



Development of Predict Observe Explain Based Flat Side Building Worksheets to Improve Students' Mathematical Representation Skills

Eka Nur Setiyani¹, Waratchaya Panomram², Tashi Wangdi³

¹Department of Mathematics Education, Faculty of Tarbiyah and Teacher Training, Raden Intan State Islamic University Lampung, Indonesia

²Department of Mathematics, Faculty of Education, Buriram Rajabhat university, Thailand

³Teacher of Mathematics, Ministry of Education, Bhutan

Article Info

Article history:

Received May 6, 2024

Revised Jun 5, 2024

Accepted Jun 19, 2024

Online First Jun 24, 2024

Keywords:

Explain

Flat Side Building Worksheets

Observe

Predict

Predict Observe Explain

ABSTRACT

Purpose of the study: This research aims to knowing student and teacher responses to Predict Observe Explain based worksheets to develop students' mathematical representation abilities.

Methodology: The type of research that will be used is research and development (R&D). In this research, the 4D device development research method (Four D Model) was used as a research and development procedure. The data collection technique in research on developing student work sheets uses a questionnaire. The data collection instrument used in this research is the product trial instrument. Data obtained through trial instruments were analyzed using qualitative descriptive statistics.

Main Findings: Based on the results of questionnaire data on student responses in the small-scale and large-scale field trials, the mathematical media developed in the criteria for interpreting attractiveness, it is very interesting as a source of learning material and is suitable for use.

Novelty/Originality of this study: This study found that the Predict Observe Explain -based flat-sided geometric worksheet is suitable for use in improving students' mathematical representation skills and getting a positive response from students and teachers. This research contributes to the development of innovative and effective learning tools in the context of mathematics learning.

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Corresponding Author:

Eka Nur Setiyani,

Department of Mathematics Education, Faculty of Tarbiyah and Teacher Training, Raden Intan State Islamic University Lampung

Jl. Letnan Kolonel H. Endro Suratmin, Sukarame, Kota Bandar Lampung, Indonesia

Email: setyaniekaanr@gmail.com

1. INTRODUCTION

Education is a means to advance the nation [1], this is in accordance with the spirit of Law no. 20 of 2003 concerning the National Education System (sisdiknas), namely: National education functions to develop abilities and shape the character and civilization of a dignified nation in order to make the life of the nation intelligent [2], aimed at developing the potential of students to become human beings who believe and are devoted to God Almighty. Almighty, noble, healthy, knowledgeable, creative, independent, and a democratic and responsible citizen [3].

Education is an effort to prepare and improve the quality of human resources. Thus education makes it necessary to advance human differences. Seeking knowledge is very important and obligatory for every human being. Therefore, the Islamic religion really respects people who have knowledge, the same as people who

believe in Allah SWT, as Allah SWT says in Surah Al Mujaadilah verse 11: Meaning: Allah will surely exalt those who believe among you and others. who were given some degree of knowledge. and Allah knows best what you do (QS Al Mujaadilah: 11) [2].

The knowledge referred to in the paragraph above is knowledge that is useful for oneself or many people and does not harm other people, one of which is mathematics. Mathematics is part of education. So mathematics education is an important aspect of life in efforts to develop and form quality humans [3]. In the process of learning mathematics, the ability to express and represent mathematical ideas is something that people who study mathematics do. Apart from that, the function of mathematics is to develop communication skills using numbers and symbols as well as sharp reasoning which can help clarify and solve problems in everyday life [4].

Likewise, the goals expected in mathematics learning by the National Council of Teachers of Mathematics. National Council of Teachers of Mathematics (2000) sets five standards for mathematical abilities that students must possess, namely communication abilities, problem solving abilities, reasoning abilities, connection abilities, and representation abilities [5]. Mathematical representation ability is one of the general goals of mathematics learning in schools. This ability is important for students and is related to communication and problem solving skills. To be able to communicate something, someone needs to represent it in the form of pictures, diagrams, graphs or other forms of representation. With representation, problems that initially seem difficult and complicated can become easy and simple, so that the problems presented can be solved more easily [6].

According to Halat and Peker "teachers are tasked with supporting students learning of abstract mathematical concepts. Although most students easily pick up rudimentary knowledge through the use of concrete objects, we ask our students to use symbols and other mathematical notation to represent their understanding" that teachers can provide lessons by teaching abstract mathematical concepts, although basically students easily understand concrete concepts but by using symbols and mathematical notation, students can present their understanding [7]. Hwang et.al, explained that "mathematics representation means the process of modeling concrete things in the real word into abstract concepts or symbols" which means mathematical representation is the process of modeling something in the real world into abstract concepts and symbols [8].

