathematics learning, mathematics is a scourge that students fear is considered a difficult lesson, teachers teach using LKS but no LKS has been developed with an open ended approach that refers to mastering students mathematical concepts. The average LKS that exists, only presents math problems whose solutions use formulas that have been taught by the teacher, so that students are not able to solve problems with different problem models. The purpose of the study was to analyze the needs of learning media, design, and feasibility of developing Student Worksheets with an open ended approach to learning mastery of mathematical concepts of grade V elementary school students. The research method uses which includes 10 steps; Research and Development design yang meliputi 10 langkah; Research and Information Collecting, planning, Develop Preliminary Form of Product, Preliminary Field Testing, Main Product Revision, Main Field Testing, Operational Product Revision, Operational Field Testing, Final Product Revision, Dissemination and Implementation. Data collection techniques with interviews, observations, assessment of media and material experts, questionnaires / questionnaires. The product resulting from the development research is in the form of an open-ended based Student Worksheet (LKS) for mathematics learning for grade V elementary school students on "fractional" material that has been revised based on suggestions from material and media experts. The results of the study were known to have differences between the control group and the experimental group, which showed a significant increase in students' mastery of mathematical concepts from the Development of Student Worksheets with an Open Ended approach.

Keywords: LKS, Open ended; Development; Mastery of concepts

1. Introduction

Learning mathematics in elementary school is the basic for the application of mathematical concepts at the next level. Learning mathematics in elementary schools needs serious attention and handling. In order for student learning outcomes to increase, there needs to be improvements in the learning process. The learning process carried out to teach mathematics can be created and developed with innovative designs or models, methods, media, techniques and strategies to achieve learning objectives or competencies to be achieved in mathematics learning.

Given the importance of concept mastery ability to develop student reasoning, teachers must have the right methods to use in learning. One way used is to develop student worksheets using an open-ended approach to improve students' mastery of concepts in mathematics so that their mathematical reasoning can also develop. To prepare the next generation who have good quality at the basic education level, one of the efforts that can be done is to equip them with literacy or the application of a culture of reasoning, critical thinking in every learning process at school (Sumaji, 2016).

2. Conceptual Framework

The results of the needs analysis conducted by researchers in the early stages of research by observing and interviewing grade 5A and class 5B teachers at SD N 1 Kebloran on April 9, 2021, Kragan District, Rembang Regency, it can be concluded that almost 90% of grade 5 students consisting of 2 classes, namely class 5A and 5B totalling 56 students at the school, it is known that students have very low ability to master concepts in mathematics lessons, Another fact is also found that low mastery of mathematical concepts causes students' reasoning in solving problems in the field of

mathematics, automatically also low. This is accordance with Setyawan & Purbohadi (2023) stated that students' mastery of mathematics was low. This is of course many factors that cause it, why it happens. Based on the results of the initial interview conducted to the teacher in grade 5 elementary school, it was found that in teaching mathematics lessons in class, the teacher only taught material in the form of calculation formulas in accordance with mathematics textbooks only in the classroom learning process and did not explain the initial concepts as the basis for the creation of the formula. So that it becomes a habit of students who are only given evaluation questions or mathematical problems that only use formulas given by educators, so that one day students get evaluation problems with other methods or ways in solving mathematical problems, students will not be able to solve them in their own appropriate way.

When teachers give learning evaluation questions, also only in the form of problems with mathematical problems whose solutions use the formulas that have been taught, as a result student do not know the basic mathematical concepts of the material taught, besides that students are not able to develop their way of reasoning when presented with problems that require solving mathematical problems critically and creatively. Making evaluation questions in the form of problem-based story questions in everyday life, many teachers have not been able to master, so they only provide existing questions, for example from the package book and Student Worksheets where the form of the questions is the same as the package books in school. This is certainly the cause of the problems that arise, this problem must certainly be responded to and handled seriously to improve learning, especially in mathematics lessons in elementary schools which are getting lower and many are a frightening scourge for many students because it is considered the most difficult subject. From the results of the needs analysis conducted by researchers in the school, it can be concluded that the needs of learning activities in schools are creative and active and not only centered on teachers but also on the students process. So that teachers can act as facilitators to facilitate and direct students in learning activities so that students can and are able to master mathematical concepts (Pahmi, 2020). This will help improve the reasoning ability of students in solving the mathematical problems presented.

