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DESCRIPTION OF STUDENTS' DESIGN THINKING ABILITY BASED ON LEVEL OF CREATIVITY

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ABSTRACT

Design thinking can help students think outside the box and develop creativity. This study aims to describe students' design thinking skills based on the level of creativity in class X Merdeka 8 SMA Negeri 1 Purwokerto. The subjects involved in this study were 36 students. The type of research used is qualitative descriptive. The data collection techniques used are written tests, interviews, and documentation. Based on the results of the creativity level test, students are grouped into five levels, namely very creative, creative, quite creative, less creative and not creative. Each level of creativity is chosen by one student using purposive sampling techniques. The results of this study show that students with a very creative and creative level are able to meet the five indicators of design thinking, namely emphatize, define, ideate, prototype, and test. Students with a creative level are able to meet 4 indicators, namely emphatize, define, ideate and prototype. While students with non-creative levels are only able to meet the indicators of emphatize, define, and ideate.

Keywords: Creativity, Design Thinking Ability, Level of Creativity

INTRODUCTION

Mathematics teachers have various challenges not only in providing material but also in shaping the process of students' thinking styles to solve mathematical problems and provide enough space to develop creativity (Appulembang, 2017). In line with Murdiana *et al*. (2020), teachers must have a significant role in developing student creativity, which is one of the challenges that must be faced. Creativity in learning is needed so that students can find innovative problem-solving and solve them from various points of view (Adiansha *et al.*, 2020). The point of view definition of creativity is defined as the ability of students to find new solutions, whether they are new to themselves, obtained from modifying, or first discovered (Monawati & Fauzi, 2018).

Creativity in its development requires high awareness from teachers to students related to mathematics learning because, with creativity, a person is seen as having excellence or good function (Amrullah et al., 2018). This can be achieved through the development of design thinking skills. Design thinking is creating new and innovative ideas to solve problems (Brown, 2018; Rusdin & Ali, 2020; Cross, 2007). Wijaya (2012) states that design thinking is the ability to think

by using reasoning in building arguments, develop strategies or methods, understand problems, and communicate ideas. Design thinking is an approach or method of solving cognitive, creative, and practical problems to answer student needs. Design thinking is an effective learning process that can enhance creativity, build skills, help students think outside the box, increase student engagement, and help highlight student talents (Tsalapatas *et al.,* 2019). Design thinking can be implemented to improve 21st-century problem-solving skills, help students deal with difficult situations, and solve complex problems both in school and in the community (Razzouk & Shute, 2012; Mauliya & Wulandari, 2021). This means that the ability to think design increases the power of reason and the ability to see the perspective of problems in solving them. Henriksen *et al.* (2018) and Sari *et al.* (2020) explain five design thinking indicators: empathize, define, ideate, prototype, and test. Based on this explanation, design thinking requires creative thinking to find ideas from various perspectives.

Creativity in its setting has three indicators: fluency, flexibility, and novelty, which can be assessed using TTCT (Siswono, 2004). Open-ended questions can optimize creativity (Maharani & Sukestiyarno, 2017; Cahdriyana & Setyorini, 2019). Khumaidi and Budiarto (2013) argue that "The Torrance Tests of Creative Thinking (TTCT)" is an assessment of the level of creativity commonly used to assess a person's level of creative thinking. TTCT assesses a person's creativity with three indicators: fluency, flexibility, and novelty (Silver, 1997; Siswono, 2004). The assessment of these indicators includes very creative categories with students who can meet the indicators of fluency, flexibility, novelty, or novelty in solving problems on the problem. Creative categories with students can meet fluency and novelty indicators or fluency and flexibility in solving problems on problems. The category is quite creative, with students able to meet novelty or flexibility indicators in solving problems on the problem. The category needs to be more creative so students can meet fluency indicators in solving problems on the problem. The category is only creative if students can show indicators of fluency, flexibility, and novelty in solving problems on the problem (Siswono, 2010).

Referring to the ability to think design, creativity indicators can solve mathematical problems not only using one method. Having the ability to think design based on the level of creativity means that students with a certain level of creativity have unique reasoning and novelty in solving mathematical problems. The students' design thinking skills can be measured through the Stanford model approach described by Albay and Eisma (2021), which states that the design

thinking indicator has five stages. The emphatize phase is the stage of gaining an empathic understanding of the user's needs, wants, goals, how they act and think, and the meaningful things to them. The define stage, also called the sensemaking stage, is done by defining the problem. This can be done by consolidating the insights they have gathered from users during the empathy stage. The ultimate goal of the define stage is to draft a relevant and achievable problem or design challenge statement. The ideate stage concentrates on creating ideas to find potential and innovative solutions to problem statements or design challenge statements that have been created at the defining stage. The fourth stage is called the prototype stage and is characterized by experimentation and turning possible solutions into natural and concrete products. This prototype will be tested and investigated to examine how it overcomes design challenge statements and identify constraints or shortcomings. This article describes the design thinking skills of grade X Merdeka 8 students based on their level of creativity in trigonometric material.

