www.bircu-journal.com/index.php/birci
Budapest International Research and Critics Institute-Journal (BIRCI-Journal)
Humanities and Social Sciences
ISSN 2615-3076 Online)
ISSN 2615-1715 (Print)
Budapest Institute

Elementary Mathematics Learning Devices with Scientific Approach Based on Process Skills

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Abstract

This study aims to describe the steps for developing elementary mathematics learning tools with a process skills-based scientific approach to improve mathematics learning outcomes and to describe the quality of the development tools. The quality of the development results is determined based on the criteria of Nieveen, namely valid, practical and effective. The competencies used in the development are Class VI statistical competencies. This research is a development research. The learning device development model in this study was adapted from the ADDIE model development model which consists of analyze, design, develop, implementation and evaluation stages. The trial was carried out in three stages, namely (1) trial / expert validation; (2) limited trials; and (3) field trials. Field trials were carried out at MI Hamzanwadi No. 1 Pancor. The research instruments used were RPP assessment sheets, LKPD assessment sheets, student response questionnaires, teacher response questionnaires and learning implementation observation sheets. The validity data analysis and the practicality data analysis were each carried out by converting the quantitative data in the form of the assessment results into qualitative data in the form of a standard scale of five. The data analysis of the effectiveness of the competency achievement test was carried out by determining the minimum percentage of completeness. This study produced learning tools consisting of lesson plans with 4 meetings, 4 subchapter student activity sheets (LKPD), and mathematics learning outcomes tests on statistical competence. Each component of the learning device is valid, practical, and effective

Keywords
development; learning tools; scientific approach; process skills

I. Introduction

Education is the most important part of human life and is a major aspect of the creation of quality human resources. Education can humanize humans into individuals who are beneficial to life, both in the lives of the individuals themselves, the nation and the state. Therefore, education must be carried out as well as possible, so that it is in accordance with the objectives. The success of a nation lies in the quality of education that can improve the quality of its human resources (Hartawan, et al, 2014).

According to Astuti et al (2019) Education is an obligation of every human being that must be pursued to hold responsibilities and try to produce progress in knowledge and experience for the lives of every individual. Education is one of the efforts to improve the ability of human intelligence, thus he is able to improve the quality of his life (Saleh and Mujahiddin, 2020). Education is expected to be able to answer all the challenges of the times and be able to foster national generations, so that people become reliable and of high quality, with strong characteristics, clear identities and able to deal with current and future problems (Azhar, 2018).

Education will create a learning process. Creating quality learning is not only through choosing the right approach or method, but the use of various media is also very influential. The method and the media used have a close relationship in the learning process, namely mutual support in the success of the learning process in the classroom. Because in essence, learning is a process of communication between teachers and students. Communicants in the learning process are students, while the communicators are teachers and students. If students become communicators to other students and teachers as facilitators, there will be an interaction process with a high level of learning. A teacher must be aware that the communication process cannot run smoothly, even the communication process can cause confusion, misunderstanding, even misunderstanding. Communication errors for a teacher will be felt by students as an obstacle to learning. Effective communication is largely determined by the activity of the recipient (communicant). *Feedback* (mental and physical) from the communicant can be used as a control tool for communicators to make improvements to the communication method that has been carried out. To avoid or reduce the possibility of miscommunication, tools are needed that can assist the communication process. These tools are called media. That is why the media is closely related to the use of approaches or methods in the learning process in the classroom. Media is an intermediary or delivery of messages from the sender to the recipient of the message. Good media will activate students in providing responses, feedback and encourage students to carry out correct practices.

Based on the results of observations, the teacher still uses the usual learning media, namely sheets of practice questions given after the teacher explains the material that day. As for other supporting media, such as textbooks distributed by teachers, each of which is one package book for 2 people or per seat. However, the contents in the textbooks are still not able to fully help students due to the communication language used in the textbooks which is still passive so that students are too lazy to read the material. Therefore, many students ask the same problem regarding problem solving from the material questions that have been explained. This is because the teacher as a facilitator is still unable to communicate the material to students in a sequential, simple and clear manner, and the use of learning media is still not appropriate so that students are confused in understanding what is conveyed by the teacher. In addition, the tests given contain monotonous questions so that students are bored and even lazy to solve these questions.