To realize all these things, mathematics teaching materials are needed in the form of Student Worksheet media that can help and facilitate mathematics learning in schools with the aim of improving and solving all mathematics problems that are currently faced by many teachers and students themselves. With the development of Student Worksheets made with an open ended approach, it is expected to increase the mastery of mathematical concepts of students, so that there is also an increase in students' mathematical reasoning to solve all mathematical problems presented. According to Sumaji, et al (2018:447) mathematical communication with open ended problems can provide opportunities for students to express creative ideas, apply formulaic concepts, new solving strategies for solving mathematical problems with many possible answers so that students are able to understand basic concepts appropriately and coherently. The development of student worksheets using an Open-Ended approach can improve mastery of mathematical concepts and reasoning and can develop students' creative thinking in problems solving.

This is reinforced by the results of research conducted by Juwita, et al. (2019) that the development of student worksheets based on an open-ended approach can improve students' mathematical creative thinking skills. In addition, another study by Purwasi & Fitriana, (2019) strengthens that the development of LKS based on the Open ended approach can train students' mathematical solving skills and mastery of concepts. Purwasi (2019) research found that the development of LKS with an Open Ended approach was carried out by adopting a 4-D development model (four D model). This model consists of 4 stages of development, namely Define, Design, Develop, and Disseminate. This action is proven in improving students' mathematical skills.

The LKS that is currently used has not accommodated the needs of students to develop their creative thinking. Creative thinking needs to be developed because it is very necessary in facing and solving the problems it faces in everyday life. The LKS used has not been able to motivate students to learn Mathematics. LKS in terms of form has not invited students' interest or interest to use it. This is because LKS is poor in color and images, made of thin and opaque colored paper. This is contrary to the characteristics of elementary school students who like various colors. To overcome these problems, open problem-based LKS is needed that can accommodate students to be more active in the learning process and can develop their creative thinking. The solution to the problems that occur in the field today is to design LKS based on open problems or LKS based on open ended problem.

From the needs analysis obtained from observations and interviews with grade 5 teachers at SD N 1 Kebloran, which has been described, it was found that the low mastery of students' mathematical concepts was caused by the teacher's teaching method only by giving formulas without providing basic mathematical concepts from the material given and the evaluation questions given were only limited to questions or problems whose solving methods were limited to formulas given by the teacher, then the researcher decided to conduct research and development of student worksheets with an open-ended approach to improve the mastery of mathematical concepts of grade V elementary school students.

This research was conducted to obtain a description and develop the following, namely, Knowing the Analysis of Student Worksheet Development Needs with an Open Ended approach for learning the ability to master mathematical concepts of grade V elementary school students, knowing the development design, and also to find out the feasibility of developing LKS by using an open-ended approach to learning the ability to master mathematical concepts of grade V elementary school students.

3. Methodology

3.1 Research Design

This type of research is R&D / Research and Development. The model in this development research is a procedural model, which is a model that is descriptive and outlines the development steps. Research and development is a research and development activity of collecting, analyzing, processing and presenting data carried out systematically and objectively accompanied by product development activities to solve a problem faced. Research Design Using quasy experiment with sampling technique, namely purposing sampling.

Based on the theory of Sugiyono (2017), the development procedure consists of 10 steps, namely (1) Research and information collection, (2) research planning, (3) Developing initial products, (4) product design validation, (5) revision of phase I product design, (6) limited trials, (7) phase II product revision, (8) field trials, (9) Final Product Improvement, (10) Dissemination

3.2 Respondent of The Study

The population of this development research is grade V elementary school students in the amarta cluster, Kragan District, Rembang Regency, Central Java. The subjects or samples used were students of grade VA SDN 1 Kebloran for the 2021/2022 academic year as a control group and VB as an experimental group, and grade V students of SDN 2 Kebloran as an experimental group.