However, the reality in the field shows that students' mathematical representation abilities are still low. This can be seen from the results of research conducted by Misel, Erna Suwangsih entitled "Application of a Realistic Mathematical Approach to Improve Students' Mathematical Representation Abilities" that the mathematical representation abilities of class IV students at public elementary school 17 Nagri Kaler are still relatively low. This is because the mathematics learning process implemented at public elementary school 17 Nagri Kaler is still conventional, namely providing material directly at the symbolic stage, providing examples and practice questions, causing students to tend to memorize the material and work procedurally [9].

Apart from that, Siti Ramziah's research entitled "Improving the Mathematical Representation of Class and students have never been invited to relate everyday problems in matrix representation. Apart from being less skilled at representing daily life problems in the form of matrices, students are also not very dominant in communicating opinions, ideas or ideas both in writing and orally [10].

In this regard, learning media is needed that helps students to discover, present and experience themselves directly, namely learning media in the form of Student Worksheets [11]. Student Worksheets are student guides that are used to carry out investigative or problem solving activities. Student Worksheets can be in the form of guides for training in developing cognitive aspects or guides for developing all aspects of learning in experimental guides. Student Worksheets, namely teaching material that has been packaged in such a way, that students are expected to be able to study the teaching material independently [12].

Based on the results of interviews with students at public junior high school 14 Pesawaran. It is known that many students do not like learning mathematics and say that mathematics is a difficult subject to learn. Apart from that, students also still experience difficulties in understanding mathematical material, both calculations and processing. Apart from that, the teaching materials used cannot help students' ability to predict, observe and explain mathematical problems in real life.

Based on the results of an interview with Nur Endang Destyowati, S.Pd, the teacher said that the learning system used so far is using the lecture and question and answer method. Learning using this method has not obtained satisfactory results and has not made students fully active in the learning process. The teaching materials used by teachers so far are textbooks and worksheets. Teachers have developed their own Student Worksheets, but only Student Worksheets are in the form of questions. The Student Worksheets developed are not yet based on Predict Observe Explain. This can be seen from the learning results of class VIII students that 57.50% got a score below the minimum completeness criteria, and 42.50% got a score above the minimum completeness criteria. It is said that the mathematics learning results of class VIII students at public junior high school 14 Pesawaran are less than satisfactory. One of the factors that influences learning outcomes is teaching materials that are not yet supportive.

Then another thing was also shown at Madrasah Tsanawiyah Nurul Islam. Based on the results of the interview with Ernawati, the learning used currently is still teacher-centred, so students are less active in learning. As in the flat-sided geometric material, students have difficulty presenting. The teaching materials used are worksheets, but they are not very interesting for students in the learning process. The worksheets used are still practice questions, assignments and material that do not contain interesting pictures in the learning process. Based on the problem, it can be concluded that most students do not like mathematics lessons and they think mathematics is difficult to understand. Likewise, the material on flat-sided geometric figures is considered difficult by students.

Student Worksheets used in schools are published by publishers and the student worksheets used only contain material, example questions and questions that are still monotonous and do not suit the needs of students, meaning that the student worksheets does not contain learning activities that involve students. directly in discovering and applying mathematical concepts. These worksheets cannot provide a learning experience for students and cannot encourage the development of students' representational abilities, so the development of supporting worksheets is needed. One of the student worksheets that can be developed is a student worksheets based on Predict Observe Explain which can be used as a guide/instruction for activities so that later it can attract students' interest and can train students' independence to discover, apply and represent it in learning process.

The Predict Observe Explain learning model is an alternative that can be used by educators to create a fun and quality learning atmosphere [13]. According to Ozdemir et al, Predict Observe Explain can improve students' understanding of science concepts [14]. Predict Observe Explain learning is a problem solving process carried out by students through three stages, namely, the prediction stage or making initial guesses (predict), observation (observe), and explanation of the results of observations (explain). This model is used to explore students' initial knowledge, provide information to teachers regarding students' thinking abilities, condition students to carry out discussions, motivate students to explore concepts they already have, and arouse students to carry out investigations [15].

