

CHAPTER I

INTRODUCTION

1.1 Background

Education is one of the most important aspects for a country to improve its human resources. In the learning process, there are several subjects that need to be mastered, and one of them is mathematics. Mathematics is a very important discipline not only in the classroom, but also closely related to everyday life (Rini et al., 2019). Speaking of mathematics learning, mathematical reasoning ability is one of the essential skills that students must possess. This is stated in NCTM (2022), which establishes five process standards in mathematics learning, namely problem-solving ability, reasoning and proof ability, communication ability, connection ability, and representation ability.

According to Shora & Kartono (2020), mathematical reasoning ability is very important to be developed so that students can understand mathematical concepts well. In addition, Novianda et al. (2021) stated that logical ability in discovering patterns and procedures used in mathematics will help students develop a deeper understanding of mathematics. Based on previous research, mathematical reasoning ability must be possessed and is very important to be developed.

The urgency of the importance of mathematical reasoning ability possessed by students is stated in the Regulation of the Minister of Education and Culture Number 21 of 2016 concerning the Content Standards of Primary and Secondary Education, which states that reasoning ability is one of the objectives of mathematics learning in schools. However, the reality in schools is quite the opposite. Moreover, the research results of Nurazizah & Zulkardi (2022) also showed that only a few students used the indicator of drawing logical conclusions, so the low level of students' mathematical reasoning ability is not something that can be ignored. Mathematical reasoning ability is important because students rarely apply these indicators in solving problems. Furthermore, the research of Prastika et

al.(2021) showed that the low level of students' mathematical reasoning ability was caused by students' lack of understanding of the problems, students' low knowledge of the material being taught, as well as their inability to carry out calculations according to procedures. This indicates the weakness in students' mathematical reasoning and shows that the classroom learning process is still not optimal.

In mathematical reasoning ability there are several indicators that must be possessed by students (Hendriyana, 2018)

1. Formulate a hypothesis – The ability to propose mathematical conjectures based on identified patterns or given information.
2. Formulating and Expressing Mathematical Statements – The ability to express mathematical concepts in various forms, such as verbally, in writing, through drawings, and diagrams.
3. Confirming the truth of an argument – The ability to gather evidence, provide justification for the correctness of solutions, and evaluate the validity of an argument.
4. Generalize – The ability to recognize patterns or properties in mathematical phenomena and use them to formulate generalizations.

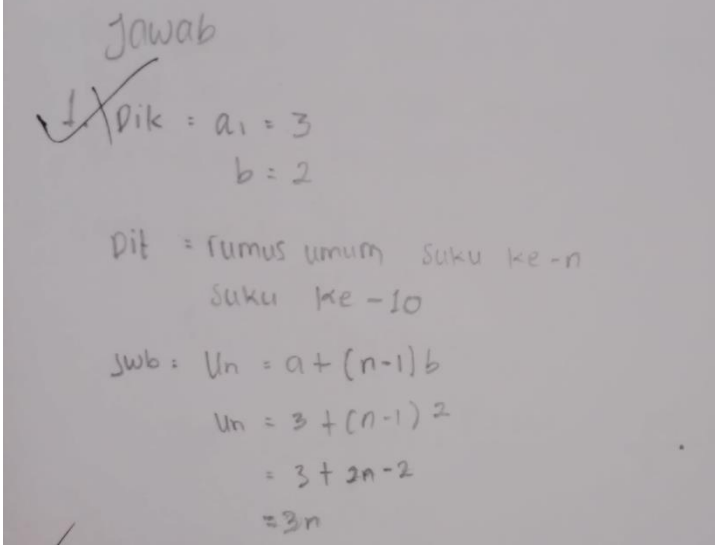
Based on the results of observations made through mathematical reasoning ability tests at one of the SMAN 5 in Pematangsiantar City on 2 September 2024, it was found that there are still many students who have not been able to solve mathematical problems. The mathematical reasoning problems given to students by researchers are as follows:

