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The Development of LKPD on the Lesson Materials of Quadrate Form Factorization in SMP

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Abstract: This study aims to produce LKPD on the subject matter of quadratic form factorization in junior high schools which is feasible according to the validator. This study uses the research and development method or R&D (Research & Development) research with the ADDIE (Analysis-Design-Development-Implement-Evaluate) model which has been modified into the ADD (Analysis-Design-Development) model due to limitations in research. The subjects of this study were validators two expert lecturers and three Mathematics teachers in SMP. While the object in this research is learning quadratic form factorization assisted by LKPD (Student Activity Sheets) in SMP (Junior High School). The results of this study indicate that the feasibility level of the RPP (Lesson Plan) and LKPD based on the problem-based learning approach based on the evaluation of the validator.

Key words: Development of Student Worksheet · Quadratic Form Factorization Material

INTRODUCTION

The use of inappropriate strategies can lead to boredom, poor understanding and monotony so that students are not motivated to learn. Therefore, a learning strategy is needed that links everyday life with the material presented so that students learn more meaningfully. New learning experiences will enter into long-term memory and will become new knowledge if they have meaning. The learning process is not only fun when students learn the material but also benefits their life later. Learning will be meaningful if it always links learning material with the real world. And the teacher helps students in constructing previously owned knowledge into new knowledge [1].

The role of students in the learning process is still lacking, that is, only a few students show active opinion and questions. The learning carried out in the classroom shows that when students are asked questions, only a few students answer questions from the teacher. Ironically, even if there are questions about the material that has been or is being studied, the questions actually arise from students who are considered to have understood, while students who do not understand do not ask questions. This causes students to be less trained to develop their knowledge in solving problems and applying the concepts they learn to the real world. Students also have difficulty in concluding the learning that has been implemented.

The flow of constructivism education suggests that in order for knowledge to last a long time in the memory of students, the concepts and knowledge should be acquired and built by students themselves. One of the learning strategies that can be used is that students work together to learn the material. As a group, students are given the opportunity to understand the concept and develop it through working on a series of tasks designed in such a way in the form of student activity sheets (LKPD).

Learning theory must be able to connect the things that exist today with how to produce these things. Learning theory explains exactly what happens, but learning theory only guides what must be done to produce this [2].

There are several things related to learning theory:

- The learning theory must pay attention to the fact that there are many trends in the way students learn and these tendencies have been owned by students long before they enter school.
- This theory is also related to the existence of a knowledge structure. There are 3 things related to the structure of knowledge: 1). The knowledge structure

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must be able to simplify a very broad range of information; 2). The knowledge structure must be able to bring students to new things, beyond the information that has been explained; 3). The knowledge structure must be able to broaden the thinking horizons of students, combining it with other sciences.

- Learning theory is also related to optimal relationships. A teacher must be able to find easy relationships about something to be taught so that students can more easily grasp this information [3].

Behaviorism Learning Theory: Behaviorism emphasizes only things that can be observed with the naked eye, so this theory views that the learning process experienced by humans is determined by the conditions of stimulus (S) and response (R). According to this theory, this S-R scheme applies in general to any organism (animal or human). Therefore, various experiments carried out based on this theory focus on modifying the stimulus and observing changes in the response of the research object [4].

Until now, the theory of behaviorism is still applied in modern education, although it must be combined with other theories, such as the theory of cognitiveism. The easiest example to understand from the application of behaviorism theory is the giving of prizes to students who excel because they are considered to exhibit positive behavior in the form of a good understanding of the lessons given. In the learning process there are many ways that can be used to apply the theory of behaviorism, including praising students who give correct answers, giving scores according to test results and so on

Cognitivism Learning Theory: Cognitivism learning theory is more concerned with the learning process than the learning outcomes itself. Baharudin explained this theory is more concerned with internal events. Learning does not only involve the relationship between stimulus and response as in behaviorism theory but also a learning with the theory of cognitivism involves a very complex thought process [5].

Cognitive learning theory is different from behavioristic learning theory, cognitive learning theory is more concerned with the learning process rather than learning outcomes. The cognitive learning model says that a person's behavior is determined by his perception and understanding of the situation related to his learning goals. Learning change is a perception and understanding that cannot always be seen as visible behavior. This theory holds that learning is an internal process that includes memory, retention, information processing, emotions and other psychological aspects. Learning is an activity that involves a very complex thinking process. The learning process occurs, among others, includes setting the received stimulus and adjusting it to the cognitive structures that are already owned and already formed in a person based on the understanding of previous experiences [6].

