Discovery Learning Application
Using a Rope (Track A Line Idea)
to Detect Critical Thinking Skills on Elementary School Students

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Abstract

The study was conducted to collect preliminary data on the effectiveness of the use of Discovery Learning models using TALI (Track A Line Idea) for students' critical thinking skills in mathematics subjects in class VI geometry material in elementary schools. The purpose of this study is to describe whether the application of Discovery Learning models using TALI can be effective against critical thinking skills students on mathematics subjects in class VI geometry material in elementary schools, with research design referring to the syntax of Discovery Learning models that are the benchmarks in learning design namely, (1) providing stimulus; (2) identify the problem; (3) collecting data; (4) data processing; (5) verification; and (6) make conclusions. This study uses a One-shot Case Study experimental research design. With the subjects of class VI students with a total of 17 students. Data collection is done by tests, observations and questionnaires. The results of this study indicate that the motivation and activities of students in Discovery Learning based on TALI are interpreted in high criteria with a percentage range from 84.12% -88.24%. This indicates that Discovery Learning as constructivism learning provides space for students to actively participate in learning by using group learning design and guided discovery so that students keep paying attention to disciplinary aspects in conducting each stage in learning activities. The results of this study indicate that the motivation and activities of students in Discovery Learning based on TALI are interpreted in high criteria with a percentage range from 84.12% -88.24%. This indicates that Discovery Learning as constructivism learning provides space for students to actively participate in learning by using group learning design and guided discovery so that students keep paying attention to disciplinary aspects in conducting each stage in learning activities. The results of this study indicate that the motivation and activities of students in Discovery Learning based on TALI are interpreted in high criteria with a percentage range from 84.12% -88.24%. This indicates that Discovery Learning as constructivism learning provides space for students to actively participate in learning by using group learning design and guided discovery so that students keep paying attention to disciplinary aspects in conducting each stage in learning activities.

Keywords:Discovery Learning; Critical Thinking Mathematics; Geometry; ROPE; Elementary School Learning.

Abstract

The study was conducted to collect preliminary data regarding the effectiveness of the use of the Discovery Learning model using TALI on students' critical thinking skills in the sixth grade geometry subject in elementary school. The purpose of this study is to describe whether the application of the Discovery Learning model using TALI can be effective on students' critical thinking skills in the mathematics subject of class VI geometry in elementary schools, with the research design referring to the syntax of the Discovery Learning model which is the benchmark in the learning design, namely, (1) provide a stimulus; (2) identify problems; (3) collect funds; (4) processing data; (5) verification; and (6) draw conclusions. This study uses a One-shot Case Study experimental research design. with the subject of class VI students with 17 students. Data was collected by means of tests, observations and questionnaires. The results of this study indicate that students' motivation and activities in conducting discovery learning based on TALI are interpreted in high criteria with a percentage range of 84.12%-88.24%. This indicates that learning Discovery Learning as constructivism learning provides space for students to participate actively in learning by using grouped learning designs and guided discovery so that students still pay attention to the discipline aspect in carrying out each stage in learning activities. The results of this study indicate that students' motivation and activities in conducting discovery learning based on TALI are interpreted in high criteria with a percentage range of 84.12%-88.24%. This

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PRELIMINARY

The phenomenon in the 21st century shows the development of economics, politics, business, and technology that requires new generations to have the special skills needed in the 21st century so that they can be successful and survive (Rotherham & Willingham, 2009; Kivunja, 2014, 2015a). These skills are popularly known as the 4Cs super skills, namely critical thinking, communication, creativity, and collaboration (SBAC, 2015; Kivunja, 2015a). Critical thinking as one of the 21st century skills provides the ability to think deeply and solve unfamiliar problems in different ways, as well as be productive and participate in problem solving (Kivunja, 2015b).

The influence of the 21st century has an impact on the educational paradigm. Education should be directed to prepare students to have 21st century skills and prepare them to face more complex life changes in the future (SBAC, 2015; Kivunja, 2014, 2015a). If the educational paradigm does not follow the demands of the required skills, students will not be ready to face changing times (Tapscott, 2009). Therefore, critical thinking is one of the main skills that are trained in schools.

