Student Worksheets on Integers and Fractions Based on Openended Approach

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Student Worksheets on Integers and Fractions Based on Open-ended Approach

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ABSTRACT

This research aims to determine the validity, practicality, and effectiveness of student worksheets in learning mathematics on integers and fractions based on open-ended approach. This type of research is Research and Development (R & D) research using the ADDIE model. Students of seventh grade of SMPN 1 Bua Ponrang were the subjects of this research. The instruments used are validation sheets for material experts, media and design experts, then practicality questionnaires for teachers and students. The data analysis technique used is descriptive qualitative and descriptive quantitative data analysis. The assessment results based on the first material expert validation questionnaire obtained a score of 78.94% which means "valid." The results of validation from the second material expert obtained a percentage score of 78.75% which is included in the "valid" category. The results of validation from media and design experts obtained a percentage score of 69.23% which means "valid." The results of practicality by educators obtained a percentage score of 98.33% with the category "very practical" and the results of practicality by students obtained a percentage score of 89.70% with the category "very practical." Based on the results of the classical provisions obtained 78.57% with an average before using the worksheet based on the open ended approach of 70.35 and after using the worksheet based on the open ended approach 76.78 which has increased in order to comply with the effectiveness category of effective. Based on these results, it can be concluded that the student worksheets based on the open-ended approach in learning mathematics on integers and fractions are valid, practical, and effective to be used as learning teaching materials.

Keywords: *Fraction, Integers, Mathematic's Student Worksheets, Open-ended Approach*

INTRODUCTION

Mathematics is one of the important subjects that every student must learn at various levels of education. Therefore, it is required to enhance students' understanding of mathematics by providing them with a basic understanding of it to prevent them from becoming bored with the subject. Most students argue that math is a very difficult and frightening subject. Because there are many symbols, numbers, and formulas in math, making the lesson less attractive to most students (Yulius et al., 2017). The existence of the 2013 curriculum requires teachers to create a learning process in which students become the center of learning. The students are required to construct their own knowledge. In this case, the teacher only serves as a guide and facilitator. In the beginning, media was only considered as teaching aids. The tools used are teaching aids, such as pictures, models, objects, and other tools that can provide certain experiences, learning motivation, and improve students' absorption and retention abilities. Unfortunately, since teachers are too focused on the learning tools they use, they rarely concern about the design, production of learning development and evaluation (Junaidi, 2019). Therefore, it requires the development of teaching materials, one of which is in the form of a student worksheet whose learning process will be associated with the ADDIE learning model to facilitate students in understanding it. In addition, students need a method to assist them in understanding the learning process so that they can be creative in solving problems.

Based on the results of interviews obtained by researchers with Mathematics teacher at SMP Negeri 1 Bua Ponrang, St. Hasanah S., S.Pd. who stated that the teachers rarely develop or prepare teaching materials independently, especially for student worksheets, a teacher has never been interested in developing teaching materials in in the form of student worksheets because of the constraints in using media in preparing teaching materials to be developed. Due to the difficulty of teachers in developing student worksheets, students are accustomed to solving closed problems that require one correct answer. This is certainly contrary to the demands of the 2013 curriculum (K-13) that learning does not only emphasize the end result but the process must also be considered. Therefore, teaching materials are needed that specifically present open problems so that students are accustomed to solving them. A method is needed to generate student creativity in solving problems, one of which is the open-ended approach method in which this method demands the development of student thinking creatively and actively in solving problems, students are required to think independently by using their reasoning power which is not only focused on learning from the teacher, and this can develop students' creative thinking (Juwita et al., 2019).

The research of Dian Utari (2020), based on the results of development with a research method using the ADDIE development model in the form of math student worksheets based on the games method integrated with local wisdom. The

feasibility of the product based on the validation of material experts, media experts and subject teachers obtained consecutive results, that is, material experts at 80.4% with a valid category, media experts at 91.3% with a very valid category, and subject teacher indicators at 82.6% with a valid category.

