



Profile of Students' Critical Thinking in Mathematical Contextual Problem Solving in terms of Independent Learning

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Abstract

Critical thinking is a careful and calculating thinking activity using complex reasoning and is essential in solving mathematical contextual problems. This study aimed to describe the profile of students' critical thinking in solving mathematical contextual problems in terms of student independence. This study uses a qualitative descriptive method with the subject of students at SMK, Dr. Soetomo Surabaya. Data collection techniques using questionnaires, interviews, and documentation. The collected data is then analyzed through four stages: data reduction, triangulation, data presentation, and conclusion. The results showed that the critical thinking profile of subjects with high levels of learning independence was more complete than subjects with moderate and low levels of learning. Subjects with a high level of learning independence have a critical thinking profile that can use the right strategy to solve problems, complete, and correctly do calculations and explanations.

Keywords critical thinking skills, problem solving, independent learning

INTRODUCTION

Mathematics is a primary education that has an essential role in the formation of human thought so that the next generation can have systematic, logical, critical, and creative thinking. Subtraction, addition, multiplication, and division are one of the low-level mathematical calculations in the development of scientific disciplines. Therefore, mathematics needs to be given at every level of education to form students to think logically, systematically, analytically, critically, and collaboratively (Depdiknas, 2016).

One of the abilities that students must have in solving mathematical problems is critical thinking (Permendikbud No 20 of 2016). Critical thinking can make a person able to solve the problems faced and search appropriately, logically, and usefully so that they can find the best problem solutions (Kurniasih, 2016). According to Cahyono (2017), problem-solving is closely related to critical thinking, which plays an active role in finding various alternative solutions, and problem-solving activities provide problematic conditions which trigger the development of students' critical thinking skills.

In order to reduce students' perception of mathematics, which is challenging to learn and understand, contextual problem solving can provide students with insight and knowledge of mathematics by relating it to everyday life. However, the facts on the ground that until now, mathematics is still a complex subject for students. Syibli (2018) emphasizes that teaching mathematics still has three fundamental weaknesses:

1. Teaching is more teacher-centered so that students are still objects, not subjects in learning.
2. The substantial transfer of knowledge paradigm positions students as passive individuals without initiative.
3. Teaching focuses on cognitive assessment, so attitudes such as student learning independence get less attention.

Learning methods in schools generally still use the lecture method, centered on the teacher (teacher-centered), so student learning independence can still not be developed. That causes students to a dependence on the teacher. Of course, this is a challenge for the world



of education in the future. According to Chamidiyah (2015), by developing and moving the working system of the student's brain by independent learning, it can be said that there is an increase in students' critical thinking skills. Learning activities with self-awareness begin with the introduction of problems and continue with acquiring the skills needed to deal with problems is an independent learning process (Mudjiman, 2011).

Independence in children planted from an early age will form children to become independent from others. Independence can be demonstrated by the attitude of students who do not always depend on teachers, schools, and their environment. Independent students can think critically and positively impact the surrounding environment so that independent students will get significantly improved learning outcomes.

Given the importance of critical thinking in solving mathematical problems based on the sources obtained, the researchers consider the profile of students' critical thinking in solving mathematical contextual problems in terms of learning independence. This study aimed to describe the profile of students' critical thinking in solving mathematical contextual problems in terms of learning independence. This research is expected to provide accurate data explaining the importance of students' critical thinking profiles on independent learning.

IMPLEMENTATION METHOD

This research is a qualitative descriptive study. The subjects in this study were students at SMK Dr. Soetomo Surabaya City. Subjects have taken using the purposive sampling technique. This technique is used to get one student with a high level of learning independence, one with a moderate level of learning independence, and one with low learning independence. The data in this study were collected using 3 data collection techniques: questionnaires, interviews, and documentation. The research instrument consisted of a learning independence questionnaire, a critical thinking ability test, and interviews. Data analysis was carried out through three stages: data reduction, triangulation, data presentation, and concluding the subject's critical thinking ability based on independent learning.

RESULTS AND DISCUSSION

Of a total of 18 people in the population who are students of Dr. Soetomo Vocational School, the researchers took as many as three subjects with each group with high, medium, and low levels of learning independence. The researchers chose purposive sampling for as many as one students in each group, then a written test and a test will be given. Interview as a subject by the researcher. This selection is also based on the teacher's consideration by paying attention to students expressing opinions. The subjects selected in this study are as follows:

Table 1. Selected Subjects with Level of Independent Learning

Code	Level of Independent Learning
SSG	High
ARS	Medium
DH	Low

In order to determine the thinking ability of the research subject, the researcher gave a subjective test in the form of a description test which aims to measure the extent to which critical thinking skills are seen in students' answers. Before the test instrument was used, it was first tested in the test group, namely the group outside the research group. After being tested, the instrument was revised based on the results of the trial analysis and suggestions from the mathematics teacher at SMK Unitomo Surabaya. After the trial was carried out, an



analysis of the validity of the items was carried out. The research uses critical thinking questions to collect data about students' critical thinking profiles. The answers to critical thinking questions will show the students' critical thinking level. The following is a critical thinking contextual math problem:

"It is known that a plot of land is 45 m². The plot of land will be made of 3 fish ponds that have the same size with a length of x meters and a width of $x + 2$ meters. Determine the circumference of each fish pond!"