One of the efforts to change the educational paradigm is by using a learning model that supports the achievement of 21st century skills (Tapscott, 2009). The learning model can be interpreted as a design that becomes a direction in carrying out learning activities to achieve learning objectives (Joyce, et al., 2009; Eggen & Kauchak, 2009). One of the recommended learning models in the 2013 curriculum is the Discovery Learning model. This model is designed to direct students so that they search and find learning content. Students are challenged to

be able to solve problems related to everyday life by constructing knowledge or their own solutions (Bruner, 1961; Hammer, 1997; Kirschner, 2006).

Several research results show the effectiveness of learning using discovery learning models such as in aspects of learning outcomes, attitudes, and skills obtained by students (In'am & Hajar, 2017; Balim, 2009; Ramdhani, 2017; Rudyanto, 2014; Muhamad, 2016; Supriyanto , 2014). This is because students are actively involved in learning activities so that their knowledge can be more meaningful and will be easily stored in their memory (Ausubel, 1961; Bruner, 1961; Tuovinen, 1999; Ramdhani, 2017) according to the characteristics of the discovery model (Svinicki, 1998). .

The topic of critical thinking is indeed very important to be researched to find the best solution for increasing these competencies. Many studies have used the discovery model to improve critical thinking skills (Lieung, 2019; Prasetyo and Kristin, 2020; Prasasti, Koeswanti, and Giarti, 2019; Oktaviani, Kristin, and Anugraheni, 2018) but it is still common and no one has used this strategy. special. Based on this, the researcher used a special strategy, namely TALI-based discovery learning to improve critical thinking skills in this study. Researchers modified the learning method by using the TALI (Track A Line Idea) method. This method gives students experience to measure the circumference of several large areas of various sizes and shapes using a rope. Be it raffia rope, wool thread, or other types of rope. The study was conducted to collect initial data regarding the effectiveness of the use of the Discovery Learning model on students' critical thinking skills in the sixth

grade mathematics subject in elementary school.

RESEARCH METHODS

The research method used in this study is a quantitative research model with an experimental research design of One-shot Case Study (Sugiyono, 2012). The use of this design is based on the research objective to find preliminary data regarding the effectiveness of learning using the TALI-based Discovery Learning model on students' critical thinking skills. This simple data will be the basis for further research in more complex research designs.

This study focuses on two variables, namely the TALI-based Discovery Learning model as the independent variable and students' thinking skills as the dependent variable. The paradigm of the two variables in this study is depicted in Figure 1 below.

Image 1.
One Shot Case Study Design

Information :
X : treatment (Discovery Learning model)
O: observe (critical thinking skills)

The use of the Discovery Learning model as a treatment is based on the syntax or learning steps of the Discovery Learning model which are arranged in the lesson plan (RPP). Observations were made to observe students' critical thinking skills. Based on this, the data collection techniques used in this research are the study of documentation, observation, and questionnaires. The research instruments used were lesson plans, student worksheets (LKPD), learning observation sheets, and critical thinking skills questionnaires.

The syntax of the Discovery Learning model that becomes the benchmark in the learning design is, (1) providing a stimulus; (2) identify problems; (3) collect and; (4) processing data; (5) verification; and (6) draw conclusions (Hosnan, 2014). Meanwhile,

critical thinking indicators that serve as benchmarks to see the extent of students' critical thinking are (1) providing simple explanations; (2) building basic skills; (3) draw conclusions (4) make further explanations; (5) determine strategies and tactics (Lestari & Yudhanegara, 2015).

The research was conducted in a private elementary school in the city of Bandung. The class that became the experimental class was class VI on the subject of mathematics lessons on geometry. There are 17 students with an age range of 11-12 years, 7 are boys and 10 are girls. The selection of class VI as the experimental class is based on several considerations. First, the majority of early mathematical understanding abilities in this class are in the low and medium categories. Second, grade VI students are in the transition stage from the concrete operational thinking period to the formal operational period (Piaget in Sanjaya, 2008). They need critical thinking training to be able to enter formal operational thinking. Third,

RESULTS AND DISCUSSION

Critical thinking ability is one of the thinking skills needed in learning mathematics. This critical thinking ability is needed more than ever to help students adapt and be more flexible as well as able to cope with information that is growing rapidly at this time (Dwyer, et al, 2014), so that this ability is included in the 21st century skills. Based on the data obtained through the instruments described previously, the following is the condition of students' critical thinking skills after being given treatment in the form of learning mathematics using the TALI-based Discovery Learning model.