RESEARCH METHODS

The approach in this study included qualitative descriptive methods conducted on grade X students at SMA Negeri 1 Purwokerto, totaling 36 people. Design thinking tests, interviews, and observations carry out data collection. The material used is trigonometry, which consists of two different problems. Before the research was conducted, all students were given a creative thinking ability test to determine each student's creativity level. Based on the test results, students were grouped into very creative, creative, quite creative, less creative, and not creative. Each category was taken as many as one student as a respondent. Purposive sampling techniques took respondents. The next step is to give all students the design thinking skills test. After the data is obtained, it is analyzed using the Mille and Huberman method: data reduction, presentation, and conclusion. The main focus of this study is the description of students' design thinking skills based on creativity level.

RESULTS AND DISCUSSION

In this section, an overview of design thinking skills in each category of student creativity levels will be described.

Student Groups Are Very Creative

Based on the researcher's observations before the test, students had received trigonometry material before by the teacher in class and students still remembered the material a little. In addition, the observations provide information that students are ready to study and do test questions. This description represents the stage of *emphatize.*

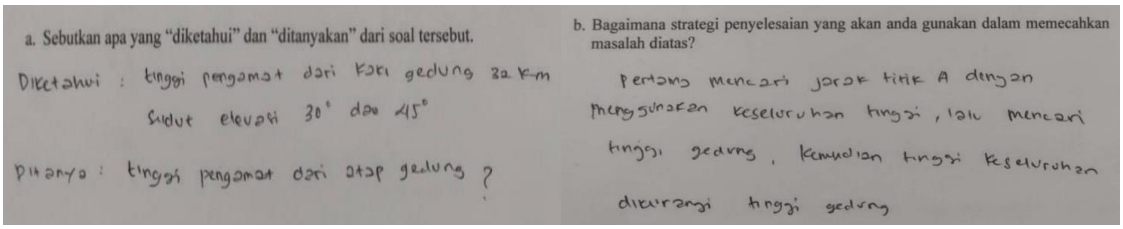


Figure 1. Respondent's Work in the Define Indicator

In Figure 1, students can write down the information in the question carefully and complete with their size, but for the points asked, students are not precise in writing information. From the answers, it can be concluded that students are able to identify problems well. Students write down strategies that will be used to solve problems. Students have looked for initial solutions to solve problems after understanding the problem based on information that is well known and correct.

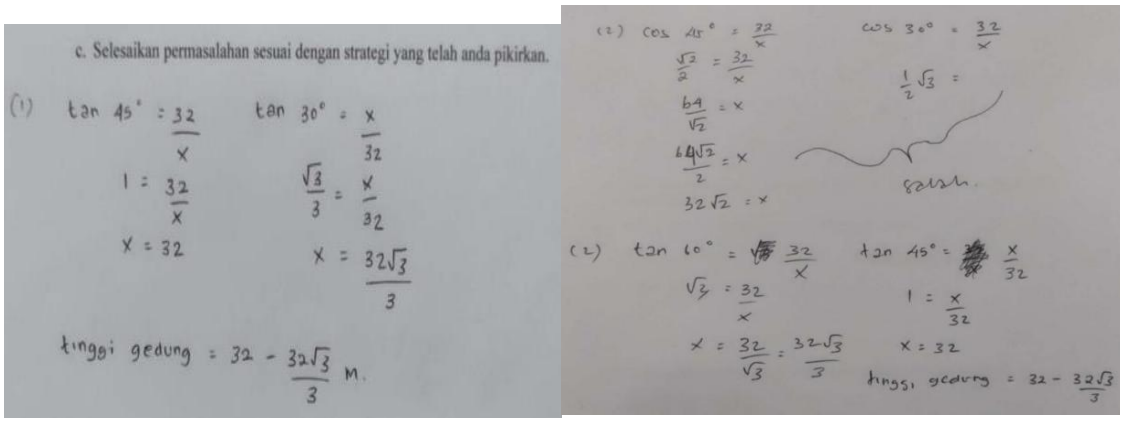


Figure 2. Respondent's Work in the Ideate Indicator

Students answer in two ways of solving as shown by Figure 2. Students use the tangent formula as an initial strategy to develop into two ways of solving. The conclusion of both ways of solving, students are able to design or make problem solutions using two ways properly and correctly. This activity is shown in Figure 3. In line with Siswono (2010) research, students with a very creative level tend to say that constructing problems is more difficult than solving problems, because students must have a certain way to make solutions. Students tend to say that finding an initial solution is more difficult than finding another answer or solution.