Cognitive learning theory emphasizes learning is a process that occurs in the human mind. Basically, learning is a business process that involves mental activities that occur in humans as a result of the process of active interaction with their environment to obtain a change in the form of knowledge, understanding, behavior, skills and attitude values that are relative and diverse [7].

The theory of cognitivism reveals that learning carried out by individuals is the result of mental interaction with the surrounding environment, resulting in changes in knowledge or behavior. In learning this theory it is recommended to use concrete media because children cannot think abstractly [8].

In this theory, there are two fields of study that are more concerned with the learning process than learning outcomes, namely:

- Learning does not only involve stimulus and response but also involves a very complex thinking process.
- Science is built in a person through a continuous process of interaction with the environment.

According to cognitive psychology, learning is seen as an attempt to understand something by linking new knowledge into existing thinking structures. This effort is actively carried out by students. Activeness can be in the form of seeking experience, seeking information, solving problems, observing the environment, practicing something to achieve a certain goal. Thus, previously acquired knowledge is critical to the success of learning new knowledge information. This theory also assumes that learning is the organization of cognitive and perceptual aspects to gain understanding. In this model, a person's behavior is determined by their perceptions and understanding. Meanwhile, situations related to goals and changes in behavior are largely determined by the internal thinking process that occurs during the learning process. In principle, learning is a change in perception and understanding that cannot always be seen as behavior (not always observable). In this theory

emphasizes the idea that the parts of the situation that occur in the learning process are related to each other as a whole. So if the whole situation is divided into small components and studied separately, then it is the same as losing something. So that in this cognitive flow there are main characteristics. The characteristics of the cognitive flow that can be seen are as follows:

- Concerned with what is in humans.
- Concerned with the whole rather than the parts
- Concerned with the role of cognitive.
- Concerned with the current condition
- Concerned with the formation of cognitive structures [9, 10]

Constructivism Learning Theory: The pioneers of the theory of Constructivism were Jean Piaget, Bruner and Vygotsky in the early 20th century who held the view that knowledge is not acquired passively but actively. The main concept in constructivism theory is that students will actively seek to make an understanding of what they understand. This means that learning is an activity based on finding out independently, solving problems, finding.

Jean Piaget, Brunner, Vygotsky. Construction means that it is constructive, in the context of educational philosophy it can be interpreted that Constructivism is an effort to build a modern cultured order of life. Constructivism is the basis of thinking (philosophy) of contextual learning, namely that knowledge is built by humans little by little, the results of which are extended through a limited context.

Knowledge is not a set of facts, concepts or rules that are ready to be picked up and remembered. Humans must construct this knowledge and give meaning through real experiences. According to constructivism, knowledge is not something static and deterministic, but a process of coming to know. Contrutivism considers that humans are able to construct or construct knowledge after interacting with the environment.

For example, knowledge about cats is not a one-time thing, but a process. The first time we see cats we gain knowledge by seeing and touching. On another occasion, we meet another cat. Interaction with various cats will make our knowledge of cats more complete and detailed. This happened continuously.

With constructivism theory students can think to solve problems, look for ideas and make decisions. Students will understand better because they are directly involved in building new knowledge, they will better understand and be able to apply it in all situations. Besides that students are directly involved actively, they will longer remember all the concepts.

Learning Models based on constructivism theory include:

- Learning Model Reasoning and Problem Solving
- Problem-Based Instruction Learning Model
- Conceptual Change Learning Model
- Investigation Group Learning Model
- Inquiry Learning Model

Bruner's Theory of Learning: Bruner was a professor of psychology at Harvard University from 1952-1972 and at Oxford University 1972-1980. He spent time at New York University School of Law and New School For Social Research in New York City. For more than 45 years Bruner has been pursuing cognitive psychology as an alternative to behavioristic theory in psychology since the mid-20th century. Bruner's cognitive approach has reformed education in the United States as well as in England. According to Bruner, in the learning process three phases or episodes can be distinguished, namely:

Information Phase: The information phase is the initial phase for acquiring new knowledge or experience where in each lesson a number of information is obtained which functions as an addition to old knowledge, either in the form of information that deepens and refines knowledge or information that is contrary to the knowledge already owned.

Transformation Phase: The transformation phase is the phase of understanding, digesting and analyzing new knowledge and being transformed into new forms that may be useful for other things, so that they can be widely used.

The Evaluation Phase (Knowledge Assessment): The evaluation phase (knowledge assessment) is a phase in assessing which information can be used to understand other symptoms and also as a phase to find out whether the transformation result is right or wrong.