Meanwhile, based on Basri et al (2020), this research aims to determine the development process and quality of problem-based math student worksheets to improve students' understanding of algebraic concepts. The development research used refers to the Plomp development model, which includes 4 phases, consisting of the initial investigation phase, the design phase, the realization phase, and the test, evaluation and revision phase. The results in this research can be concluded that the problem-based math student worksheet fulfills the criteria of valid, effective and practical.

Then, according to Purnamasari et al (2019), the development of student worksheet learning tools was conducted following two main phases, which are the preliminary and formative evaluation phases. Based on the results of this research, the learning outcomes conducted individually obtained an average of 90.78 including the good category and the results of the final student ability test obtained teaching materials that have a potential effect.

In order to observe the problem solving ability of students in solving open-ended problems, special material is needed to be presented in teaching materials, one of which is fractional material. Fractional is a material that produces more than one way that can be used to solve problems. Since fractional is highly related to integers, the researchers chose a special material in the research, that is, integers and fractions. Based on the background of the problems described by the author, the researcher is interested in conducting research on student worksheets on integers and fractions based on an open-ended approach. Therefore, this research aims to determine the validity, practicality, and effectiveness of student worksheets in learning mathematics on integers and fractions based on open-ended approach.

LITERATURE REVIEW

Student Worksheets

According to Trianto, Student Worksheets (LKPD) are printed teaching materials of sheets containing tasks in which there are instructions and steps for doing the task. Student worksheets can be used as guides for the development of all learning aspects in the form of experimental and demonstration guides (Thalhah, 2019). The National Education Department explains that student worksheets are usually consisting of instructions, steps to complete the task, a task instructed in the worksheet must be clear about the basic competencies to be achieved (Noer, 2018). Student worksheets that students need are worksheets that are interesting and require a creative attitude in learning (Sasmito & Mustadi, 2015). This is intended to lead students to be active during the learning process. Some studies state that the

feasibility of student worksheets can be assessed from various aspects. Each research is different from one another. The feasibility of student worksheets reviewed from the aspects of validity, practicality, and effectiveness of the good category (Norsanty & Chairani, 2016). Meanwhile, according to the developed student worksheets are categorized as feasible and based on the student response questionnaire (Firdani, 2015). However, according to Dewi (2022), the feasibility of the student worksheet is viewed from the validation results of the material feasibility aspect and the media feasibility aspect which is categorized as very feasible.

Learning Approach

According to Rahman (2018) stated that learning approach is the perspective in the teaching and learning process that is used for an effective learning atmosphere and supports the achievement of the expected objectives. In addition, based on Indrawati's research, learning approach can be interpreted as a starting point or a teacher's perspective on a learning process, which refers to a perspective on the occurrence of a learning that is still general terms (Isrok'atun & Rosmala, 2018). The learning approach is the perspective or starting point of an educator towards a learning process, which refers to the general perspective on the occurrence of learning.

Open-ended Approach

The open-ended approach is a learning approach that is open and has many solutions to solve various existing problems. This approach is also a learning approach that provides problems to students, which allows students to develop their own way to answer or solve the problems that have been provided (Ibrahim & Widodo, 2020). Learning with an open ended approach can be implemented through (1) providing problems; (2) solving problems; (3) presenting students' findings; (4) mentoring and orienting students, and (5) making conclusions. The purpose of the open-ended approach is to develop students' creative activities and mathematical thinking through the simultaneous problem solving. On the other hand, students' creative activities and mathematical mindset should be developed as much as possible according to each student's ability (Betty Biliya, 2015). The existence of student worksheets that can assist students in training themselves to solve problems is important. Developing math student worksheets aims to facilitate students to interact with the material provided, present tasks that increase students' assignments to the material provided, train students' learning independence, facilitate teachers in providing assignments to students (Rosdiana et al., 2023). Development of student worksheets based on an open-ended approach, the steps taken in this development research include collecting references. It aims to assist researchers in their research and development. Then, researchers will make

products, such as student worksheets for learning mathematics. Furthermore, researchers revise products that have been validated.

