Mathematical Critical Thinking Ability Viewed from Students' Habits of Mind in Problem Based Learning Assisted Sevima Edlink

Ita Zuliyanti[a,*], Endang Retno Winarti[a], Gilang Anjar Permatasari[b]

[a] Mathematics Department, Universitas Negeri Semarang, Gunungpati, Semarang, 50229, Indonesia
[b] SMA Negeri 1 Karanganyar, Karanganyar, Demak, 56252, Indonesia

* E-mail address: itazuliyanti@students.unnes.ac.id.

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Abstract

The purposes of carrying out this research were to determine the role of the model Problem Based Learning assisted Sevima Edlink and influence Habits of Mind on the mathematical critical thinking skills of class XI students at SMA Negeri 1 Karanganyar on the basic material of indeterminate integrals. Problem Based Learning assisted Sevima Edlink applied in the learning process in the classroom and integrated into learning resources in the form of student worksheets developed by researchers. Student worksheets developed by researchers have also integrated with contextual approaches and learning models Problem Based Learning with the content of the material and the problems associated with the daily life of students. The research method used in this research was a Mixed Method with models Sequential Explanatory (derivative combination). Activities in this study included learning in class three times for the experimental and control groups, tests of mathematical critical thinking skills for the experimental and control groups, filling out questionnaires for the experimental group, and interviews for the experimental group. The results of this research are Problem Based Learning assisted Sevima Edlink can play a positive role in improving students' mathematical critical thinking skills as shown from the test results and students' mathematical critical thinking skills are also influenced by Habits of Mind. From the research results obtained the learning model Problem Based Learning assisted Sevima Edlink can be one way to improve students' mathematical critical thinking skills. Besides that, it also needs to improve Habits of Mind students, because the higher Habits of Mind students can think critically mathematically will be higher.

1. Introduction

The role of education which is so important for human life results in the implementation of learning in schools. One of the subjects that students must learn is mathematics. Mathematics is required to be studied with the aim of developing the abilities of students. As for US-based Partnership for 21st Century Skills (P21), identify critical thinking skills (Critical Thinking Skills), creative thinking skills (Creative Thinking Skills), communication skills (Communication skills), and collaboration skills (Collaboration skills) as a necessary competency in the 21st century (Siti, 2018). These competencies are known as 4C competencies, and one of the abilities that students must possess is the ability to think critically mathematically.

Critical thinking is summarizing what is known, knowing how to solve a problem and finding sources to support problem solving (Diana & Anugraheni, 2022). Critical thinking enables students to solve mathematical problems in the process of reasoning, proving, and problem solving. Described by de Araujo et al. (2023) critical thinking is a skill that a person has in thinking and is applied in a structured way to process information obtained when faced with a problem so that appropriate decisions can be made based on logical thinking involving classification, assessment, inference and strategy. Critical thinking as an

advanced activity of simple thinking involving processes that are far more complex is also often needed to find the truth of a statement, problem, or information. The ability to think critically makes students more critical in looking at things, able to digest the information conveyed properly, and able to analyze the information. Glazer defines that critical thinking in mathematics is the ability and disposition to combine prior knowledge, mathematical reasoning, and cognitive strategies to generalize, prove, or evaluate foreign mathematical situations reflectively (Rosmaiyadi, 2017). In this study, indicators of mathematical critical thinking skills were used as a reference to determine students' mathematical thinking abilities. The indicators of mathematical critical thinking skills used in this study refer to critical thinking according to Jacob & Sam (2008) which is divided into four important stages, namely Clarification, Assessment, Inference, and Strategy.

In explanation Dwirahayu et al. (2018) that Habits of Mind are attitudes, values, and skills that enable a person to display performance or behavioral intelligence based on the motivation given to guide students in dealing with or solving problems. Habits of Mind this implies that behavior requires a disciplined mind that is trained in such a way that it becomes a habit to keep trying to do wiser and smarter actions. This is understandable because all forms of behavior carried out by an individual are the result of the habits of his mind. Therefore, Habits of Mind possessed by a person will affect his success, one of which is success in learning mathematics at school.

