IMEIJ
*Indo-MathEdu Intellectuals Journal*

p-ISSN: 2808-5604
e-ISSN: 2808-5078
**Volume. 2, No.2, October 2021**

# STUDENTS' CRITICAL THINKING SKILLS IN SOLVING PROBABILITY

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***Article History***

Received: 14-08-2021

Revision: 25-09-2021

Accepted: 07-10-2021

Published: 20-10-2021

***Abstract.*** Critical thinking is thinking quickly and rationally in response to the surrounding environment so that it can solve problems well and bring benefits. This research aims to find out the critical thinking skills of students in solving problems on probability. This type of research is qualitative descriptive. The subjects in the study numbered one person who was selected using purposive sampling techniques using the criteria of student test results. The instruments used are tests and interviews. Tests are used to find out students' learning outcomes and interviews are used to determine students' critical thinking skills. Data analysis used is qualitative data analysis consisting of data reduction, data presentation, and conclusion withdrawal. Data analysis results obtained that the subject in the learning process and problem solving process has the ability to think critically and meets three indicators of critical thinking skills, namely trying to know information well, providing reasons for problem solving, and finding alternative solutions.

**Keywords:** Critical Thinking, Problem Solving, Probability

***Abstrak.*** Berpikir kritis merupakan berpikir secara cepat dan rasional sebagai bentuk tanggapannya terhadap lingkungan sekitar sehingga dapat memecahkan masalah dengan baik dan membawa manfaat. Penelitian ini bertujuan untuk mengetahui kemampuan berpikir kritis siswa dalam menyelesaikan soal pada peluang. Jenis penelitian ini yaitu deskriptif kualitatif. Subjek dalam penelitian ini berjumlah satu orang yang dipilih menggunakan teknik purposive sampling dengan menggunakan kriteria hasil tes siswa. Instrumen yang digunakan yaitu tes dan wawancara. Tes digunakan untuk mengetahui hasil belajar siswa dan wawancara digunakan untuk mengetahui kemampuan berpikir kritis siswa. Analisis data yang digunakan yaitu analisis data kualitatif yang terdiri dari reduksi data, penyajian data, dan penarikan kesimpulan. Hasil analisis data diperoleh bahwa subjek dalam proses pembelajaran dan proses penyelesaian soal memiliki kemampuan berpikir kritis dan memenuhi tiga indikator kemampuan berpikir kritis yaitu berusaha mengetahui informasi dengan baik, memberikan alasan untuk dalam penyelesaian masalah, dan mencari alternatif penyelesaian.

**Kata Kunci:** Berpikir Kritis, Penyelesaian Masalah, Peluang

***How to Cite***: Haq, I. M & Sawitri, F. W. (2021). Students' Critical Thinking Skills in Solving Probability. *Indo-MathEdu Intellectuals Journal*, 2 (2), 108-117. http://doi.org/10.54373/imeij.v2i2.23

## INTRODUCTION

Mathematics learning aims for students to have critical thinking skills (Oktaviani et al., 2019; Putri et al., 2020). Math learning should give students the probability to learn to think mathematically (Aksu & Koruklu, 2015). Learning is an activity or effort made by teachers so that students learn, so it should give students the probability to develop their proximal development zone through various types of indirect assistance (Egmir & Ocak, 2020; Giselsson, 2020)

The gap between the implementation of learning and the learning outcomes achieved by students is very large (Greenberger, 2016). The gap above, among others, is because students still have difficulty in solving routine problems (Lamada et al., 2019), especially non-routine problems such as critical thinking in math learning (Umam, 2018). The thought processes trained in schools are limited to cognition, memory, and convergent thinking (Riyadhotul et al., 2019), while divergent thinking and evaluation are less so attentive, learning activities focused on recording, memorizing, and recalling, learning is concentrated on exercises that are procedural and mechanistic (Bahatheg, 2019; Ratnawati et al., 2020).

The results of observations dated April 2 to 3, 2013, in observing the learning process in students of class XI of SMK Islam Said Na'um, especially in mathematics learning, it is known that teachers in the learning process are only oriented to learning outcomes in the form of high grades, while students' critical thinking skills are not considered. Teachers always emphasize to students to get high grades this is certainly a problem in students (Hidayat et al., 2019).

