



DESIGN WORKSHEETS MATH TRAIL TO OUTDOOR LEARNING MATHEMATICS

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ABSTRACT

The aim of the research carried out was to produce valid mathematics trail worksheets for outdoor learning. This research is a design research type of development study using two stages of initial evaluation and formative evaluation from Tessmer, namely prototyping, self-evaluation, expert review, one-to-one, small group, and field test. The research discussed in this article has reached the expert review stage. Data collection uses walkthrough and documentation techniques. The results of this research are math trail worksheets that are valid according to the validator's comments and suggestions and have been declared valid by the validator at the expert review stage. In this research, the results were obtained from validators consisting of 3 lecturers and 2 mathematics teachers. From the language aspect, the average validation result was 3.45 in the very valid category, from the appearance aspect, the average was 3.32 in the valid category, and from the presentation aspect, the average was 3.53, very valid. The average of the 3 aspects obtained was 3.45 in the very valid category. In the LKS material, the result was 3.56 in the very valid category and in the problem solving construct, an average of 3.44 was obtained in the very valid category. So the worksheet developed can be concluded to be valid by the validator.

Keywords: learning, mathematics, math trail, outdoor, worksheets

1. INTRODUCTION

Mathematics learning according to Dienes in Hudojo (2005) is learning about mathematical concepts and structures contained in the material studied and looking for relationships between mathematical concepts and structures in it. In essence, learning mathematics is closely related to systematic thinking patterns, namely thinking of formulating something that is done or related to structures that have been formed from existing things.

In the process of learning mathematics, students are accustomed to gaining understanding through experience about the properties possessed and not possessed by a set of objects. Through observation of examples and not examples, students are expected to be able to grasp the understanding of a concept. Furthermore, with this abstraction, students are trained to make estimates, guesses, or tendencies based on experience or knowledge developed through specific examples (generalizations). In the process of reasoning, an inductive and deductive mindset is developed.

The definition of outdoor learning is education that is carried out outside the room which is defined as education in-, for-, and about the environment (Donaldson, 1958). The key words of this definition are in, for, and the surrounding environment which can be interpreted that outdoor education is carried out outdoors, learning that exists in nature and the purpose of this learning is for the benefit of the environment in the future (Priest, 1986). According to Priest, there are 6 main things in outdoor learning, namely a method for learning activities, an experience for students, taking place outdoors, activities requiring all senses, based on the Pliner interdict curriculum, and problems found involving people and natural resources around.

The results of Research by (Pambudi et al., 2021) revealed that learners have difficulty seeing real problems in everyday life and are linked in mathematical models. Similarly, the results of research (Khusna & Ulfah, 2021) reveal that the ability of students to make mathematical models is still lacking. Indoor mathematics learning cannot explore students' mathematical literacy skills but can only transfer knowledge from educators to students (Wardani & Ayriza, 2021). Therefore, learners should be given the opportunity to face real-world situations that suit their daily lives directly (A. N. Cahyono & Ludwig, 2019) and be able to directly apply mathematics lessons directly in their daily lives (Ahsan et al., 2020). This learning method is in accordance with constructivist learning theory. The main point in constructivism theory is how to provide opportunities for



students to understand what they have understood in the learning process by applying and direct practice in everyday life (Suparlan, 2019). Math trails are one of the appropriate techniques to be applied in outdoor learning in mathematics learning (Gurjanow & Ludwig, 2017).

Math trails are a task force along a pre-designed path, which contains a series of stop posts where students must solve math problems around them (Barbosa & Vale, 2020; A. N. , Cahyono & Ludwig, 2017). Real problems must be part of learning mathematics in schools and math trails can be the solution (Jablonski & Ludwig, 2020). Students can see directly the environment around them from a mathematical point of view and immediately find mathematical concepts around them (A. N. , Cahyono & Miftahudin., 2018; Ismaya et al., 2018). After that, learners can immediately apply their math skills in various situations that directly lead to their more contextual mathematical skills and abilities (Barlovits & Ludwig, 2020). Problems on math trails can be solved by following the cycle of mathematical modelling (A. N. Cahyono et al., 2020). Although math trails are not new, the use of technology can help students when experiencing the mathematical modelling process (Molina-Toro et al., 2019). One way to combine the concept of math trails with the use of technology in an advanced learning environment is to use the Math City Map.