Table 1
Student Critical Thinking Recapitulation

Mathematical Critical Thinking Ability	Critical Thinking Process Achievement	
	Achieved	Not achieved
Elementary Clarification	78.24%	21.76%
Basic Support	68.24%	31.76%
Inference	78.82%	21.18%
Advance Clarification	85.88%	14.12%
Strategy and Tactics	81.76%	18.24%

Table 1 represents the initial achievement of mathematical critical thinking skills from learning that has been carried out based on each indicator of mathematical critical thinking ability (Susanto, 2013; Lestari & Yudhanegara, 2015). Elementary clarification or providing a simple explanation is indicated to have emerged from the beginning of learning, namely in the process of stimulation and problem statements. In this stage, students are given a stimulus or stimulus to observe a two-dimensional flat shape followed by a challenge from the teacher in the form of open questions about the circumference and area of the shape. Approximately 7 students were able to respond and provide arguments that meet the focus of the questions posed. The training process from elementary clarification doesn't just stop there,

Basic support indicators or building basic skills in this study were developed in terms of measuring objects with various shapes and sizes and must meet measurement accuracy. In the process of developing these basic skills, there is a data collection stage where students are challenged to collect circumference measurement data by conducting simple group experiments. In this data collection stage, the teacher has a role in facilitating and helping students to collect data that is packaged in the student worksheet (LKPD). As the time allotted for 30 minutes in completing the challenge, each group showed

progress or development so that the measurement results were more precise with a faster and more efficient process.

Figure 2
Measuring technique of rope folding and the use of tapes

In this study, inference or making conclusions which include conducting deduction and induction activities as well as considering the results and determining the value of the considerations are facilitated by discovery learning at the data processing and verification stage. The data processing stage is intended to train and test students to try and explore their conceptual competencies. At this stage, students prove the measurement results with the ROPE strategy to induce and deduce it into perimeter and area theorems. The unique thing in the learning process is that some students prove the circumference of a circle calculated using the ROPE strategy and calculate the circumference using a formula, besides that students are also directed to prove the relationship between circumference, area and flat shape so that in the end they can construct the answers obtained from the LKPD calculations. The following is a picture that shows that students are able to construct their understanding based on what they have found.
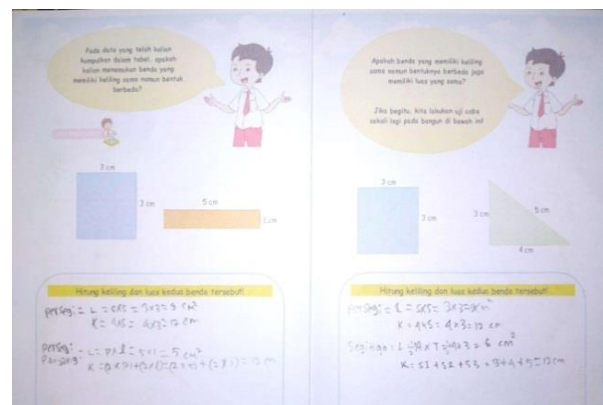

Figure 3

Student learning conclusion

Advance clarification or make further explanations as indicators of mathematical critical thinking packaged in the form of an explanation from each student regarding the differences in shape, circumference and area. The follow-up treatment of making these conclusions stimulates students to explain some of the benefits of the activities that have been carried out and their relevance to everyday life.

Strategy and tactics become a very interesting indicator of mathematical critical thinking in TALI-based discovery learning because the strategies and tactics were developed by students in their respective groups. Each group has been able to carry out effective and efficient strategies in a clear and structured division of tasks in measuring objects that are racing against time. In addition, each group also has its own tactics, both in measuring large objects and complex shapes such as circles and pentagons. Figure 4 below is an illustration of the measurement strategies and tactics carried out by students other than those depicted in Figure 2.

Figure 4
Group data collection strategies and tactics

The implementation of TALI-based Discovery Learning that has been carried out in this study can also bring up some positive student responses to the learning carried out. Based on student journal notes published in the form of open-ended questions from the questionnaire distributed at the end of the lesson, it shows that students feel happy, enthusiastic and focused when learning because they can know and find the circumference and area of several flat objects using contextual media. The teacher's expertise in choosing media and designing appropriate learning is one of the factors that

determine the success of students' critical thinking (Susanto, 2013).