RESEARCH METHODOLOGY

This type of research is a Research and Development (R&D) development research using the ADDIE development model which consists of five stages namely Analysis, Design, Development, Implementation, and Evaluation. These are the description of ADDIE steps that researchers will conduct as follows:

1. Preliminary Research Step (Analyze)

   The problems discovered during the learning process are studied at this step and then formulated to solve them. During this step, the researchers analyzed three things, such as Needs Analysis, Curriculum Analysis, and Student Analysis.

2. Initial Product Development Step (Design)

   During this step, the student worksheets based on an open-ended approach that will be developed according to the results of the analysis that was conducted earlier were designed. The researchers designed a student worksheet based on an open-ended approach that focused on the content, appearance and benefits developed, including the introduction, content and conclusion. Researchers also collected references used in the development of materials in student worksheets based on an open-ended approach. During this step, the researcher also compiled instruments such as material expert validation sheets, media and design experts, validation sheets for practicality test questionnaires for educators and students, and validation sheets for learning outcomes tests that would be used to assess student worksheets based on an open-ended approach to learning mathematics on integers and fractions in seventh grade at SMP Negeri 1 Bua Ponrang which were presented to validators. The instrument is structured by considering aspects of student worksheet assessment, such as format feasibility, language feasibility, illustration feasibility, and content feasibility. An additional instrument besides the main instrument in the student worksheet based on the open-ended approach is the instrument of a questionnaire for the practicality of teachers and students who will be used to assess the student worksheet based on the open-ended approach.

3. Expert Validation Step (Development)

   After the student worksheet based on the open-ended approach was completed, it was consulted with the two supervisors and after receiving approval, it was continued to the validation step by 3 validators consisting of two lecturers from IAIN Palopo and one Mathematics teacher from SMP Negeri 1 Bua Ponrang. After the student worksheets

based on the open-ended approach were revised and declared valid, the student worksheets were tested for practicality on a limited basis to 14 students from class VII.1 and 1 mathematics teacher of seventh grade SMP Negeri 1 Bua Ponrang by filling out a response questionnaire for teachers and students to find out the feasibility of student worksheets based on the open-ended approach prepared by the researchers.

4. Implementation Step

   The researcher provided limited learning to 14 students from class VII.1 at SMP Negeri 1 Bua Ponrang by using student worksheets based on an open-ended approach during four sessions. After learning is provided to students, then testing of students' learning outcomes is needed to determine the effectiveness of using student worksheets based on an open-ended approach to students.

5. Final Production Step (Evaluation)

   This step involves formative and summative evaluation. Formative evaluation is conducted at the end of each step. While summative evaluation is conducted at the end of the development after testing validation, practicality and effectiveness.

The subjects in this research were students of class VII.1 at SMP Negeri 1 Bua Ponrang. There were 14 respondents in this research because this research was conducted during the Covid-19 pandemic which the learning system was conducted by dividing the students into 2 groups alternately every week for one session. Meanwhile, the object of this research is teaching materials in the form of student worksheets based on an open-ended approach to learning mathematics on integers and fractions in seventh grade of SMP Negeri 1 Bua Ponrang. The instruments used in the development of this research, such as (1) expert validation sheet; (2) practicality questionnaire; (3) learning outcomes test; (4) interview; and (5) documentation. The data analysis techniques that will be conducted in this research are described as follows:

1. Qualitative Descriptive Analysis

   This technique is used to manage data from the review results of mathematics material experts; design and media experts; and mathematics learning subject experts.