Departing from the problems above, it is necessary to use learning tools based on a scientific approach (*scientific approaches*). The devices intended in this case are RPP, LKPD and student learning outcomes tests. RPP (Learning Implementation Plan) includes subject identity units, competency standards, basic competencies, competency achievement indicators, learning objectives, teaching materials, time allocation, learning methods, learning activities, assessment of learning outcomes and learning resources. The use of learning tools in the form of lesson plans with a scientific approach will further support the learning process, this is in accordance with the function of the lesson plans, namely as a reference for teachers to carry out teaching and learning activities (learning activities) to be more focused and run effectively and efficiently.

As for the use of print media in the form of LKPD based on a scientific approach (*scientific approach*) which is to present mathematics subject matter in LKPD in accordance with the mathematics lesson. Such as a presentation that contains or includes scientific activities, namely 5M (observing, asking, reasoning, trying/creating and presenting/communicating). This LKPD is what students need to make it easier for them to understand mathematical material. In addition, it will also train students' skills and create students who are able to be scientific.

Student activity sheets (LKPD) are sheets containing assignments that must be done by students. The activity sheet contains instructions, steps to complete a task. The tasks given to students can be in the form of theory and or practice. LKPD or student worksheets can also be given to students to measure the success of the learning that has been done, because it contains questions or assignments either individually or in groups. There are several advantages of LKPD as a print media, namely; 1) students can learn and progress at their own pace. Subject matter can be designed in such a way that it is able to meet the needs of students, both those who are fast and slow to read and understand, 2) besides being able to repeat the material in printed media, students can follow logical sequences of thoughts, 3) display text and images on the page. Print media has become commonplace, and this can add to the attraction, and can facilitate understanding, and 4) the information content of print media is easy to update and revise in accordance with developments and new findings in the field of science, the material can be reproduced economically and distributed easily.

II. Research Method

The approach used in this research is development research which will produce a product in the form of a mathematics learning device with a *scientific* base on process skills. Learning device products that will be produced are RPP, LKPD and learning outcomes tests. The scientific approach (*scientific approach*) in learning as intended includes observing, asking, reasoning, trying and forming networks (5M).

The RPP, LKPD and learning outcomes test products that will be produced are oriented to the components of the *scientific* commonly referred to as 5M (observing, asking, reasoning, trying/creating and presenting/communicating). With the RPP, LKPD and learning outcomes test products, students will be helped in improving their mathematical process skills. The mathematical process skills that will be improved are only four aspects that are focused on by researchers, namely in terms of students' skills in observing, calculating, measuring and communicating results.

The method used in this research is research *and development*. This type of research is a type of research that develops or produces an interactive teaching material so it is necessary to test the validity of the interactive teaching material (Sugiyono, 2015). Research and development is research conducted to produce or develop a product. This research and development aims to produce mathematics learning tools with a *scientific* base on process skills for grade VI elementary school. The products developed are then tested for validity, practicality and effectiveness.

The instrument used to determine the effectiveness of learning tools (RPP, LKPD and learning outcomes tests) in this development research is in the form of data collection through tests obtained after students follow the learning process using learning tools (RPP, LKPD and learning outcomes tests) which were developed to measure the effectiveness of the product.

In this study, the validity analysis used descriptive analysis. This analysis aims to transform the raw data set into a form that is easy to understand, in the form of more concise information (Oei, 2010). In this study, the results of descriptive analysis were used to determine the validity of the learning tools developed. The data obtained from the results of filling out the questionnaire given to the learning device material experts is a quantitative descriptive statistical analysis. This data is then converted into a percentage.

In this study, for practical analysis the data were obtained from the results of descriptive analysis. This is data processing which is treated the same as the validity analysis. The descriptive analysis uses descriptive statistics. Sugiyono (2018) says descriptive statistics are statistics used to analyze data by describing or describing the data that has been collected as it is without intending to make general conclusions or generalizations.