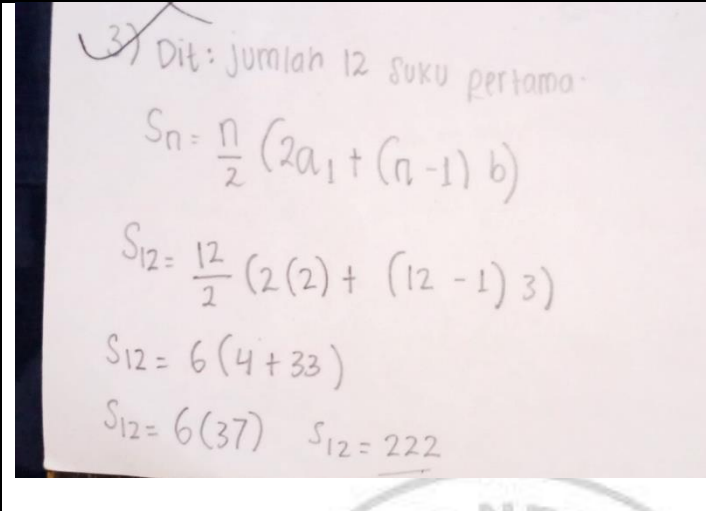
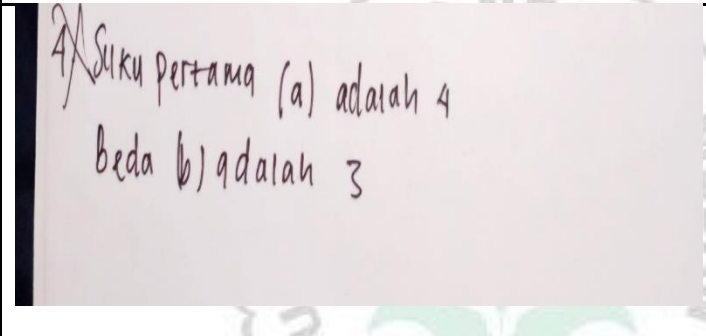
1. Find an arithmetic sequence with first term $a_1 = 3$ and difference $b = 2$. Write the general formula for the n th term of the sequence and find the 10th term?.
2. Given a geometric sequence with first term $a_1 = 5$ and ratio $r = 3$. If the sum of the first 5 terms of the sequence is 1210, is this statement true or false?.
3. Given a sequence of numbers 2, 5, 10, 17, 26, ... determine the sum of the first 12 terms.

4. An arithmetic sequence has 5 terms with the last term being 16 and the sum of all terms being 50. Find the first term and the difference of the sequence.

The questions above can measure mathematical reasoning ability in making conjectures, performing mathematical manipulations, drawing conclusions, compiling evidence, providing reasons or evidence for the correctness of solutions, checking the validity of an argument, and identifying patterns or properties of mathematical phenomena to make generalizations, but students are less able to answer these questions as in the table below

Table 1.1 Student Answer Sheets

Student Answer Sheet	Analysis of Students' Mathematical Reasoning Ability
	In question number 1, students are asked to formulate hypotheses, we can see that students can state hypotheses
	In question number 2 students are asked to state that a statement is true or false, It seems that some students may be struggling to formulating and expressing Mathematical Statements

 3) Dit: jumlah 12 suku pertama. $S_n = \frac{n}{2} (2a_1 + (n-1)b)$ $S_{12} = \frac{12}{2} (2(2) + (12-1)3)$ $S_{12} = 6(4 + 33)$ $S_{12} = 6(37) \quad S_{12} = 222$	In question number 3, it can be seen on the student sheet that students cannot find a pattern in a number line in the problem.
 4) Suku pertama (a) adalah 4 beda b) adalah 3	In problem number 4, it can be seen that the students were unable to gather evidence or provide justification for their answers

Based on the analysis of student answer sheets (Appendix 6), as many as 66% of students were in the very low score category, 18% were in the low category, and 15% were in the medium category. Most students experienced difficulties in answering questions number 3 and 4. Those questions required mathematical reasoning ability, especially in finding patterns to make mathematical generalizations and collecting evidence from an argument. This shows that the mathematical reasoning ability of students is still lacking.

Based on the results of interviews conducted by the researcher with teachers and students, it is known that there are still many students who are not able to solve mathematical reasoning problems. The teacher explained that the learning that took place in the classroom also made students less active in learning. The teacher also said that students felt confused in solving the problems, students only memorized formulas and examples given by the teacher during the teaching and learning process. The teacher further explained that in his own mathematics teaching, he had

not utilized technology as a learning medium. Therefore, students felt that learning mathematics was difficult and not enjoyable.