The research results at the clarification stage showed that subjects with a high level of learning independence (SSG) could write down the facts on the questions correctly and precisely. It also shows that subjects with a high level of learning independence (SSG) can formulate questions correctly. Based on the interview results, it is known that the SSG subject can state information/facts on the questions correctly and correctly and formulate the questions asked in the questions. Based on the triangulation of the results of the SSG subject test and the researcher's interview with the SSG subject, it can be said that the data related to the clarification indicators on the questions are valid. So it can be concluded that the SSG subject can fulfill the clarification stage on the question properly, correctly, and precisely.

Based on the stage of working on critical thinking profile questions and interviews at the clarification indicator stage, the SSG subject was declared to have passed the clarification stage, which was in line with the research by Pratama et al. (2020), Nurhastuti et al. (2017) entitled "The Influence of Learning Models and Independent Learning on Science Critical Thinking Skills for Class V Elementary School Students in East Jakarta" and research by Mayaningtyas (2016) entitled "Analysis of Critical Thinking Ability in Resource Based Learning in Review From the Learning Style of High School Students Class X" which states that students with high levels of learning independence can state information completely and accurately.

These results differ from those in subjects with a moderate level of learning independence (ARS). At the clarification stage, ARS subjects could write down the facts in the questions correctly and precisely. They were able to formulate questions on the questions correctly and correctly but incompletely. In addition, the results of the interviews showed that the ARS subjects could state information/facts on the questions correctly and correctly but were incomplete. Able to fulfill the clarification stage on the question well, correctly, but with a few shortcomings. Based on the stage of working on critical thinking profile questions and interviews at the clarification indicator stage, the ARS subject was declared passed at the clarification stage even though the information written by the subject was incomplete.

The results of the clarification stage on the third subject also showed different results. The third subject is a student with a low level of learning independence (DH). The results showed that DH subjects could only write down precisely what was stated in the question. Based on the interview results, it was found that the DH subject could only state information/facts on the questions correctly and correctly but incompletely. In addition, DH subjects were also able to formulate the questions asked the questions, but they were incomplete.

Based on the triangulation of the DH subject's test results and the researcher's interview with the DH subject, it can be said that the DH subject's data related to the clarification indicators on the questions are valid. So, it can be concluded that the DH subject was able to fulfill the clarification stage on the question well, correctly but with a few shortcomings. DH subjects were declared to have passed the clarification stage even though they could only write down what was known in the questions.



The second stage is the assessment stage. SSG subjects at the assessment stage could dig up relevant information or knowledge from the questions by drawing sketches of the information obtained in the questions. SSG subjects can also determine the concept or idea that will be used to solve the problem in the form of an accurate and complete description of the sketch image. Able to explain the idea or concept used to solve the problem in the problem and explain the sketch images used to solve the problems on the questions correctly and completely. Based on the stage of working on critical thinking profile questions and interviews at the assessment indicator stage, the SSG subject is declared to have passed the assessment stage.

Different results were shown on the ARS subject, where the ARS subject could dig up relevant information or knowledge from the problem. By describing a sketch of the information obtained on the question and determining the concept or idea that would be used to solve the problem in the form of an accurate but incomplete description of the sketch image. The interviews showed that the ARS subject was able to explain the ideas or concepts used to solve the problems in the questions but were incomplete and able to explain the sketch images used to solve the problems in the questions correctly and completely. Based on the triangulation of the results of the ARS subject test and the results of the researcher's interview with the ARS subject. It can be said that the ARS subject's data related to the assessment indicators on the questions are valid and passed at the assessment stage even though the information is incomplete.

The results of research on subjects with low levels of learning independence (DH) are known that DH subjects can make mathematical models of the questions given correctly and provide correct and complete explanations. The results showed that the DH subjects could explain the ideas or concepts used to solve the problems in the questions but were incomplete. Through interviews, DH was also able to explain the sketch images used to solve problems in a precise and complete manner. Based on the triangulation of the DH subject's test results and the researcher's interview with the DH subject. It can be said that the DH subject's data related to the assessment indicators on the questions are valid and pass at the assessment stage even though the information is incomplete.