In this study, the results of descriptive analysis were used for the practicality of the learning tools developed, as well as the analysis of the validity of the data. The data obtained from the results of filling out the questionnaire given to material experts, teaching material media experts and students is a quantitative descriptive statistical analysis. This data is then converted into a percentage. The percentage in the practicality questionnaire is sought by using the following formula:

Analysis of the effectiveness in this study is indicated by the analysis of student learning outcomes.approach *scientific* based on process skills developed are said to be effective if they have met the classical completeness of *post test* the students *scientific* process-based skills during large-scale trials. The minimum completeness criteria (KKM) for mathematics that have been set by the education unit is 65. While the classical completeness set in this study is 70% of the students who have achieved the minimum completeness criteria (KKM).

III. Results and Discussion

Based on the results of the development research that has been described, the development of learning tools is carried out with the steps of developing the ADDIE model consisting of the *analysis*, *design*, *development*, *implementation*, and *evaluation* (evaluation) produces learning tools in the form of lesson plans, LKPD and learning outcomes tests with a *scientific* based on process skills on Statistics material for MI Class VI with valid, practical, and effective criteria.

In the analysis stage, *three components* of analysis are carried out, namely needs analysis, student characteristics, and curriculum. From the results of the analysis, it is known that there are still limited tools for learning mathematics that can facilitate students in building and finding mathematical concepts independently. The LKPD developed by the teacher contains material that is presented directly and practice questions. This causes students to become passive and less active so that the ability of process skills is neglected. In addition, the presentation of material or problems that have not been linked to everyday life causes students to find it difficult to solve *scientific problems*. Therefore, it is necessary to have learning tools that use a *scientific method that* is able to facilitate students in building and finding mathematical concepts independently and using these concepts in solving problems in everyday life. One of the materials that must be mastered by class VI students in semester 1 is Statistics. Learning mathematics, especially in statistical material using a *scientific method*, is expected to develop the ability of students' process skills. The development of learning tools with a *scientific* to statistical material refers to the curriculum used by schools, namely the 2013 Curriculum.

At the design stage, preparation of lesson plans, preparation of LKPD designs, preparation of learning outcomes test designs and preparation of instructional device instrument designs is carried out. The preparation of the lesson plan design is carried out by taking into account the steps, namely: (1) designing the identity of the lesson plan, (2) formulating learning objectives, (3) designing learning materials, (4) selecting learning methods, (5) designing learning activities, (6) selection of learning resources, and (7)

design of learning assessment. Meanwhile, the steps for preparing the LKPD draft are: (1) preparing a map of LKPD needs, (2) determining the title of LKPD, and (3) writing LKPD which includes the formulation of basic competencies, determining the form of assessment, compiling materials, and compiling the LKPD structure. LKPD is prepared based on four aspects of the eligibility criteria, namely the suitability of the material, the suitability of the didactic requirements, the suitability of the construction requirements, and the suitability of the technique. At this stage, the design of the instrument for assessing the quality of learning tools is also carried out, which consists of an instrument for assessing learning devices, response questionnaires, observation sheets for learning implementation, and test instruments for student learning outcomes.

At the development stage development of learning device assessment instruments, development of learning tools, validation of learning tools, and revision of learning tools is carried out in the form of minor improvements to the LKPD component. The learning device assessment instrument that has been designed is then compiled and consulted with the supervisor. Before being used, the instrument was validated by the validator lecturer. The RPP is developed based on a previously prepared design. The steps of learning activities in the lesson plan refer to the steps of the *scientific*. LKPD is developed based on a design that has been prepared previously and refers to the components of the *scientific*. The learning tools that have been developed are then validated by expert lecturers on learning tools. The validator's assessment shows that the learning tools are worth testing with revisions. Furthermore, before being tested in schools, the learning tools were revised according to the input and suggestions from the validator.

At the implementation stage, the revised learning tools were tested at MI No. 1 Pancor Class VI consisting of 20 students. The trial of learning tools was carried out in five meetings and in the last meeting, a test of student learning outcomes was carried out and filling out a response questionnaire. At the evaluation stage, improvements or revisions to learning devices were made based on suggestions and input from teachers and students during the trial process.