Mathematics teaching materials in the form of worksheets are needed by educators and students as a means to support the learning process and as a solution to improve problem solving skills (Istiqomah & Suparman, 2019; Julian & Suparman, 2019) therefore it is important to develop worksheets to support outdoor learning.

2. METHODS

This study uses the development studies method with preliminary evaluation and formative evaluation stages according to Tessmer. The stages are Prototyping, self-evaluation, expert review, One-to-One, Small Group, and Field Test. The article only contains up to the stage of prototyping and self-evaluation, this is because this research is still ongoing and has not ended. The analysis carried out at the preliminary research stage is a needs analysis, namely curriculum and material. learner analysis and software analysis. At this stage worksheets will be designed for outdoor learning which will be used as an initial draft. The next stage is self-evaluation, namely by analyzing the initial draft personally then the results of the analysis are prototype I. Furthermore, the first prototype was given to 5 experts (expert review) consisting of expert validators (lecturers) and practitioner validators (mathematics education teachers) according to (Dewi et al., 2019). Prototype I will be given to 5 learners in class IX (One-to-one stage). In this step prototype I will be assessed, evaluated, and given suggestions from the point of view of face validity (language, appearance, and presentation), content validity (material), and construct validity (problem-solving). The suggestions and criticisms submitted will be input for researchers to carry out revisions and will continue to produce prototype 2, LKPD which has reached the valid criteria.

3. RESULTS & DISCUSSION

Preliminary research

The results of this stage are still low in students' problem-solving abilities, there is no worksheets used in the learning process at school, in the learning process only using textbooks issued by the Ministry of Education and Culture, students need worksheets that supports learning and supports problem-solving skills. The next stage is to design solutions to problems that are worksheets, materials, learning outcomes, and product assessment sheets in accordance with the independent curriculum and problem-solving abilities. The result obtained was an initial draft in the form of prototype I.



Development and prototype phase

Self Evaluation

This step the researcher conducts personal and peer evaluation. At this stage what needs to be revised is the cover in the design to adjust the components on the worksheets. In the revised content section are instructions for using LKPD. The result obtained in this step is to

Expert Review

Prototype I has been produced will be given to experts consisting of expert validators and practitioners. Expert validators are 3 lecturers and practitioner validators are 2 mathematics teachers. The following is a table of the results of validation carried out by experts.

Table 1. Results of Worksheets assessment by validators

Validitas	Face			Content	Construct
Aspects	Language	Display	Presentation	Material	Problem solving
Expert Assessment 1	3,60	3,00	4,00	3,80	3,83
Expert Assessment 2	3,10	3,50	3,57	3,00	3,33
Expert Assessment 3	3,50	3,40	2,93	3,80	3,04
Practising Assessment 1	3,70	3,10	3,57	3,40	3,17
Practising Assessment 2	3,57	3,60	3,57	3,80	3,83
Average aspects	3,95	3,32	3,53	3,56	3,44
Average Validity	3,45			3,56	3,44
Category	Very Valueable			Very Valueable	Very Valueable
Average value validity				3,48	Very Valueable

In table 1, it can be seen that face validity reaches an average value of 3.45 with a very valid category. Content validity obtained an average score of 3.56 with a very valid classification. The worksheets developed has been adjusted to the learning objectives. The average construct validity value is 3.44 in the very valid category because the worksheets has been developed in accordance with the stages of problem solving. After revision based on suggestions and criticisms from validators, this worksheets is declared valid and can be used.



Figure 1. Cover worksheets, Instructions for Use Worksheets, Math Trail Task

4. CONCLUSION

The worksheets designed for math trails in outdoor learning in grade IX Junior High School have been proven valid. The results of the study show that worksheets are valid in terms of face validity, content validity, and construct validity based on validator suggestions and criticisms. This research will proceed to the one-to-one, small group, and field test stages to see the practicality and potential effects of these student worksheets.

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