Several studies on the Predict Observe Explain model include research by Rizky Dezricha Fannie and Rohari entitled "Development of Student Worksheets Based on Predict Observe Explain in Linear Program Material for Class Linear programs are easier for students to understand because students' way of thinking has been directed towards descriptions of material and examples of questions that are worked on using the steps of the Predict Observe Explain learning model in the Predict Observe Explain -based worksheets. This mathematics worksheet is equipped with the competency standards mentioned in the introduction to the worksheet. To evaluate students' abilities who have listened to the material and examples presented in the student worksheets, students can work on evaluation questions for each learning activity which has been assisted by Predict Observe Explain steps [16].

Apart from that, researcher Ulfanie Wiyatamal, et al entitled "Development of POE-based LKS (Predict, Observe, and Explain) on the Subject of Temperature and Heat in High School Physics for class % with excellent interpretation on all aspects of the material. The results of the POE-based student worksheets validation test by media experts showed an achievement percentage of 88% with very good interpretation in all aspects of the media [17].

The novelty of this research is that it offers an educational innovation that has the potential to significantly improve students' mathematical representation abilities through a more interactive and reflective learning approach. By integrating the Predict Observe Explain method in student worksheets, this research introduces a new way to stimulate critical thinking and deep understanding of mathematical concepts, encouraging students to more actively predict, observe, and explain the mathematical phenomena they study. This research is important to conduct because there is an urgent need to improve students' low mathematical representation abilities, which have a direct impact on their understanding and achievement in mathematics subjects. The urgency of this research is also driven by increasingly complex curriculum demands, where Predict Observe Explain-based worksheets can be an effective solution to help students develop critical and analytical thinking skills from an early age. The aim of this research is to determine student and teacher responses to Predict Observe Explain based worksheets for developing students' mathematical representation abilities.

2. RESEARCH METHOD

2.1. Research Type

The type of research that will be used is research and development (R&D). Sugiyono said, " research and development is a research method used to produce certain products, and test the effectiveness of these products" [18]. Research and development of certain products produced for the administrative, educational and other social fields is still low [19]. In fact, there are many specific products in education and society that need to be produced through research and development [20].

2.2. Development Procedure

In this research, the 4D device development research method (Four D Model) was used as a research and development procedure [21]. The 4D development model consists of four steps: definition, design, development, and deployment [22]. The definition stage aims to determine the requirements for developing Predict Observe Explain-based worksheets by analyzing the objectives and limitations of the material [23]. The design stage involves collecting data about Predict Observe Explain-based mathematics learning on flat-sided geometric material as well as preparing the worksheet structure framework based on competency maps. The development stage includes validation of the student worksheet by material experts and media experts, revision based on validation results, and testing student responses [24]. The dissemination stage was carried out to disseminate the Predict Observe Explain-based student worksheet learning media that had been developed [25].

2.3. Data Collection Technique

The data collection technique in research on developing student work sheets uses a questionnaire. A questionnaire is a data collection technique that is carried out by giving a set of questions or written statements to respondents to answer. 6 Questionnaires are used when evaluating and testing student worksheets based on Predict Observe Explain. Evaluation of student worksheets based on Predict Observe Explain is carried out by media expert validators and material expert validators. Meanwhile, student worksheet trials based on Predict Observe Explain provide student questionnaires and field trial teacher questionnaires.

2.4. Data Collection Instrument

Instruments are tools that function to facilitate the implementation of something. The data collection instrument used in this research is the product trial instrument. This instrument is in the form of a questionnaire testing aspects of attractiveness which is given to students and teachers. The attractiveness aspect test questionnaire is in the form of student worksheet teaching materials based on Predict Observe Explain which was developed to determine the level of attractiveness of students and teachers.

2.5. Data Analysis Technique

Data obtained through trial instruments were analyzed using qualitative descriptive statistics. The student and teacher response questionnaire regarding product use has 4 answer choices according to the content of the question. Each answer choice has a different score which means the level of suitability of the product for the user. The assessment score for each answer choice can be seen in the table below:

Table 1. Trial Assessment Score (modified)

Score	Attractiveness Answer Choices
4	Very interesting
3	Interesting
2	Less attractive
1	Very Less Interesting

The results of the assessment scores from each student and teacher are then averaged and converted into questions to determine attractiveness. The conversion of scores into assessment questions can be seen in the following table:

Table. 2 Criteria for Attractiveness Test (modified)

Quality Score	Questions Quality Aspects of Attractiveness
$3,26 < x \leq 4,00$	Very interesting
$2,51 < x \leq 3,26$	Interesting
$1,76 < x \leq 2,51$	Less attractive
$1,00 < x \leq 1,76$	Very Less Interesting

3. RESULTS AND DISCUSSION

This research was tested in two stages, namely small group testing and large group testing to find the attractiveness of the product. The results of product trials are categorized as attractive based on the learning media attractiveness scale, if $1.00 < X \leq 1.76$; Very Less Attractive, if $1.76 < X \leq 2.51$; Less Attractive, if $2.51 < X \leq 3.26$; Interesting, if $X > 3.26$; Very Interesting [26].