The results of the development of the final product of learning devices have been tested for validity, practicality and effectiveness. Based on the aspect of the validity of the assessment results, each component of the learning device, namely RPP and LKPD, achieved a minimum assessment qualification of good. Thus the learning tools that have been developed in the form of RPP and LKPD have met the valid criteria.

Based on the results of the RPP assessment, an average score of 4.5 out of a maximum score of 5 was obtained with a very good classification. This shows that the RPP that has been developed is in accordance with the principles of development and the components of the RPP as stated in Permendiknas no. 41 of 2007. Meanwhile, based on the results of the LKPD assessment, an average score of 4.2 was obtained with a maximum score of 5 with good classification. This shows that the developed LKPD has met the quality aspects of the feasibility of teaching materials, namely in terms of the suitability of the material, the suitability of the didactic requirements, the suitability of the construction requirements and the suitability of the technical requirements. With a good classification, it has been shown that the use of LKPD with a *scientific* base on process skills is feasible to use in learning in schools.

The developed RPP and LKPD have met the practical criteria based on the responses given by teachers and students as well as the results of observations of the implementation of learning. In general, the teacher's response to the learning tools used is very good and the student's response is good. Meanwhile, the implementation of the observed learning

process also showed very good results. This means that the learning tools developed meet the practical criteria.

Based on the results of the student response questionnaire, an average score of 3.2 was obtained from a maximum score of 5 with good classification. Based on Table 4.16 the aspect of convenience has a score with good criteria, this shows that the application is easy to use. Meanwhile, the average score obtained from the results of the teacher's response by the mathematics teacher is 3.5 out of a maximum score of 5 with a very good classification. All aspects of the student response questionnaire obtained a very good classification. Thus the learning tools developed are considered practical to be used by teachers in learning mathematics on statistical material. This means that the learning tools developed can assist in the implementation of learning, because the teacher can know the activities that must be carried out to achieve the learning objectives to be achieved (Mulyasa, 2007: 221).

During the activity, the researcher made observations on the learning activities that were being carried out, then filled out the observation sheet on the implementation of learning carried out with a validator, namely the principal of MI Hamzanwadi No. 1 Pancor. In general, the percentage of learning implementation using the developed learning tools is 92.64% with very good criteria. This means that the teacher has carried out learning activities in accordance with the RPP that has been developed. In addition, the RPP developed has fulfilled the function of implementing the RPP, namely to streamline the learning process in accordance with the planned activities (Mulyasa, 2007: 218).

Based on the learning process using the developed learning tools, the results of the data analysis of the students' learning test results reached a very good category with the percentage of students' completeness in the learning outcomes test conducted at the end of the meeting was 90%. Thus, the developed mathematics learning tools meet the effective criteria.

Based on the achievement of valid, practical, and effective criteria from the learning tools that have been developed, a final product is obtained in the form of learning tools with a *scientific* based on process skills on statistical material for MI Class VI that meet the quality criteria of learning tools, namely valid, practical, and effective. So it is suitable for use in learning (Nieveen: 1999).

IV. Conclusion

The conclusions obtained from research and development of elementary mathematics learning tools with a *scientific* based on process skills in Statistics material Development of learning tools (RPP, LKPD and Learning Outcomes Tests) with a *scientific* based on process skills to improve student learning outcomes in class VI statistics material MI Hamzanwadi No. 1 Pancor as a tool and learning resource for teachers as educators. The practicality of learning tools (RPP, LKPD and Learning Outcome Tests) with a *scientific* based on process skills in the statistical material for class VI MI Hamzanwadi No. 1 Pancor was tested through expert validation tests, educational practitioner validation, small group tests and operational field tests at MI Hamzanwadi No. 1 Pancor, which corresponds to the syntax of process skills. Learning tools (RPP, LKPD and Learning Outcome Tests) with a *scientific* base on process skills are effective for improving student learning outcomes.

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