Based on the results of the second semester daily tests obtained from the mathematics teacher for class XI SMA Negeri 1 Karanganyar for the 2021/2022 academic year for mathematics at SMA Negeri 1 Karanganyar which consists of 5 classes, an average value of 54.76 was obtained. With the completeness set at 68, the average still does not meet the completeness that has been set. Of the 150 students who took the second semester daily tests, 105 students scored below 68. One of the reasons for this is allegedly because the mathematical critical thinking skills of class XI SMA Negeri 1 Karanganyar are still not optimal, so there needs to be a change in the implementation of learning that is able to facilitate the mathematical critical thinking skills of class XI students at SMA Negeri 1 Karanganyar can be increased. One way to improve critical thinking skills is to apply a mathematical learning model Problem Based Learning assisted Sevima Edlink.

In the 2013 curriculum, a learning model that can be used to develop 21st century skills, especially critical thinking skills, is a learning model Problem Based Learning. This is also supported by Agoestanto et al. (2022) which states that one of the efforts that can be taken to develop students' mathematical critical thinking skills is to apply a learning model Problem Based Leraning. Problem Based Learning is a learning model that encourages students to study and work together in groups to find solutions to real-world problems so that students' abilities such as problem solving, thinking, group work, communication and information develop positively (Pujiastuti et al., 2016). This problem is used to link thinking habits and students' analytical abilities and initiatives on learning materials. Problem Based Learning prepare students to think critically and analytically, and to seek and use appropriate learning resources.

The trend of change and innovation in the world of education will continue and develop in the 21st century. Technology also affects critical thinking skills, problem solving abilities, and creative thinking abilities. In learning activities, the technology used is Learning Management System (LMS) is Sevima Edlink. Sevima Edlink is an android-based application specifically for the world of education which aims to provide a learning space that bridges teachers and students in learning activities that can be carried out anytime and anywhere with more flexible study times (Khotimah & Nafi'ah, 2022). Sevima Edlink in learning, of course, it makes it easier for students to process deeper information about the material being studied, and students can freely access subject matter and practice questions.

Based on the background above, in this study, learning mathematics will use a learning model Problem Based Learning assisted Sevima Edlink which is integrated into learning resources in the form of student worksheets as a means to solve the problems provided.

2. Methods

This study used mixed research (Mixed Method), namely research that combine or associate quantitative and qualitative forms (Cresswell, 2014). The research model used in this research was Sequential Explanatory. The first phase carried out in this Sequential Explanatory design was collecting and analyzing quantitative data, followed by the second phase, namely collecting and analyzing qualitative data. The research design used can be seen in table 1 as follows.

Table 1 Research Design Posttest-Only Control Design

Group	Treatment	Test
Experiment	X	Posttest
Control	Y	Posttest

The population in this study were students of class XI SMA Negeri 1 Karanganyar. The research sample was selected by technique Simple Random Sampling out of the 5 existing classes, class XI MIPA 2 was selected as the experimental group and class XI MIPA 1 as the control group. The experimental group will be given treatment in the form of learning mathematics using a learning model Problem Based Learning assisted Sevima Edlink and the control group will be given treatment in the form of learning mathematics with a learning model Problem Based Learning without assisted Sevima Edlink. After the learning activities are carried out, the two groups will carry out tests of mathematical critical thinking skills, which previously had been tested on the trial group (Class XI MIPA 5) and for the experimental group, fill out a questionnaire Habits of Mind after carrying out the test. The results of the mathematical critical thinking ability test will be analyzed with a conditional test to find out whether the data is normally distributed and homogeneous. Then data analysis was carried out which included (1) one sample average test and proportion test (classical completeness test) for the experimental group, (2) two average similarity test and two proportion similarity test, (3) regression and correlation test. From the results of the questionnaire Habits of Mind on the results of tests of mathematical critical thinking skills in the experimental group, 6 research subjects were selected randomly Purposive to do an interview. The determination of the subject for the interview was carried out in a random way Purposive namely chosen with certain considerations and goals (Sugiyono, 2021).

Qualitative analysis techniques in this study included data reduction, data presentation, and drawing conclusions based on the description of the mathematical representation ability test results obtained. In addition, data validity techniques were carried out as an effort to be accountable for the research that had been carried out. In this study, researchers used data validity checking techniques through triangulation, which consisted of source triangulation and technical triangulation. Source triangulation was done by checking or comparing data obtained from various sources. While triangulation, the triangulation technique in this study was carried out by comparing the results of tests of mathematical representation abilities and data from interviews with research subjects.

