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Implementation of Open-Ended Type Questions to Improve Numeracy Skills in Elementary School Students

Sarah Mei Ambarwati
Universitas Pendidikan Indonesia

Al Jupri
Universitas Pendidikan Indonesia

Abstract: Numeracy skills in the 21st century are a foundation that elementary school students must have. This ability is, of course, related to the ability to be able to find and process information in various forms of symbols and numbers, as well as the ability to analyse the forms of information contained in tables, graphs, infographics, and charts. The use of open-ended questions is given to students to train their thinking to be more rational, systematic, and critical in solving various mathematical problems in everyday life. This research aims to describe the effect of implementing open-ended questions on improving elementary school students' numeracy skills. This ability will be measured by giving open-ended questions to 28 fifth grade students as research subjects. The research method was carried out using a mixed method. Data collection was obtained through testing and observation techniques. Student numeracy ability data was analysed using the interactive model from Miles Huberman. Based on research results, students' numeracy abilities can be improved by providing open-ended questions, as evidenced by the percentage of test results, which increased by 32% in the proficient and proficient categories. Apart from that, the increase in numeracy skills can be seen in significant changes in student behaviour to become more critical and provide solutions to problems found in the context of everyday life. Thus, it can be concluded that giving open-ended questions can improve elementary school students' numeracy skills.

Keywords: Numeracy, Open-ended questions, Problem solving

Introduction

The development of information communication technology has an impact on all aspects of life including education, along with the development of technology 4.0 in the world's life order. In the 21st Century Skills Framework developed by the World Economic Forum (WEF), numeracy is the foundation of literacy that students must have to be able to adapt and survive in the dynamic 21st century. In the era of technology 4.0, literacy becomes broader and covers many fields, such as ICT literacy, financial literacy, numeracy literacy, and many more (Herawan, 2022).

The current condition of students' abilities in Indonesia can be seen from the results of the Program for International Student Assessment (PISA) test in 2022 which experienced a decrease in scores on each assessment subject, namely reading, mathematics and science. PISA in 2022 has been participated by 81 countries and Indonesia's position is ranked 67th (Kemendikbudristek, 2023). In fact, the subject of math skills became the main topic because the average score dropped by 13 points to 366 and 106 points adrift of the global average score (OECD, 2017).

Based on the results of the AKM on the Rapot Pendidikan in one of the primary schools in 2023, it shows that students' numeracy skills scored 62.22% with the following distribution: the proportion of students with advanced numeracy skills is 17%, proficient numeracy skills is 73%, basic numeracy skills is 10%, and

numeracy skills need special intervention is 0%. This shows that students' numeracy skills still need to be improved (Rapor Pendidikan Kemendikbud, 2024).

Descriptive data from observations of 5th grade learning activities in one of the elementary schools found several problems, including the learning process that does not familiarize students to be able to improve the character of critical reasoning, it is caused because the problems given by the teacher are not in accordance with events that occur in everyday life. It can be seen that most students cannot solve mathematical problems found in everyday life. Teachers do not use contextualized learning approaches or strategies, causing students to be less interested and have difficulty in understanding the learning material. In addition, the formative assessment of numeracy-based students shows poor results, namely more than 30% of students score less than 70 which is determined from the Criteria for Achievement of Learning Objectives.

Numeracy skills are a person's ability to formulate, apply, and interpret mathematics in various contexts, including the ability to reason amatically and use concepts, facts, and procedures to describe, explain, or predict phenomena or events (Ekowati, D. W., Astuti, Y. P., Utami, I. W. P., Mukhlishina, I., & Suwandayani, B. I. To be able to improve numeracy skills, students must have learning experiences by linking numeracy content found in everyday life such as buying and selling activities, recording the identity of their friends in class, observing the construction of surrounding objects, and many more. Numeracy literacy also requires students to be able to communicate and explain the phenomena they face in mathematical concepts (Prenzel et al., 2015). . The world of education must teach many skills needed to survive in the modern world, such as basic skills such as reading, writing, using computers, and various professional skills such as communicating, thinking creatively, reasoning critically, and understanding oneself well (Widodo, 2019).