The third stage is the conclusion stage. SSG subjects were able to reach conclusions correctly. SSG subjects also found the correct killing of each fish pond. However, the SSG subject could write down the results and generalizations from the conclusion. Namely, the circumference of each fish pond was 16 m. The results of the interviews showed that the SSG subjects were able to convey the final results of the problems on the questions. Based on the triangulation of the results of the SSG subject test and the researcher's interview with the SSG subject, it can be said that the data related to the inference indicators on the questions are valid. So, it can be concluded that the SSG subject can fulfill the inference stage well.

These results are not much different from the research on ARS subjects. ARS subjects were able to reach conclusions correctly. ARS subjects could also find the correct killing of each fish pond. However, the ARS subject could write down the results of the conclusion. Namely, the circumference of each fish pond was 16 m. The results of the interviews showed that the ARS subject was able to convey the final results of the problems in the questions. Based on the triangulation of the test results of the ARS subject and the results of the researcher's interview with the ARS subject, it can be said that the data of the ARS subject related to the inference indicators on the questions are valid and passed at the conclusion stage.

The results of research on subjects with low learning independence (DH) related to the inference stage showed that DH subjects could reach conclusions correctly and write down the results of the conclusion, namely, the circumference of each fish pond was 16 m. The



results of the interviews showed that the DH subject was able to convey the final results of the problems on the questions. Based on the triangulation of the results of the DH subject's test and the results of the researcher's interview with the DH subject, it can be said that the DH subject's data related to the inference indicators on the questions are valid and passed at the conclusion stage. which is in line with the research conducted by Pratama et al. (2020), Nurhastuti et al. (2017) entitled "The Influence of Learning Models and Independent Learning on the Science Critical Thinking Ability of Class V Elementary School Students in East Jakarta," and research by Mayaningtyas (2016) entitled "Analysis of Critical Thinking Ability in Resource Based Learning in Review From the Learning Style of High School Students Class X" which states that students with low levels of learning independence can convey the final results of the problems in the questions.

The next stage is the strategy stage. The results of the strategy stage showed that the SSG subjects could work on the questions coherently and correctly. SSG subjects could also determine the steps for completion, such as finding the area of each fish pond first. Then the SSG subject looks for the value of x by using the formula for the area of a rectangle. SSG subjects could find the value of the length and width of each fish pond. To fulfill the strategy stage, the subject is expected to be able to explain the results of his work well. SSG subjects can explain well the steps of completion that have been found in the problem. Based on the triangulation of the results of the SSG subject test and the researcher's interview with the SSG subject, it can be said that the data related to the strategy indicators on the questions are valid. So, it can be concluded that the SSG subjects were able to fulfill the strategy stage well and pass the strategy stage.

ARS subject's work related to strategy indicators on questions shows that ARS subjects can work on questions coherently and correctly. ARS subjects can also determine the completion steps, such as finding the area of each fish pond first. Then the ARS subject looks for the value of x by using the formula for the area of a rectangle. ARS subjects could find the value of the length and width of each fish pond. In order to fulfill the strategy stage, the subject is expected to be able to explain the results of his work well. The interview results showed that the ARS subject could explain well the completion steps that had been found in the problem. Based on the triangulation of the test results of the ARS subject and the results of the researcher's interview with the ARS subject, it can be said that the ARS subject's data related to the strategy indicators on the questions are valid and passed at the strategy stage.

The study's results on subjects with low learning independence (DH) showed that DH subjects could work on questions coherently and correctly. DH's subjects could also determine the completion steps, such as finding the area of each fish pond first. Then the subject DH looks for the value of x by using the formula for the area of a rectangle. DH subjects could find the value of the length and width of each fish pond but did not provide alternative answers.

In addition, the interview results showed that the DH subject could explain well the steps of completion that had been found in the problem. Based on the triangulation of the DH subject's test results and the researcher's interview with the DH subject, it can be said that the DH subject's data related to the strategy indicators on the questions are valid. So, it can be concluded that the DH subjects were able to fulfill the strategy stage well. Based on the stage of working on critical thinking profile questions and interviews at the strategy indicator stage, the DH subject was declared to have passed the strategy stage.

CONCLUSION

Based on the description of the results and discussion, it can be concluded that the critical ability between students with high levels of learning independence and students with



moderate and low levels of learning independence has several differences. Namely, students with high levels of learning independence can better explain all indicators entirely and accurately. Because of the differences between students with high, medium, and low levels of independence in critical thinking skills, it should emphasize children studying independently at home. For other research, it is better to examine contextual problem solving than independent learning.

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