The initial stage carried out by researchers is to analyze the needs of product development needed. Needs analysis is carried out in 2 ways, namely by interview techniques for students and teachers, with observation of learning on students and teachers. At this stage, researchers make interview and observation instruments with appropriate grids needed in research activities. The following researchers present the results of the analysis of development needs at the interview and observation stage as follows;

Based on the results of interviews with 10 students, it was found that the teaching materials in the form of LKS used so far did not use an open question base, students were less enthusiastic, the material presented was less coherent, teaching materials in the form of LKS were less attractive, the learning atmosphere was less pleasant, LKS had been difficult to use, some teachers who used LKS and students agreed and were interested in LKS teaching materials based on open questions (open ended).

Based on the results of the interview with the teacher, it can be seen that in mathematics learning activities at school the teacher has not used teaching media that is not appropriate so that in stimulating the ability to master mathematical concepts the teacher finds it difficult. The results of this interview show the need for the development of Student Worksheets with an Open Ended approach to improve the ability to master mathematical concepts of grade V elementary school students.

From the observations made by researchers that 5 teachers were observed, only 2 teachers used media that made students active, 3 teachers used media that were in accordance with basic competencies, 2 teachers compiled a learning ratio, 1 teacher conveyed the competencies to be achieved to students, teachers did not make perceptions of learning material, only 1 teacher related the material to other relevant knowledge and realities of life, Only 1 teacher carries out learning according to the competencies to be achieved, 1 teacher carries out contextual learning, learning activities are not student-oriented, teachers do not use effective and efficient media in learning, teachers do not prioritize student involvement, teachers use spoken and written language correctly in learning, teachers do not monitor student learning progress, teachers do not carry out evaluations according to competence, teachers compile final evaluations according to conference, teachers compile summaries and teachers provide enrichment tasks Follow-up.

Based on the results of student observations in Learning, it shows that from 10 children it was found that all children answered greetings from the teacher, 2 children did not pay attention to the teacher's perception, 4 students did not answer the teacher's questions, did not pay attention to the teacher's explanation, students did not conclude the learning material, 6 students did not do the evaluation questions, 8 children did not pay attention to the explanation of homework and all of them did prayer together.

After conducting a preliminary study for needs analysis, it can be found that in its implementation, there are still many who have not used learning media that suits the needs of students. It is necessary to develop Student Worksheets with an Open Ended approach to improve the ability to master mathematical concepts of grade V elementary school students. The design for the development of Student Worksheets (LKS) open ended approach to mastery of mathematical concepts of fractional material is described below;