In addition to introducing the learning process phase, Bruner also divides the learning process into three stages. Bruner's learning theory is known for its three well-known learning stages, namely the enactive, iconic and symbolic stages.

Basically, every individual when experiencing or recognizing events in his / her environment can find a way to restate the event in his mind, which is a mental model of the events he is experiencing.

This is the stage of the learning process according to Bruner's learning theory which becomes a learning model, namely the enactive, iconic and symbolic model. The stages of the learning process are:

- The enactive stage; In this stage, students in their learning use or manipulate objects directly in the form of concrete objects or real situations.
- The iconic stage; at this stage it states that children's activities begin to involve mental which is a description of objects. In this stage, students do not directly manipulate objects, but can manipulate them by using images of objects. Knowledge is presented by a set of images that represent a concept.
- The symbolic stage; this stage the child manipulates symbols directly and has nothing to do with objects. Children achieve the transition from the use of iconic presentations to the use of symbolic representations which are based on a more flexible and abstract system of thinking [10].

Bruner's study emphasizes cognitive development. Similar to the stages of the learning process he put forward, according to Bruner, cognitive development also goes through three stages which are determined by how to see the environment, namely enactive (0-2 years), iconic (2-4 years) and symbolic (5-7 years).

- The enactive stage (0-2 years), a person doing activities in an effort to understand the surrounding environment. It means in understanding the world around him, the child uses motor knowledge. For example through bite, touch, grip and so on.
- Iconic stage (2-4 years), a person understands objects or their world through pictures and verbal visualization. That is, in understanding the world around them, the child learns through the form of parables (appearing) and comparison (comparison).
- The symbolic stage (5-7 years), a person has been able to have ideas or ideas that are greatly influenced by their ability to speak language and logic. In understanding the world around them, children learn through symbols of language, logic, mathematics and so on.

Based on Bruner's learning theory, a learning presentation model that was adapted from the learning phases emerged, namely the enactive, iconic and symbolic learning presentation model.

Concept: A concept will reveal an abstraction formed by the generalization of specific things. In mathematics, a concept is an abstract idea that can be used to classify ideas, ideas, or events and at the same time to classify those ideas, ideas or events that are examples or not examples of these abstract ideas. For example, the concept of sets, equations, inequalities, triangles, cubes, functions, variables, matrices, vectors and so on. According to him, there are three types of mathematical concepts, namely:

Pure Mathematical Concepts: The concept of pure mathematics is an agreement that classifies an idea and the relation between those ideas, which is totally independent of how the idea is presented. For example, the idea of ??the number six, can be represented as "VI" in Roman numerals, or "?" in Arabic script, or "llll l" in turus form, or "110" in base 2, or written as "6" in numerals. arabi, those are the six number concepts. Likewise the concept of a rectangle, can be presented in the form of a square, rectangle, parallelogram, kite, rhombus, or trapezoid, or any rectangle. For non-math examples, some objects around us, say chairs. There are study chairs, guest chairs, rocking chairs, wheelchairs, car seats, royal throne chairs and so on. When the concept of a chair has been obtained, then we will easily say that the other object is not a chair, or is a chair.

The Concept of Notation: The concept of notation is an agreement that classifies an idea which is a direct consequence of how the idea is presented. Suppose that the notation "7" in numbers is denoted by "725", which means 7 hundreds. the notation "7" in numbers denoted by "473", means 7 tens and the notation "7" in numbers denoted by "867", that is, 7 units. The first "7" notation has values of 700, the second "7" is worth 70 and the third "7" is worth 7 as units. This is the placement of the notation for representing numbers in the base ten system.

Applied Concept: Applied concepts are the application of pure mathematical concepts and notation concepts to solve mathematical problems and other related fields of study. For example, the concept for the addition operation on integers: fifty plus one hundred and twenty-five can be written as "50 + 125 = 175". There are tens and units place values in the number 50, which are added (in the set concept is concatenated) by the number 125) [10, 11].

Research Method: This study uses the research and development method or research R&D (Research & Development) with the ADDIE (Analysis-Design-Development-Implement-Evaluate) model. Research and development methods are methods used to produce certain products and test the effectiveness of these products. This development research follows a cycle of steps. The steps of this research or development process consist of reviewing the research findings of the product to be developed, product development based on these findings, conducting field trials in accordance with the background in which the product will be used and revising the results of the field tests. In short, research and development can be interpreted as research that produces a product that is validated by several teams of experts which will then be tested in the field. The research and development carried out is to produce a product in the form of mathematics teaching materials in the form of LKPD on the material of quadratic form factorization in SMP. This research was only conducted up to the development stage due to the limitations of researchers [12].