SMK Islam Said Na'um was chosen as a research location, because the learning process that took place at the school was not oriented to students' critical thinking activities. Teachers in the learning process only focus on learning outcomes in the form of grades, while the student's critical thinking activity so with this research is expected to describe students' critical thinking skills in mathematical learning, especially on the probability material. Probability material is one of the materials that are very important in learning mathematics, because by studying this material students can use their understanding in solving various problems such as determining one's victory in the race and so on.

The results of these observations are certainly an obstacle for students, because in learning mathematics aspects of understanding and thinking students must be one of the goals that need to be achieved (Afriansyah et al., 2020; Bećirović et al., 2019; Karanja, 2021), Because by having the ability to think critically students will be able to analyze various problems well, and be able to solve problems that occur in the scope of school and in

everyday life (Putri et al., 2020; Sianturi et al., 2018). This research aims to find out the ability to think critically of students in solving probability.

## METHOD

This type of research is using qualitative descriptive research. Selection of subjects using purposive sampling (Creswell & Creswell, 2018) using certain criteria, namely student test results. The process of taking subjects based on the highest grades obtained by class XI students after carrying out the test. Indicators in this study are (1) trying to know the information well, (2) providing reasons for solving problems, (3) looking for alternative solutions (Mulyanto et al., 2018; Prasasti et al., 2019).

Data collection instruments in research use tests of critical thinking skills, interviews, and documentation. The test was conducted on all students of class XI of SMK Islam Said Na'um. Student test results are used as a basis for determining the research subject. Interviews are conducted after students carry out the test and have selected a research subject based on the results of those tests. The interview process is conducted on a subject with unstructured interview techniques. Documentation collection is carried out every research or treatment, both in the learning process, observation, and test implementation. The data analysis technique used is qualitative data analysis, with stages of redution data, display data, and conclusion drawing (Sugiyono, 2014)

## RESULTS

Interviews with subjects are conducted based on data on test results. The subject is selected because in the implementation of the test it obtains the highest score. In addition to having the highest score based on the results of observations on the learning process of learners who are subjects included in the category of active learners, because they often ask questions and also often solve problems in front of the class. The subject includes one of the learners who are smart and diligent in learning. So that in the process of receiving the subject's education report is one of the learners who have quite good performance. To obtain more accurate data about the subject's critical thinking skills, in-person interviews are conducted, where questions posed to the subject are developed based on answers given by the subject.

In general, the results of interview tests conducted on the subject for problem number 1 are as follows.

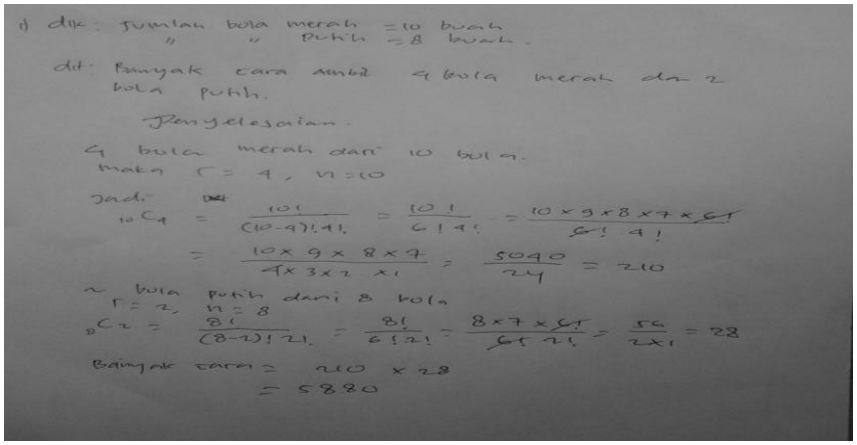


**Figure 1.** The subject's work in solving problem number 1

To find out more clearly about the ability to think critically the subject in solving problem number 1 can be known from the results of the following interview.

R : Are you trying to explain the answer you got?
AH : In that matter it is known that a bag contains 10 red balls, 8 white balls. The ball to be taken is 6 balls at once. While asked is how much to take 4 red balls and white balls. So to solve the problem, first determine the combination of taking 4 red balls from a total of 10 pieces. Next, determine again the combination of taking 2 white balls from 8 white balls. After obtaining both combinations, it is determined how many ways to take the 6 balls.
R : Why do you have to look first for it per part?
AH : Yes, because if you search directly then you can't get its value.
R : Where did you get the 210?
AH : The value of 210 was obtained from the combination of taking 4 white balls from 10 white balls. When combined, it will get a value of 210.
R : Where did you get a score of 28?
AH : 28 obtained from the combination of taking 2 white balls from 8 white balls.