2. Quantitative Descriptive Analysis

   There are three techniques of this analysis, such following below:

   a. Validation Data Analysis Technique

      The activities carried out in the process of analyzing data on the validity of the students' worksheet products are validators are provided validation sheets for each instrument to be filled in with a check point sign on a Likert scale of 1-4 as follows:

      Score 1: Irrelevant

Score 2: Less relevant
Score 3: Quite relevant
Score 4: Highly relevant

Furthermore, based on the validation sheet that has been filled in by technical validators, analyze the validity data from the tabulation by experts to find the percentage with the formula:

$$Percentage = \frac{\sum score\ per\ item}{Maximum\ Score} \times 100\%$$

Based on the percentage results and then categorized appropriate with Table 1 such following below (Munir, 2018):

Table 1. Categorization of Validation

%	Category
0-20	Invalid
21-40	Less valid
41-60	Quite valid
61-80	Valid
80-100	Highly valid

b. Practicalization Data Analysis Technique

Technical analysis of practical data from the tabulation results by teachers and students using the formula:

$$Percentage = \frac{\sum score\ per\ item}{Maximum\ Score} \times 100\%$$

Based on the percentage results and then categorized appropriate with Table 2 such following below (Munir, 2018):

Table 2. The Practicality Category of Student Worksheets Questionnaire

%	Category
0-20	Impractical
21-40	Less practical
41-60	Quite practical
61-80	Practical
80-100	Highly practical

c. The Effectiveness Analysis of Student Worksheets

Individual completion can be achieved if the learning outcomes of students reach ≥ 70 from a maximum score of 100, while classical completion can be achieved if 70% of the students

in the class have achieved a score ≥ 70. Classical Completion can be calculated using the following formula:

$$KK\ (\%) = \frac{\sum ST}{n}$$

Description:
KK (%) = Classical Completion
ST = The number of students who reached the Minimum Completeness Criteria (KKM)
n = The number of all students

Student worksheets based on an open-ended approach are considered effective if there is an improvement in learning outcomes after being provided with learning using student worksheets based on an open-ended approach by providing an evaluation of the final test questions, compared to the learning outcomes before being provided with learning using student worksheets based on an open-ended approach with classical completion ≥70% of the number of students in the class who achieved a score ≥70.

RESULT AND DISCUSSION

This development research produced a product in the form of a student worksheet based on an open-ended approach to mathematics learning on integers and fractions. The research was conducted at SMP Negeri 1 Bua Ponrang. This research and development was conducted to determine the validity, practical and effectiveness of student worksheets based on an open-ended approach. The procedure used in the research and development of student worksheets based on the open-ended approach uses the ADDIE development model (analyze, design, development, implementation, evaluation). The evaluation of this module development process is always conducted at all four phases of development. Based on the results at the analysis step of the research, it is known that in the learning process activities still use student worksheets from publishers as teaching materials. Therefore, the learning process needs to be developed as teaching materials in the form of student worksheets based on an open-ended approach.

After analyzing, the next stage is design. This step begins with designing and preparing the components that will be used in making student worksheets based on an open-ended approach such as material, practice questions, and figures about integers and fractions. In addition, this step also designs the research instrument, which consists of material validation instruments; media and design validation instruments; mathematics subject validation instruments; practicality questionnaire instruments for teachers and students; and learning outcomes test instruments.

The next step is development. This step is making the module draft that has been designed earlier and the validation process. The finished product is then

validated by experts and educational practitioners. The purpose of validation by validators is to determine the validity of student worksheets and questionnaires that have been made, in addition to getting input, criticism, and suggestions in improving student worksheets that have been developed.

Student worksheets based on an open-ended approach that have been validated, then proceed to the next step is implementation. Implementation is used to test the product. This trial was conducted with a limited trial to 14 students of SMP Negeri 1 Bua Ponrang class VII.1. The trial was conducted by teaching students with the assistance of student worksheets based on the open-ended approach developed by the researcher and conducting a final test to students to see the effectiveness of student worksheets based on the open-ended approach. The final step of this development is evaluation, in which there are two types of evaluation, such as formative evaluation and summative evaluation. Formative evaluation in development is conducted at the end of each step. While summative evaluation is the last evaluation of product development after testing validity, practicality and effectiveness.