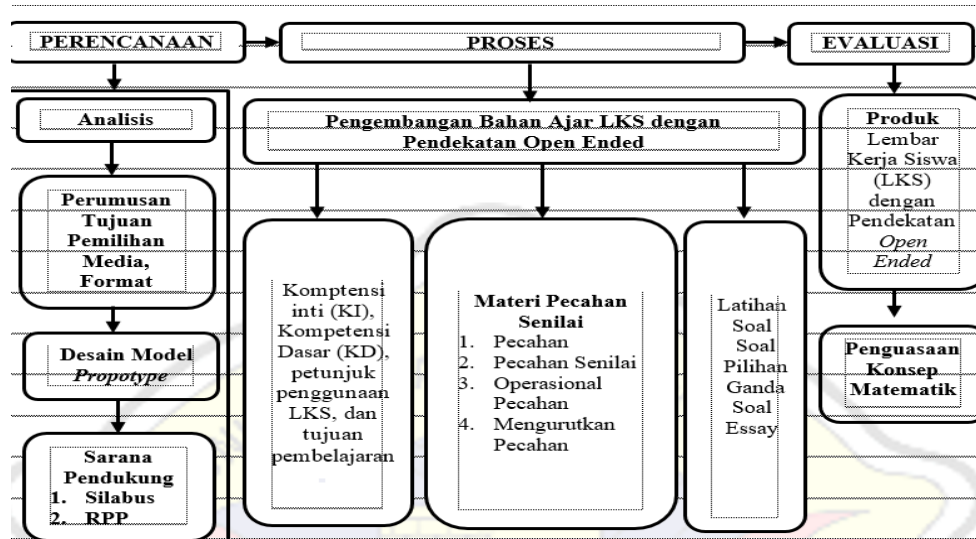


Fig. 1- The lks of media development steps based on the open ended approach.

In this stage, researchers begin to carry out activities, namely designing initial products. When starting to design the initial product, a fractional material concept analysis will be carried out, determine the prototype to be used and adjusted to the feasibility requirements of LKS media, besides that it will also contain all elements based on an open-ended approach to spur students' ability to master mathematical concepts so that students can solve mathematical problems through various kinds of literacy.

After the compilation of the development of Student Worksheets with an Open-Ended approach to improve the ability to master students' mathematical concepts is completed, then validity tests are carried out to media experts and material experts to determine the level of media feasibility and the feasibility of the material that has been designed in the learning process, and revisions are made to improve the LKS that has been designed. The validity and revision of this media learning media is in the form of quantitative and qualitative data. Quantitative data is obtained from the Likkert scale assessment questionnaire, while qualitative data is in the form of assessments from validator suggestions. The data was obtained through two stages of assessment, namely material expert validation and media validation. The Validation of material experts and media experts is assessed by being given in the form of scores 1-5. Material aspect consists of material, language. After the validator provides an assessment, then the assessment score is summed divided by the number of indicators. The assessment score validation criteria can be seen in the table.

Table 1 - The material expert of assessment score criteria.

Percentage	The Validation Criteria
76-100	1. Valid
51-75	2. Quite Valid
26-50	3. Less Valid
0-25	4. Invalid

The assessment conducted by media experts aims to find out whether the product is worth testing. Comments and suggestions from validators are used as a reference for product improvement. Assessment is given in the form of scores with a range of 1-5. Media expert validation consists of 3 parts, namely size, cover design and content design with a score range of 1-5. The validation of assessment scores can be seen in the table;

Table 2 - The media expert of assessment score criteria.

Precentage (%)	Criteria
0-20	Very Unworthy
21-40	Not Worth It
41-60	Pretty Decent
61-80	Proper
81-100	Very Worth It

The validation criteria of media experts can be determined by the following formula;

$$\text{The Average Assessment of Results Score} = \frac{\text{Number of Assessment Scores}}{\text{Total Indicators}}$$

4. Findings and Discussion

Based on the research that has been done, there are several findings that have been described before. These findings are as summarized in the problem statement. To answer these problems, researchers conduct research and development through 10 stages or steps, namely (1) Research and information collection, (2) research planning, (3) Developing initial products, (4) product design validation, (5) revision of phase I product design, (6) limited trials, (7) phase II product revision, (8) field trials, (9) Final Product Improvement, (10) Dissemination. The following researchers describe the research activities carried out through 10 steps carried out as follows;

4.1 Knowledge

In the first stage is Research and Information Collection. The steps taken in the stages of research and information collection are conducting interviews and observations / observations during the learning process. The second stage is planning and data collection, namely reviewing core competencies (IC) and basic competencies (KD) to determine the indicators to be achieved, conducting literature studies to collect material, making research instrument grids, making research instruments to be used are validation sheets, observation sheets and interview guidelines.

Furthermore, the third stage is to develop an initial product in the form of Student Worksheets with an Open-Ended Learning Approach with the following sequence of steps; Create a cover layout, Choose images according to the specified material, Write the specified material. In this stage, researchers begin to carry out activities, namely analyzing the concept of fractional matter, determining the prototype to be used and adjusted to the feasibility requirements of LKS media, besides that it will also contain all elements based on an open ended approach to spur students' ability to master mathematical concepts so that students can solve mathematical problems through various kinds of literacy.