Students realize that finding a concept requires mathematical connection skills that connect one mathematical concept to other mathematical concepts. In this case, students are fully aware that finding a perimeter and area requires good and correct measurement and multiplication skills. This indicates that Discovery Learning that is carried out fulfills the need for teaching critical thinking, namely providing extensive training in various skills, so that students can learn how to think critically on their own and provide opportunities to connect one skill in another context (Fisher, 2000).

Learning designed in the form of group discussion learning provides opportunities for students to discuss and exchange ideas with each other. What is unique is that students are able to work well in heterogeneous groups based on gender and ability and are chosen randomly. Some of these things provide results and conscious recognition from students that mathematics is becoming more desirable and useful for their lives or indicates the emergence of mathematical dispositions from students.
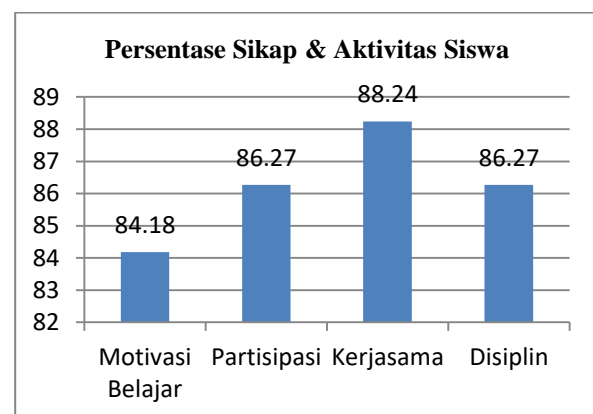

Figure 5
Students' attitudes & activities during learning

In addition to detecting critical thinking skills as reflective and reasonable thinking in deciding what to believe or do (Ennis, 1985), this study is supported by several other findings. This is clarified as illustrated in Figure 5 which is a picture of students' attitudes and activities during the learning

process. The results above show that students' motivation and activities in conducting TALI-based Discovery Learning are interpreted in high criteria with a percentage range of 84.12%-88.24%. This indicates that learning

*Discovery Learning*as constructivism learning provides space for students to participate actively in learning by using grouped learning designs and guided discovery so that students continue to pay attention to the discipline aspect in carrying out each stage in learning activities. This indicates that the discovery method used in discovery learning is an implementation component of heuristic learning, which is a learning approach designed to make students active where learning is led by them, discovers by them and makes reflections by themselves during learning activities (In' am & Hajar, 2017).

Learning will be more meaningful if students are directly and actively involved in learning activities. Students will pay attention to learning more effectively (Svinicki, 1998). When carrying out learning with the Discovery Learning model, the teacher must guide students so that there are no misconceptions or misunderstandings (Kirschner, 2006). Honomichl (2012) provides 3 approaches to guided discovery learning, namely, (1) strategic delivery of material; (2) the existence of feedback; and (3) probing questions and explanations. These three things are very necessary to guide learning activities using Discovery Learning so that learning produces maximum output and there are no misconceptions.

The Discovery Learning learning model contains the stages of verification and generalization. This stage is the most important stage in discovery learning. Verification means re-examining what has been done using existing theories (In'am & Hajar, 2017). In its implementation, re-checking is carried out by students through a structured discussion process with guidance from the teacher. The purpose of the discussion is to examine some of the activities that have been carried out as well as to equalize perceptions and draw a common thread from the differences in strategies and

tactics for each group's tasks. Thus students in the class still obtain the same generalizations even though they are based on different experiences.

CONCLUSION

The Discovery Learning model can influence learning activities effectively by using teaching aids that involve students. The Discovery Learning model can help students better understand, be active and think critically in learning materials and facilitate meaningful experiences for students. This is because in applying the research design it refers to the syntax of the Discovery Learning model which is the benchmark in the learning design, namely, (1) providing a stimulus; (2) identify problems; (3) collect funds; (4) processing data; (5) verification; and (6) draw conclusions better, time management and classroom management are quite good. Learning Discovery Learning is also aligned or correlated with mathematical thinking skills because each stage of discovery can facilitate the development of students' critical thinking. Discovery learning as constructivism learning provides space for students to participate actively in learning by using grouped learning designs and guided discovery so that students still pay attention to the discipline aspect in carrying out each stage in learning activities.

THANK-YOU NOTE

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