3. Results & Discussions

3.1. Quantitative Research Results

The results of the mathematical critical thinking ability test are tested for normality and homogeneity first as a condition of whether the data obtained is normally distributed and homogeneous. Data on tests of mathematical critical thinking skills obtained that the data is normally distributed and homogeneous. Then a hypothesis test will be carried out which includes (1) one sample average test and proportion test (classical completeness), (2) two average similarity test and two proportion similarity test, (3) regression and correlation test.

To determine students' mathematical critical thinking skills with learning models Problem Based Learning assisted Sevima Edlink Class XI MIPA SMA Negeri 1 Karanganyar achieves classical completeness by means of one sample test and proportion test (classical completeness). Test the average of one sample with the provision that the average is more than 68, the value is obtained sig(2-tailed) $= 0.000$ for $0.000 < 0.05$ means that the average test of students' mathematical critical thinking skills in learning mathematics uses a learning model Problem Based Learning assisted Sevima Edlink more than 68. While the classical completeness test with the provision that the number of students who get a score of at least 68 is more than or equal to 0.745. obtained $z_{count} = 2.786$ for $2.786 > 1.65$ means the proportion of students who complete the class using the model Problem Based Learning assisted Sevima Edlink more than 0.745. From the two tests it was concluded that students' mathematical critical thinking abilities used models Problem Based Learning assisted Sevima Edlink class XI MIPA SMA Negeri 1 Karanganyar achieved classical completeness.

To find out the differences in the mathematical critical thinking skills of students in the experimental group and the control group. a similarity test of two means and a similarity test of two proportions were carried out. Test the similarity of the two averages obtained sig. (2-tailed) of 0.001 and t_{count} 3.339. So it is obtained that the value $0.001 < 0.05$ and $t_{count} > t_{1-a}$ that is $3.339 > 1.672$ means the average test results of students' mathematical critical thinking skills using the model Problem Based Learning assisted Sevima Edlink more than using model learning Problem Based Learning without assisted Sevima Edlink. While the similarity test of two proportions is obtained $z_{count} = 2.011$ for $2.011 > 1.65$ means the proportion of students who complete the class given the learning model Problem Based Learning assisted Sevima Edlink more than the proportion of students who complete the class given the learning model Problem Based Learning without assisted Sevima Edlink. From the two tests it was concluded that students' mathematical critical thinking skills were given learning models Problem Based Learning assisted Sevima Edlink better than students' mathematical critical thinking skills given learning with models Problem Based Learning without assisted Sevima Edlink.

To find out if Habits of Mind students influence the ability to think critically mathematically students are tested regression and correlation. Linearity test obtained value sig. $= 0.279$ for $0.279 > 0.05$ meaning there is a relationship between Habits of Mind on students' mathematical critical thinking skills after participating in model learning Problem Based Learning assisted Sevima Edlink. Regression significance test obtained value sig. $= 0.000$ for $0.000 < 0.05$ means the relationship between Habits of Mind with mathematical critical thinking skills is meaningful. Test the significance of the correlation coefficient obtained value $t_{count} = 5.627$ for $5.627 > 1.701$ it means that there is a significant correlation Habits of Mind on mathematical critical thinking skills. The value of the coefficient of determination is 0.531 means that the value of mathematical critical thinking ability is caused by 53.1% factor Habits of Mind.

3.2 Qualitative Research Results

The results of the qualitative research are in the form of interviews with 6 research subjects who have been determined based on the results of questionnaires and test results. to obtain information about students' responses to tests of mathematical critical thinking skills in learning mathematics using learning models Problem Based Learning assisted Sevima Edlink.

Figure 1. T-2 Test Results on Question Item 5

Subjects T-1 and T-2 are subjects with Habits of Mind with high-level mathematical critical thinking skills. Subjects T-1 and T-2 have been able to meet the specified critical thinking ability indicators.

Figure 2. S-1 Test Results on Question Item 5

Figure 3. S-2 Test Results on Question Item 5

S-1 and S-2 subjects are subjects with Habits of Mind moderate with mid-level mathematical critical thinking skills. S-1 and S-2 subjects have fulfilled the indicators of mathematical critical thinking ability. but are still not optimal in the inference stage of the mathematical critical thinking ability indicators.

