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Worksheet-Based Learning Research to Improve Creative Thinking Skills

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Abstract. This study aims to develop student worksheets that can be used in research based on research so that students' creative thinking abilities can increase. The research method used is development research that refers to a five-step cycle model, namely analysis, design, development, implementation, evaluation. The results of the study showed that the results of the study showed that from the results of the review of the three validators it was excellent and perfect.

1. Introduction

Creative thinking is one of the abilities that is rarely noticed in learning Mathematics [1–3]. Though creative thinking is one of the factors that can influence students in solving mathematical problems [4,5] besides representation ability and mathematical communication skills [6–8]. One of the problems in mathematics learning is the low ability of students to solve problems, especially non-routine or open-ended issues; this is due to one of them due to student weaknesses in aspects of creative thinking skills needed to solve problems [2,5,9,10]. Assembled with this, research is still required relating to creative thinking because this ability is one of the goals that must be achieved in Mathematics education.

Many ways can be used to improve the ability to think creatively in students. The use of appropriate learning models such as realistic Mathematics learning, discovery learning, Predict-Observe Explain, open-ended problem-based learning, experiential learning of problem posing can



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improve students' creative thinking skills [11–14]. Using the learning model, a teacher needs to prepare a learning device that supports the learning model used so that the learning used can be by the expected goals [15,16].

Research is an essential means to improve the quality of learning, especially in high education [17]. The Indonesian Ministry of Research, Technology and Higher Education has encouraged more research and publications; even national standard qualifications have required students to publish research results [18]. In this regard, learning and research need to be integrated so that it is more contextual in education. It is because learning will be meaningful to students if contextual, adapted to student development and easily understood by students [16,19]. Some ways to integrate education and research include teaching materials with the results of lecturers' research, using the latest research findings, learning activities with contemporary research issues, teaching research methodologies in the learning process, learning with small-scale research activities, learning involving students in institutional research activities, encourage students to feel part of the research culture in the department, enrich the learning process with values that must be possessed by researchers [20].

Teaching is said to be useful if it can combine the three main elements of learning well, namely: teaching strategies, management techniques, and curriculum design [21]. The success of learning can be seen from the learning tools that have been prepared by the teacher before education [22]. So that a teacher needs to develop a strategy to prepare learning devices such as worksheets. By making learning tools such as student worksheets that are tailored to research-based learning, students' creative thinking abilities can increase. In this regard, the purpose of this study is to develop student worksheets that can be used in research based on research so that students' creative thinking abilities can increase.

2. Method

The method used in this study is a development research model. The development research model is the research method used to produce a particular product not to test the effectiveness of the product [23,24], so the primary objective of this development research is to obtain Worksheet-Based Learning based on research learning that can be used in learning Mathematics Statistics. This development research refers to a five-step cycle model, namely analysis, design, development, implementation, evaluation [25], but in this study, it was carried out only until the third stage of development.

In the analysis phase, development needs analysis activities, product development requirements that are by user needs and proper research and development models to develop the product [26]. Analysis can be done through literature studies or preliminary research. In the analysis phase identification of components of competence or skills that must be mastered by students, teaching materials and learning methods which is a needs analysis of Worksheet development. In the design phase, a Worksheet prototype was prepared. This prototype is compiled based on the results of the study in the previous stage

In the development phase, the validity of the prototype is carried out by people who are experts in content, and readability tests by students. Seeing the feasibility of teaching materials carried out with content validity. Content validity shows that teaching materials are not developed randomly but must be scientifically justified [24]. Indicators or aspects of assessment worksheet refers to content, display, and language.

3. Results and Discussions

Based on the experience of the researchers teaching mathematics statistics courses at the Mathematics Education Study Program at the Universitas PGRI Madiun on discrete and continuous opportunity distribution material. They are confused in distinguishing discrete and continuous questions. In learning, class students rarely ask questions. Only lecturers who submit questions to students, so the ability to raise problems has not developed [27]. Based on the needs analysis of mathematical statistics, it was revealed that 85.26% of students stated the need for a worksheet to facilitate understanding the problem of distribution of opportunities faced. The hope is that with the ability to solve mathematical statistics, the ability of students to raise questions is growing. The strength of students to submit opportunities distribution problems can be new problems, specific problems into other forms that have the same meaning as the material distributed opportunities, ask questions before, during, and after solving issues related to the real distribution opportunities.

The initial design of the worksheet consists of three parts, namely the initial, core and closing. The first part of the title page, the introduction, and the entry contents. The core part consists of introductory material and core material. The introductory material includes opportunities, permutations, and combinations of events. The core material section comprises of a discrete opportunity distribution and a continuous opportunity distribution. At the beginning of the presentation of the material given the opportunity problems on a small scale that can be solved with the instructions given to find the concept. Conclusion section, students provide reflection and evaluation on the worksheets they usually do to make improvements. Examples of small-scale problem submissions that exist on the spreadsheet.

Two dice are thrown, one is red while the other is green. Suppose x states the result in a green and y results in a red.

1. Make two questions related to the revelation
2. Find problems in daily life that are associated with the chance of an event along with the problem and its solution

Worksheet assessment by content validator and material containing pre-solution posing activities, within solution posing, post-delivery solutions. A simple Worksheet view can develop problems that

refer to students' ability to raise problems. Based on the validator's assessment, the Worksheet fulfills the requirements for testing to students.

Table 1. Validator Assessment Results

Validator	Content	Language	display
1	85,32	80,33	78,56
2	80,10	82,67	80,25
Average	82,71	81,50	79,41

Based on Table 1, it can be seen that the two validators give an assessment above 75 both for content, language, and appearance. A prototype is said to be feasible to proceed to the next stage if the validators assess at least 75 or in a proper category [24,28]. Thus the prototype worksheet that has been designed can be continued at the next stage or limited trial.

The validated worksheet was conducted with a limited trial for 30 students. Students are explained how to work the Worksheet in solving problems correctly. In five meetings attended by students, it includes pre-solution posing activities, within solution posing, postal solutions. After completing studying all the material, students were asked to fill out a response questionnaire

Table 2. Results of student responses to the worksheet

Indicator	Positive response	Negative reaction
A spreadsheet is easy to understand	26	4
Teaching the lecturers	27	3
Learning atmosphere	23	7
Learning uses research-based	30	0
Understanding learning material	24	6

From table 2, the results of student responses to worksheets that have been validated indicate that more than 75% of students give a positive assessment of the spreadsheet that has been developed. These results suggest that the worksheet developed is easy for students to understand.

Learning tools are tools or equipment to carry out a process that enables educators and students to carry out learning activities [29], preparation of learning tools that are an integral part of learning planning designed in the form of syllabus, lesson plans, preparation of learning media and resources learning, assessment tools, and learning scenarios [30]. By developing one of the learning tools such as research-based learning worksheets that can be used in Mathematics statistical learning, it is hoped that communication skills and the ability to think creatively can be better. If the ability to

communicate and think creatively is good, the ability of students to solve problems can be better [4,31,32].

4. Conclusion

Based on the results of the evaluation by the validator and the test on the Worksheet, it can be concluding that the Worksheet contains pre-solution posing activities, within the solution posing, post-delivery solutions. Worksheet design consists of three parts, namely (1) the initial page includes of page titles, introductory words, and table of contents, (2) Section contents containing the chapter title on opportunity and contribution opportunities, (3) Closing as a reflection and evaluation of the material presented in Worksheet for the next revision. Also, the results of limited trials on student responses indicate that most students easily read and understand the worksheets that have been developed

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