RESULTS

This research is a development research, so the product of this research is LKPD based on a valid and effective problem-based learning approach. The purpose of this development research is to describe: (1) the validity of the LKPD based on the developed problem-based learning approach; and (2) Student learning outcomes through LKPD based on a problem-based learning approach. To achieve these objectives, development research was first carried out using the ADDIE model but after modification, this study only reached the ADD which has been described in chapter III which includes three stages, namely analysis, design and development. . The results of the development are in the form of LKPD.

Description of the Analysis Phase (Analysis): The Analysis stage aims to analyze and determine learning needs by analyzing the objectives and limitations of the material. The results of the activities at the analysis stage are described as follows:

Based on observations of LKPD in SMP found several weaknesses in LKPD where the teacher is still from school, where the school takes from the publisher and does not use the approach in it so that indirectly the material that the teacher is low student learning outcomes. To overcome this problem, it is necessary to develop LKPD that meet valid criteria.

Based on the results of observations on LKPD in SMP found some weaknesses in the LKPD used by teachers are still from the school phak, where the school takes from the publisher and does not use the approach in it so that indirectly the material taught by the teacher is not the same as the content in the LKPD and makes students are saturated and make student learning outcomes low. To overcome this problem, it is necessary to develop LKPD that meet valid criteria.

Based on observations of LKPD in SMP found several weaknesses in LKPD where the teacher is still from school, where the school takes from the publisher and does not use the approach in it so that indirectly the material that the teacher is low student learning outcomes. To overcome this problem, it is necessary to develop LKPD that meet valid criteria.

The material used in this research is Quadratic Form Factorization material which refers to the 2013 curriculum. This analysis aims to identify, detail and systematically arrange the concepts that students will study in the Quadratic Form Factorization material. This concept is then adjusted to a problem-based learning approach.

Description of the Design Stage: Learning activities at LKPD are developed by emphasizing the learning process that uses a problem-based learning approach. The results of each activity at this design stage are as follows:

In Preparing LKPD the Basic Competencies Obtained Are: In compiling LKPD, the assessment is also carried out when the lesson is finished and also takes into account the material in the LKPD, the material is in the form of quadratic form factorization, the structure of the LKPD that the researchers do is entitled LKPD Mathematics based on problem based learning on quadratic form factorization material for junior high school students and instructions and LKPD work steps are also listed in the LKPD.

Media Selection: The learning media needed in the implementation of mathematics learning in quadratic form factorization material include the Learning Implementation Plan (RPP) and Student Worksheets (LKPD). Some of the learning aids needed include: white boards, markers, erasers, notebooks and pens.

Format Selection: The format selection for LKPD is adjusted to the principles, characteristics and steps of the problem-based learning approach. The learning implementation plan contains basic competencies, competency achievement indicators, learning objectives, materials, learning models and methods, learning tools / media / resources and learning activities. Learning activities consist of an introduction, core and closing activities.

RPP: RPP consists of 1 set for 1 meeting. The RPP is outlined as follows:

The time allocation used is 2 x 40 minutes used for 1 meeting with the factorization sub-material of the quadratic form equation. The learning objectives in this lesson plan are that students can understand the factorization of the quadratic form equation and students can explain the characteristics of the quadratic form equation.

LKPD: The LKPD developed in this study is a LKPD based on a problem-based learning approach. This LKPD contains activities that encourage students to communicate their ideas in writing. From the tasks that exist in this LKPD, students are required to build concepts by working with friends in a group and demanding individual responsibility.

CONCLUSION

Based on the results of the research and discussion described in the previous chapter, several conclusions can be drawn, namely: That this research uses the ADDIE development model which consists of Analysis, Design, Development, Implementation and Evaluation, but after being modified due to the limitations of the researcher, this research is only up to the development stage. (ADD) namely Analysis, Design and Development.

Suggestion: Based on the results of this study, it has been proven that the LKPD developed in SMP is categorized as feasible, so the researchers provide several suggestions, namely:

- For teachers and schools, it is suggested that LKPD be used in the process of teaching and learning activities
- For further researchers, the results of this study can be useful information for conducting research of the same type and as a comparison.
- To students, it is suggested to be more active in carrying out their learning activities in order to obtain even more active learning outcomes.

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