Figure 4. R-1 Test Results on Question Item 5

Figure 5. R-2 Test Results on Question Item 5

Subjects R-1 and R-2 are subjects with Habits of Mind low with the ability to think critically mathematical lower level. Subjects R-1 and R-2 have met the indicators of mathematical critical thinking skills. but are still not optimal in the indicators of mathematical critical thinking skills in the inference and strategy stages. From the results of student work and the results of interviews. synchronous results were obtained. but in interviews additional information was obtained compared to student work.

3.3 Discussion

The results of the study showed that students' mathematical critical thinking skills were applied using learning models Problem Based Learning assisted Sevima Edlink in class XI SMA Negeri 1 Karanganyar achieve classical mastery. This is of course influenced by the factor of the application of the learning model Problem Based Learning and use of the LMS Sevima Edlink in teaching and learning activities. These results prove that the use of learning models Problem Based Learning and LMS Sevima Edlink have a positive impact on students' mathematical critical thinking skills. According to de Araujo et al. (2023) that the class given the model Problem Based Learning achieve classical mastery. In addition. it was also explained that there was an increase in students' mathematical critical thinking skills after participating in learning mathematics with models Problem Based Learning. Apart from the factor of applying the model Problem Based Learning. there is another factor. namely the use of LMS Sevima Edlink. LMS is used Sevima Edlink in the experimental group also provided things that were beneficial to students. which made it easier for students to process deeper information about the material being studied. and students could freely access subject matter and practice questions.

The results of the next study showed that students' mathematical critical thinking skills were modeled learning Problem Based Learning assisted Sevima Edlink better than students' mathematical critical thinking skills with model learning Problem Based Learning without assisted Sevima Edlink. Students who are given learning models Problem Based Learning without assisted Sevima Edlink more passive in learning activities. only a few students are active and in discussions only certain students play an active role. So that it causes less optimal learning outcomes for students who are given learning models Problem Based Learning without assisted Sevima Edlink. This result is in line with Wijayanto (2017) statement that there is an effect of assisted learning Sevima Edlink on students' mathematical critical thinking skills because it makes it easier for students to innovate looking for learning resources not only fixated on the teacher. thus enabling students to actively participate during the learning process. which will result in obtaining optimal results. A part from that. different learning sources are also a factor for better students' mathematical critical thinking skills. because the student worksheets developed by researchers are also integrated with contextual approaches and models Problem Based Learning with the content of the material and the problems associated with the daily life of students. This is in accordance with Ramadhana & Pulungan (2021) that the development of contextual-based mathematics student worksheets can improve students' mathematical reasoning abilities.

The results of subsequent studies stated that Habits of Mind students influence students' mathematical critical thinking skills. Student with Habits of Mind students with high mathematical critical thinking skills. while students with Habits of Mind students who have low ability to think critically mathematically low. This is in accordance with Dwirahayu et al. (2018) as a characteristic of what intelligent people do when

they are faced with problems whose solutions cannot be known easily. It can be concluded that the higher Habits of Mind students will influence them in finding a solution to a problem.

The results of the interviews also provide the conclusion that the two students with Habits of Mind High students have optimal mathematical critical thinking skills. indicated by students being able to fulfill all indicators of mathematical critical thinking skills which include clarification. assessment. inference. and strategy. Two students with Habits of Mind are having the ability to think critically mathematically under students with Habits of Mind high. indicated by students still not optimal at the inference stage indicator. Student with Habits of Mind low students have the ability to think critically mathematically under students with Habits of Mind high and medium. indicated by students not optimal at the inference stage indicator and not optimal at the strategy stage indicator.

4   Conclusion

Based on the results of the research and discussion that has been done. it is concluded that (1) students' mathematical critical thinking skills after participating in Problem Based Learning model assisted Sevima Edlink on indeterminate integral basic material to achieve classical mastery. (2) students' mathematical critical thinking skills after participating in learning with the Problem Based Learning assisted Sevima Edlink better than students' mathematical critical thinking skills with models Problem Based Learning without assisted Sevima Edlink. (3) there is an influence between Habits of Mind on students' mathematical critical thinking skills after participating in model learning Problem Based Learning help Sevima Edlink. (4) the higher Habits of Mind students. the higher the ability to think critically mathematically. Application of learning Problem Based Learning indefinite integral basic material should use the help of another LMS which is easier to use and can help students learn the material more easily.

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