The reason is because the learning approach used in mathematics learning is still conventional, meaning that students still play a passive role and the learning is only teacher centered (*Teacher Centered Learning*). Students are only given information and asked to memorize and record all the information delivered by the teacher. This is in line with Fadhillah et al. (2023) in the results of observations from the research conducted, where teachers rarely use new learning approaches in the teaching and learning process of mathematics and only use conventional learning approaches. According to Boaler (1998), The conventional textbook approach, which prioritizes calculation, rules, and procedures, often at the cost of depth of understanding, presents significant challenges for students. This approach encourages rigid learning that is largely confined to the school context and has limited practical application. According to Apriyani et al. (2017), the learning process is called student centered or only dominated by the teacher. This is in line with the opinion of Takeuchi in Shimada (1997) that mathematics education should not only teach finished solutions, but also encourage students to be involved in open-ended and explorative thinking. By introducing the open-ended approach in teaching, the goal is to develop all aspects of students' mathematical abilities, not just following existing patterns. According to him, the traditional teaching style, which is similar to teaching in universities since the 19th century, tends to form a limited and closed view of mathematics in students.

One approach that is considered capable of improving mathematical reasoning is the use of the Open-ended approach in learning. The Open-ended approach is a learning approach in which students are faced with problems, questions, or tasks that allow for multiple possible solutions rather than being confined to a single predetermined answer or rigid procedure. Through these questions, students can develop the ability to reason, analyze, and evaluate information more effectively. This statement is based on research conducted by Shadiq (2004) that learning by providing open-ended problems can improve students' reasoning ability.

According to Rohaeti et al. (2019), Information and Communication Technology (ICT)-based media can help the process of mathematical reasoning and are easy to use. One of the media that can be used is Kahoot. Kahoot is a game-based learning platform that allows teachers to create interactive quizzes that are engaging and enjoyable for students. One strategy that can be applied is by integrating the Kahoot game media. Kahoot has four main features, namely: games, quizzes, discussions, and surveys. The use of Kahoot in the educational environment offers several advantages, including uniform delivery of material, better learning processes marked by increased interest, interactivity, and student engagement, the potential to improve students' learning quality, and the optimization of teacher productivity (Putra & Afrilia, 2020). Kahoot makes it easier for students to understand math problems so they can answer questions correctly and can build mathematical reasoning and ideas in solving mathematical problems (Assegaf et al., 2022).

Thus, this research is expected to make an important contribution in the development of effective learning strategies to improve students' mathematical reasoning ability. The results of this study are also expected to provide practical recommendations for teachers in implementing innovative and interactive learning approaches in the classroom.

Based on these problems, it has been conducted this research with the title **“THE EFFECT OF OPEN-ENDED APPROACH ASSISTED WITH KAHOOT APPLICATION TOWARDS MATHEMATICAL REASONING ABILITY OF SENIOR HIGH SCHOOL STUDENTS”**

1.2 Problem Identification

Based on the above background, the identification of this research problem is as follows:

1. Teacher-centered learning.
2. Students who are less active in learning.
3. Students only memorize formulas and problems given by the teacher.

4. Math learning is considered difficult.
5. Mathematical reasoning ability of students of SMAN 5 Pematangsiantar is still low.
6. Conventional learning approach is less helpful to improve mathematical reasoning ability at SMAN 5 Pematangsiantar.
7. At SMAN 5, learning has not used technology as the media.

1.3 Problem Limitation

Based on the background and identification of these problems, then to direct this research to be more focused and specific, the researcher determines the problem in this study, namely by conducting an open-ended approach in learning mathematics class XI students of SMAN 5 Pematangsiantar.

1.4 Problem Formulation

Based on the identification and limitation of the problems mentioned above, the question in this study is :

1. Does the open-ended approach assisted by kahoot affect students' mathematical reasoning ability?
2. How significant is the effect of the open-ended approach assisted by the Kahoot application on students' mathematical reasoning abilities?

1.5 Research Objectives

The objectives of this research are:

1. To find out whether there is an effect of using the Open-ended approach on students' mathematical reasoning ability.
2. To find out how significant the effect of the Open-ended Learning Approach assisted by the Kahoot application is on students' mathematical reasoning ability.

1.6 Research Benefits

The benefits of this research are:

1. This research can help teachers in their task to improve students' mathematical reasoning ability.
2. This research can be used as a reference for further similar research and can be used as a reference in classroom learning approaches.
3. This research can provide experience and knowledge in using the open-ended approach in learning activities.