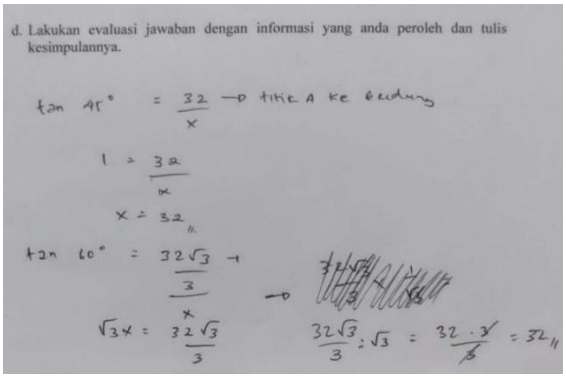


Figure 3. Respondents' Work in the Prototype Indicator

In the *test* section, students stated that they were not sure of the answers obtained. However, students also have curiosity regarding what ways can be used in solving problems. It can be concluded, students are able to evaluate the resulting answers to the problem correctly.

Student Groups Are Creative

Before the test begins, the teacher encourages students in the form of ice breaking, one of the students leads to pray, and helps students remember the previous material by giving several questions. From the observations, students were able to answer some questions given by the teacher and were eager to follow the study. This indicates that the emphatize indicator is met.

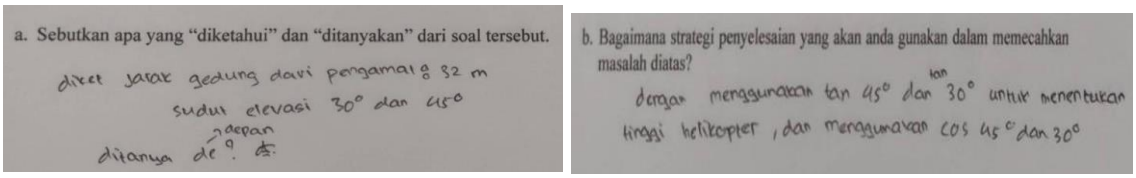


Figure 4. Respondent's Work in the Define Indicator

Students can write down the information in the question carefully and complete with its size. It can be concluded that students are able to identify problems well. In Figure 4 students also write down strategies that will be used to solve problems. Students have looked for initial solutions to solve problems after understanding the problem based on information that is well known and correct.

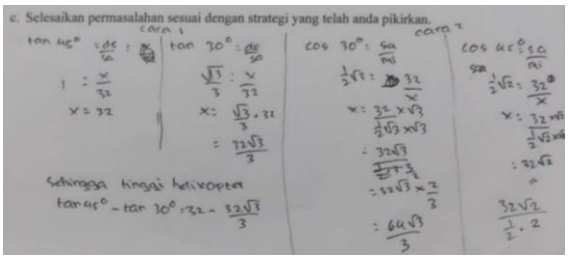


Figure 5. Respondent's Work in the Ideate Indicator

Figure 5 shows that students answer in two ways of resolution. The first solution uses a tan 45° and tan 30° and the second solution uses cos 45° and cos 30°. Based on the two ways the student solves, only one way has the correct answer (Figure 6), but the student is able to make other solutions according to his ability. So that students are able to design or make problem solutions using two ways properly and correctly. The above explanation is in line with Siswono (2004) research, at the idea generation stage, students develop their ideas from personal experience and subject matter. Whether from looking at pictures or real-life experiences. At the solution search stage, students propose easy solutions. Students are not sure that the solution is the best, but students have confidence at the time of working.

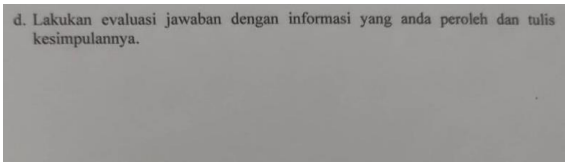
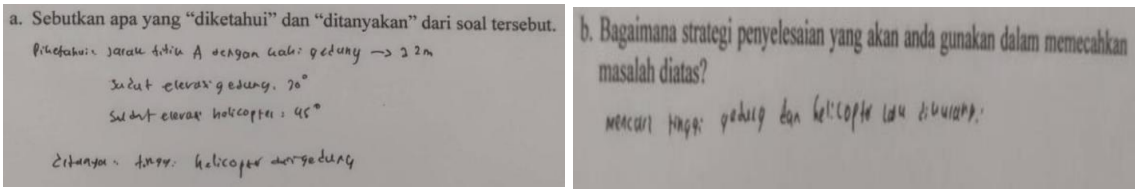

d. Lakukan evaluasi jawaban dengan informasi yang anda peroleh dan tulis kesimpulannya.