In the fourth stage, the next step when the teaching materials have been compiled, will then be validated by material experts, namely Hikmah Rahmatul Laeli, M.Pd and media experts, namely Dr. Erik Aditia Ismaya, S.Pd, M. A by using assessment scores and suggestions as improvement materials. The fifth stage is to revise the Product Stage I. Product revision development is carried out based on criticism and suggestions from validators, material experts, and media experts during product validity tests. Revision activities are carried out to improve weaknesses and shortcomings that exist in the developed product.

The sixth stage is to conduct a Limited Trial. At this stage, product development trials will be carried out on students in class V totaling 5 children and 5 teachers as colleagues. This trial implementation activity is used to find out how the feasibility of the development product. The seventh stage is to Revise Product Phase II. This second revision activity was carried out based on criticism and suggestions from the supervisor at the time of conducting limited trials. Furthermore, the results of the revision will be used to improve Student Worksheets with an Open-Ended Open-Ended Learning Approach.

The seventh stage is to Revise Product Phase II. This second revision activity was carried out based on criticism and suggestions from the supervisor at the time of conducting limited trials. Furthermore, the results of the revision will be used to improve Student Worksheets with an Open-Ended Learning Approach. Eighth stage with Field Trials. After the Student Worksheet with an Open-Ended Learning Approach is formed, it is then tested with teacher response questionnaires and student response questionnaires. The Completion of the final product, the final stage or the last is Dissemination. Product dissemination is carried out by distributing soft copies of LKS through WA grup, through cluster KKG and through school seminars. Completion of the final product, the final stage or the last is Dissemination. Product dissemination is carried out by distributing soft copies of LKS through WA grup, through cluster KKG and through school seminars.

The development stage is carried out with the analysis stage of the learning implementation plan, media design process and instrument preparation. Material expert validation obtained 94.6% results with a valid predicate. The validation of media experts received a score of 88.3%, with a very decent category. Validation of teaching experts obtained 91.4% results with a valid predicate. The validity test results of 20 instrument items are declared valid because the r value is calculated $> r$ table (0,632). The results of the reliability test of the observation instrument with a reliability coefficient of 0.899, where the alpha value > 0.6 , it can be concluded that the observation instrument is reliable. The results of the teacher response questionnaire showed the number of positive responses 41 out of 50 (82%) with a very decent category. The student response questionnaire showed a positive response with a score of 86% with a very like category. Based on the results of these calculations, it can be seen that the development of Student Worksheets with an Open Ended approach to improve the ability to master mathematical concepts of grade V elementary school students is suitable for use in learning mathematics on fractional material.

5. Conclusions and Recommendations

The results of the study found that based on the needs analysis, it is known that the implementation of learning has not used learning media that is in accordance with the needs of students for mastery of mathematical concepts. Therefore, it is necessary to develop Student Worksheets with an Open Ended approach to improve the ability to master mathematical concepts of students in accordance with the analysis of core competencies and basic competencies of elementary school students in fractional material learning.

Based on the results of these calculations, it can be seen that the development of Student Worksheets with an Open Ended approach to improve the ability to master mathematical concepts of grade V elementary school students is feasible to be used in learning fractional themes. The development stage of the researcher designs a prototype of learning devices (instructional material). The selection of media and formats for materials and production of early versions underlies the main aspects at the design stage and the later stage is media design.

Based on the conclusions, there are several suggestions from researchers, namely: This open-ended based mathematics LKS can be used as printed teaching materials used in learning that can help students develop their creative ideas in solving a problem in several ways or several answers. Open-ended based mathematics LKS for elementary schools can be used as alternative teaching materials that can be used in the teaching and learning process, establishing student creativity in learning mathematics.

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Conflict of Interest

The authors declare no conflicts of interest.

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