The average attractiveness results obtained on a small scale which was attended by 10 students obtained an average score of 3.67 based on the results of the response questionnaire completed by the students. These results placed the media in the "Very Interesting" criteria. In the large-scale field trial which was attended by 30 students, the average score of interest obtained was 3.47 in the "Very interesting" criterion. Based on the results of questionnaire data on student responses in the small-scale and large-scale field trials, the mathematical media developed in the criteria for interpreting attractiveness, it is very interesting as a source of learning material and is suitable for use. For more clarity, see table 3.

Table 3. Average Results of Student Response Questionnaires

	Score Average	Criteria
Scale Small	3.67	Very Interesting
Scale Big	3.47	Very Interesting

In field trials, both small and large scale, it was found that students were active in learning [27], students easily concluded parts of the material by looking at the existing illustrations, students were enthusiastic about participating in mathematics learning with this media as well as daily problems presented in the media. Learning helps students gain real benefits from the subject matter [28]. In this case, learning media can be an alternative teaching material for students to overcome boredom when learning with textbooks.

After conducting small group trials and field trials, the product was then tested again for teacher trials [29]. This teacher trial was carried out to confirm the data and determine the general attractiveness of the product [30]. The number of respondents in this teacher test was 1 junior high school/madrasah tsanawiyah class VIII teacher by giving a questionnaire to determine the teacher's response to the attractiveness of the student worksheet. This teacher trial was carried out at public junior high school 14 Pesawaran. The results of the field trial obtained a score of 3.15 with the interpretation criteria achieved being "interesting", this means that the worksheet developed by the researcher has very interesting criteria to be used as a tool in teaching and learning activities on flat-sided geometric material for class VIII junior high school/madrasah tsanawiyah.

The advantages of the flat-sided building worksheet based on Predict Observe Explain which were developed include: (1) as a learning guide for students independently by empowering the potential that exists in school; (2) student worksheet prepared by applying the Predict Observe Explain based learning model, equipped with exercises to determine the level of mastery of the material and achievement of basic competencies for each material; (3) The worksheet developed contains experimental activities so that it can help teachers guide students in experimental activities to discover concepts and can help students to carry out an investigation or discovery. The weakness in this development is that the material contained in the Predict Observe Explain based flat-sided geometric worksheet is still limited to flat-sided geometrical material so it needs to be developed more widely.

Mathematics learning at the junior high school level often faces challenges in helping students understand abstract concepts, especially in flat-sided geometric shapes. Good mathematical representation skills are very important so that students can visualize and manipulate geometric objects effectively. Therefore, an innovative and interactive learning approach is needed to improve this ability. The development of student worksheets based on Predict Observe Explain is one of the proposed solutions. The Predict Observe Explain method encourages students to make predictions, observe results, and explain their findings, thereby improving mathematical understanding and representation.

This research has a significant impact on the mathematics learning process at junior high school level, especially in teaching flat-sided shapes. With the introduction of Predict Observe Explain-based student worksheets, students not only gain a deeper understanding of geometric concepts, but also develop their critical and analytical thinking skills. The Predict Observe Explain approach encourages students to be more active and reflective in learning, thereby improving their overall mathematical representation skills. Implementing the results of this research in the classroom can improve the quality of mathematics education and provide teachers with effective tools to overcome learning challenges, as well as prepare students with the skills needed to understand and solve mathematical problems in the future.

4. CONCLUSION

The conclusion of this research is that students' responses to the student worksheet obtained an average value with very interesting criteria and the teacher's response to the student worksheet obtained an average value with interesting criteria. Limitations in measuring the improvement of students' mathematical representation skills which may be influenced by external factors such as variations in teacher teaching methods and students' academic backgrounds. For further research, it is recommended that the development of Predict Observe Explain based worksheets be applied to other mathematics topics to see the consistent increase in students' mathematical representation skills. In addition, longitudinal studies need to be conducted to evaluate the long-term impact of using these worksheets on the understanding and application of mathematical concepts.

ACKNOWLEDGEMENTS

The researcher would like to thank all parties who have helped in this research.

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