Figure 6. Respondent's Work in the Prototype Indicator

Students are not able to evaluate answers because they do not understand the meaning of the word evaluation, but in learning students are usually able to check back the answers that have been obtained. So, it can be said that students are able to master the test indicators.

Student Groups Are Quite Creative

Based on the researcher's observations before the test, students had received trigonometry material before by the teacher in class and students still remembered the material a little. This relates to the emphatize aspect.


a. Sebutkan apa yang "diketahui" dan "ditanyakan" dari soal tersebut.

b. Bagaimana strategi penyelesaian yang akan anda gunakan dalam memecahkan masalah diatas?

Figure 7. Respondent's Work in the Define Indicator

From Figure 7 students can write down the information in the question completely in writing the measurements. So it can be concluded that students are able to identify problems well. Students write down strategies that will be used to solve problems. Students have looked for initial solutions to solve problems after understanding the problem based on information that is well known and correct.

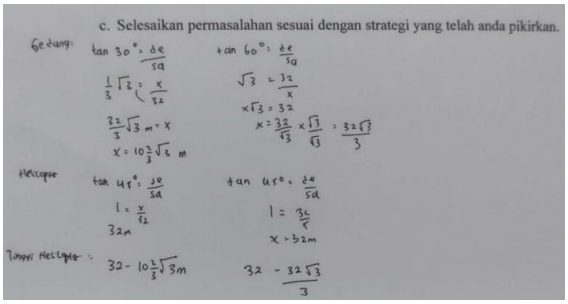


Figure 8. Respondent's Work in the Ideate Indicator

Students answer in two ways of completion, shown in Figure 8. Both solutions are the same using tan 45° and tan 30° but with different strategies. Based on the two ways the student solves, both answers are correct. So that students are able to design or make solutions to problems using two ways properly and correctly. In the evaluation indicator, students are unable to evaluate the answers because they do not understand the meaning of the word evaluation and are not used to double-checking the answers that have been obtained. This result is obtained through interviews so that it can be said that students are not able to master the test.

Student Groups Are Not Creative

In the emphatize indicator, the results of the researcher's observation at the time before the test was carried out, students had received trigonometry material before by the teacher in class and students still remembered the material a little.

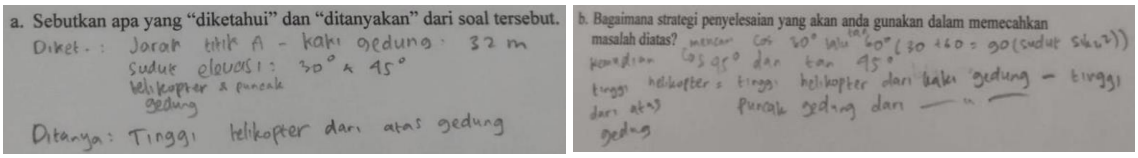


Figure 9. Respondent's Work in the Define Indicator

Students can write down the information in the question completely in writing down the measurements. So, it can be concluded that students are able to identify problems well. Students write down strategies that will be used to solve problems. Students have looked for initial solutions to solve problems after understanding the problem based on information that is well known and correct. This description can be proven by Figure 9.

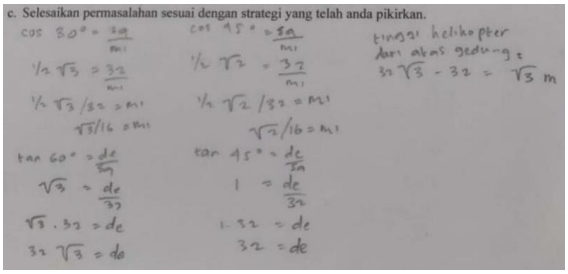


Figure 10. Respondent's Work in the Ideate Indicator

Based on Figure 10, students answer in two ways of completion. However, from both answers students are not able to produce the correct answer because students are not able to calculate accurately and thoroughly. It can be concluded that students are not able to design or make solutions to problems. Students are unable to evaluate answers because they do not understand the meaning of the word evaluation and are not used to double-checking the answers that have been obtained. So, it can be said that students are not able to master the test indicators.

CONCLUSION

Based on the analysis of the results of the design thinking ability test on trigonometric material, on; 1) Students with a very creative level are able to meet the five indicators of design thinking, namely emphatize, define, ideate , prototype, and test; 2) Students with a creative level are able to meet the five indicators of design thinking, namely emphatize, define, ideate, prototype, and test; 3) Students with a quite creative level are able to meet four indicators of design thinking, namely emphatize, define, ideate, and prototype; and 4) Students with a not creative level are able to meet three indicators of design thinking, namely emphatize, define, and ideate. To improve students' design thinking skills on trigonometric material, in delivering material teachers should have different ways of teaching or strategies to students when learning in class according to the level of creativity students have.

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