Based on the results of the interview above, it can be known that the subject in the interview process is able to solve the problem directly. Completion by subject on probability material looks very good. Because in addition to being able to solve the problem, the subject can explain the answers obtained. When viewed from the way the problem is solved by the subject, in the solution of the problem first the subject seeks information related to the problem. The subject analyzes carefully, the question is what is known and what is asked of the question, after which look for alternative solutions to the problem in accordance with what is asked. The subject's explanation of the solution of the worked problem looks very appropriate, so it can help and know how the subject gets the answer.

The stage of solving the problem by the subject can be concluded that in solving problem number 1, the subject meets the indicator of critical thinking ability used, namely trying to know the information well, providing reasons for solving problems and finding alternative solutions. To further strengthen the results of the research obtained, the interview process continued on question number 2.

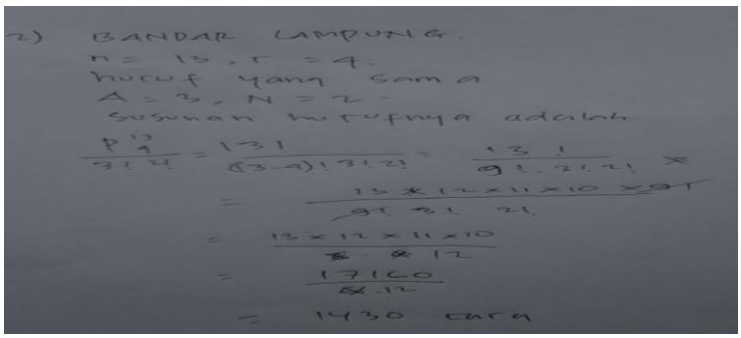


**Figure 2.** Completion of question number 2 by subject

R : Are you trying to explain the answer you wrote in solving problem number 2?
AH : In question number 2, we determine how to randomly draft 4 letters from the word "BANDAR LAMPUNG". So from the number of letters obtained the total number of words is 13 or the value of n = 13. Because it will be arranged 4 letters randomly then the value of r = 4. The same number of letters contained in the word is A there are 3 letters and N there are 2 letters. Next, put into the permutation formula, it will get the answer.
R : How do you know that the same letters A = 3 and N = 4?
AH : To find out that, we just look at the same letter in the word "BANDAR LAMPUNG". In that word, it appears that the letter A is 3 and the letter N = 2
R : Where did you get the value n = 13?
AH : The value n = 13 is obtained from the total number of letters in the word 'BANDAR LAMPUNG'.

The solution of problem number 2 by the subject is done by analyzing the problem well, namely every keyword contained in the problem, then trying to use the appropriate approach to solve the problem. The subject is able to provide an explanation of the problem being done, and is able to maintain arguments about how to solve the problem. The results of the above interview show that the subject in the learning process is able to reflect indicators of critical thinking skills in the process of solving the problem of probability material.

**Indicators of Critical Thinking Achieved by the Subject**

1. Trying to know the information well

   The ability to know information well is owned by the subject in solving problems on the probability material. This can be seen from the way the subject solves the problem in

the implementation of interviews conducted by researchers directly. The subject before solving the problem always tries to understand the problem well and then withdraws the information obtained from the problem. This ability is contained in the following interview excerpt.

R : What do you think about number 2?
AH: In question number 2 we are told to determine how to arrange 4 letters from the word "BANDAR LAMPUNG" randomly. So in solving the problem first determined the number of words contained in the word "BANDAR LAMPUNG" and the letters that will be arranged randomly. From what is known in the problem, then we can determine how much the value of n, r, and the same typeface. From the data then by using the permutation formula, we can solve the problem.

2. Provide a reason for solving the problem

The subject is able to give reasons for the process of resolving the problem during the interview. The subject can give reasons for the process of solving the problem carried out, and able to express his opinion on how to get answers. In general, the ability of students to provide reasons for problem solving is contained in the following interview excerpts.