The validity level of student worksheets based on the open-ended approach developed is very important. A student worksheet is considered valid if it fulfills the validation test criteria conducted before the student worksheet is tested. There are validation results obtained from all three validators previously described, including the presentation of the first material expert validation with an average value of 78.94% with a valid category; for the presentation of the second material expert with an average value of 78.75% with a valid category, media and design experts with an average value of 69.23% with a valid category. This finding is aligned with research conducted by Ratna Juwita, Arinka Putri Utami, and Palupi Sri Wijayanti, the research obtained validation results from 3 people who indicated that overall student worksheets obtained an average of 84.7% with a very valid category so it can be concluded that student worksheets based on an open-ended approach that have been developed by researchers with valid categories and are suitable for use in the learning process (Juwita et al., 2019).

After the validity test is conducted and the results explain that the product developed, that is, the student worksheet based on the open-ended approach, is valid, then the product can be tested for its practicality. The results of the practicality of student worksheets based on the open-ended approach were obtained by administering a practicality questionnaire to 1 teacher and 14 students of class VII.I SMP Negeri 1 Bua Ponrang. After the students' worksheet based on the open-ended approach is assessed for its practicality, then quantitative data analysis is analyzed, that is, the total score of practicality and qualitative data, namely comments and suggestions from practitioners.

The results of practicality questionnaire analysis by teachers on student worksheets based on an open-ended approach indicate that the assessment for all three aspects is in the very practical category. The aspects assessed are the

appearance aspect, the content presentation aspect, and the benefit aspect of the student worksheets based on the open-ended approach. Based on the results of practicality by mathematics teacher, the average score obtained is 98.33% which is in the very practical category.

Furthermore, based on the results of the analysis on the instrument sheet of practicality by students, the student worksheet based on the open-ended approach reaches the level of practicality with an average percentage of students' responses of 89.70% with a highly practical category. This finding is aligned with research conducted by Ratna Juwita, Arinka Putri Utami, and Palupi Sri Wijayanti (2019), the research obtained the results of the practicality of 5 students of seventh grade at SMPN 1 Kasihan obtained an average practicality of student worksheets of 75% with a highly practical category. Therefore, it can be concluded that student worksheets based on an open-ended approach on integers and fractions at SMP Negeri 1 Bua Ponrang fulfill practical criteria for use in the learning process at school and outside of school.

The test of learning outcomes of VII.1 students after using student worksheets based on an open-ended approach on the integers and fractions material with a classical completion value of 78.57% which has increased the average value of students from an average value of 70.35 before using the student worksheets based on an open-ended approach. However, after using LKPD based on an open ended approach, the average value of students is 76.78. Relevant research results from the VII.1 students' learning outcomes test which is in accordance with the classical completion of students' learning outcomes is ≥ 70% and has increased the average value of students. This finding is aligned with research conducted by Sandi Putra, the result of learning outcome test analysis obtained a percentage of classical completion of 86.51% with an effective category (Putra, 2019).

CONCLUSION

Based on the results of the validity test of student worksheets based on an open-ended approach on integers and fractions, the percentage of the first material expert validator is 78.94% with the category "valid", the percentage of the second material expert validator is 78.75% with the category "valid", while the media and design experts obtained a percentage of 69.23% with the category "valid." The results of the practicality test of teachers and students on student worksheets based on an open-ended approach on integers and fractions obtained a percentage of 98.33% score by teachers who were in the " highly practical " category and a percentage of 89.70% in the " highly practical " category by students. The effectiveness test of student worksheets based on an open-ended approach on integers and fractions obtained the results of Classical Completion in class VII.1 obtained a score of 78.57% with an average of 76.78 with an effectiveness category that is effective. Based on this data, it is known that the student worksheet based on

the open-ended approach developed is feasible and effective to be used as teaching material in assisting students in the learning process.

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