R : Are you trying to explain the answer you wrote?
AH : In that question the clan said that a bag containing 10 red balls, 8 white balls. The ball to be taken is 6 balls at once. While asked is how much to take 4 red balls and white balls. So to solve the problem, determine the combination of taking 4 red balls from a total of 10 pieces. Next, determine the combination of taking 2 white balls from 8 white balls. After obtaining both combinations can determine the number of ways to take 6 balls.
R : Where did you get the 210?
AH : The value of 210 was obtained from the combination of taking 4 white balls from 10 white balls. When combined, it will get a value of 210.

3. Ability to find alternative solutions

This ability is achieved by students in solving problems on the probability material. This is evident from the ways of solving the problem done by the subject. In solving the subject problem is able to find the right solution or way in solving the problem given during the interview process. This can be seen in the following interview excerpt.

P : Are you trying to explain the answer you wrote?
AH : It is known that a bag contains 10 red balls, 8 white balls. The ball to be taken is 6 balls at once. While asked is how much to take 4 red balls and white balls. So to solve the problem, first determine the combination of taking 4 red balls from a total of 10 pieces. Next, determine again the combination of taking 2 white balls from 8 white balls.

## DISCUSSION

Creative students are actually the same position as other ordinary learners at home, school and community. But because of their potential creativity they need special help to develop the critical thinking skills they have (Riyadhotul et al., 2019). With the ideal learning approach, the potential of critical thinking can continue to be honed well (Noer & Gunowibowo, 2018). By using the right method, the learning method that places learners as learning subjects so that students can be motivated in carrying out learning and developing students' critical thinking (Nurdiansyah et al., 2021; Sholihah & Shanti, 2017). Because by thinking critically learners can easily bring problems into the real world (Egmir & Ocak, 2020), This is also in line with the demands of national education goals that require learners to have critical thinking skills so as to facilitate themselves to plunge into society. Critical thinking of learners should be fostered early with habituation of learning that can encourage critical thinking skills (Sadikin et al., 2019).

In order for the education process to provide assistance to students, the role of teachers and mentors in schools should recognize creative and critical students (Oktaviani et al., 2019). By recognizing students who think critically then it is easier for teachers to guide students to develop their creative potential. The potential for critical thinking will make it easier for teachers to develop students' ability to solve every problem they face, because creative students tend to be able to solve every math problem well (Sarıcan et al., 2021). The nature of relationship assistance to guide students who have the ability to think critically is actually the same as the relationship for students in general. It's just that, ideally teachers and mentors know the mechanisms of the creative process and manifestations of creative behavior. This understanding provides great probability for teachers and mentors to succeed in helping the development of creative students (Noer & Gunowibowo, 2018).

Based on the results of research conducted by interviewing the subject directly obtained that the subject in his learning reflects attitudes or indicators of critical thinking. Of the three indicators used in this study the subjects met all three indicators trying to know the information well, provide reasons for problem solving, looking for alternative solutions. This is based on the data of interview results on the subject. Indicators try to know the information well owned by the subject in this study. This is seen from the way the problem is solved by the subject, namely before solving the subject problem first analyzes the problem well and find out the information contained in the problem. In the indicator provides a reason for solving the problem, namely the subject is able to explain and express his opinion regarding the process of solving the problem that he has done. The subject was able to explain the

answers he obtained well to the researcher directly during the interview process. In the third indicator also owned by the subject in this study, namely the subject was able to find alternatives to the solution of the problem provided by the researcher.

The process of solving the questions given by the teacher on the training question and during the interview process can be completed by the subject itself. Based on the results of observations made by researchers directly known that the subject in solving various problems and training problems he did by himself without seeing or help from his friends. The same thing is also seen during the interview, where the subject can rework the problems well and researchers pay attention to them directly. One aspect that is also owned by the subject is, the subject is very interested and motivated to solve or work on various problems that are considered new.

## CONCLUSION

Based on the results of the study, it can be concluded that the subject in the learning process and problem solving process has the ability to think critically and meets the three indicators of critical thinking skills used in this study, namely trying to know information well, providing reasons for problem solving, and looking for alternative solutions.

## ACKNOWLEDGMENTS

Thank you to the Principal and teachers of SMK Islam Said Na'um for all the assistance in the data collection stage, so that this research can take place properly and smoothly.

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