A teacher must be careful in making questions that can train and familiarize students to be able to practice numeracy skills. Teacher competence in designing literacy and numeracy learning will affect the quality of activities in terms of creativity, proficiency, and perseverance of teachers in planning, implementing, and evaluating the learning process (Patriana, Wulandari, & Sutama, 2021). So the solution chosen in this study is to provide open-ended type questions to help teachers improve students' numeracy skills. One type of problem that can be used to measure literacy skills is open-ended problems. Open-ended problems are problems that have many solutions or solution methods. In accordance with the opinion of Hidayanto and Khalistin in (Yanti, et al., 2019), they argue that open-ended problems are problems whose solution method is more than one way (flexibility) and the solution can also be diverse to find the correct answer (fluency).

The advantages of open-ended problems refer to Ari Sohimin in (Kurniati & Astuti, 2016), namely (1) Students have comprehensive mathematical opportunities, (2) Students with low ability can solve problems in their own way. Students with low ability can solve problems in their own way, (3) Students can be individually brave in providing evidence or explanations of their answers, and (4) Students have the opportunity to do math comprehensively answer, and (4) Students will have the experience to find something in answering the questions that have been given answer the questions that have been given.

Providing open-ended type problems certainly needs to be supported by teacher competence in developing and making open-ended type problems. Teachers use learning models that can support students to be able to construct their understanding such as Problem Based Learning, Discovery Learning, Project Based Learning, and others. Along with so many learning approaches or methods, it is hoped that teachers will be able to develop the ability to think logically, analytically, systematically, critically, and creatively so that it will have an impact on learning outcomes and achievements which are a demand along with the complexity of life problems that humans must face (Nurlita, 2015). Students are expected to have the ability to ask questions, reason, develop projects, and communicate their ideas, both orally and through writing. Thus, after reviewing various problems and based on several views and theories. This study aims to describe the effect of the implementation of open-ended questions on improving the numeracy skills of elementary school students.

Method

This research method is a type of qualitative with a combination method (mixed method) to explain the implementation of open-ended questions to improve the numeracy skills of elementary school students. Qualitative research is research that aims to understand the phenomena experienced by research subjects such as behavior, perceptions, motivations, and actions holistically through descriptive means on a special natural content by utilizing various kinds of natural methods (Rusandi, & Rusli, 2021). In this study, a quantitative approach was used to obtain data on students' numeracy skills. The research was conducted in one of the

elementary schools in Bandung City. The subjects in this study were 28 fifth grade students, so the sample was the total number of fifth grade students. The consideration of choosing the research subjects is because these students will participate in AKM and are at the stage of character development period (Kadek et al., 2022).

The research procedure adopted from (Creswell, 2009) with sequential explanatory strategy. Quantitative data collection was carried out using test techniques, while qualitative data collection was carried out by examining the results of educational report documents and observations of the learning process. The indicators used in this study are numeracy indicators from Kemendikbudristek (2017) as indicators of assessment of open-ended based numeracy test questions.

Table 1. Numeracy skill indicators

No	**Indicators**
1	Use a variety of numbers and symbols related to basic mathematics to solve practical problems in a variety of daily life contexts.
2	Analyze information presented in various forms (graphs, tables, charts, etc.).
3	Interpret the results of such analysis to make predictions and decisions.

Quantitative data results were used as the basis for qualitative data collection. Then qualitative and quantitative data are analyzed to be combined and compared which aims to focus which data reinforces, expands, or invalidates quantitative data. The quantitative data will be presented in tabular form supplemented by qualitative data. Furthermore, the research results obtained will be analyzed to be able to draw conclusions.

The data collection instrument to measure numeracy ability consists of 5 open-ended questions which are presented in the form of varied questions, namely filling and description. The use of instruments to measure numeracy skill has a very important role for students (Shamini, & Rosyidi, 2021). Observation guideline instruments to measure critical reasoning character during the learning process activities. It takes an instrument that can train and familiarize students to have critical reasoning character in solving problems in learning both at school and at home (Rumtini et al., 2022). Indicators of measuring numeracy skills in solving open-ended problems are divided into 3 categories, namely 1) high; 2) medium; and 3) low. Based on the type of data, quantitative analysis is presented in the form of a table containing converted values on a 0-100 scale. The following conversion values for the level of tendency of students' numeracy skills are shown in Table 2.

Table 2. Student score categories

Score	Categories
67-100	High
66-34	Medium
33-0	Low

Description: Respondent Score = $\frac{Respondent\ score}{Maximum\ score}$ x 100

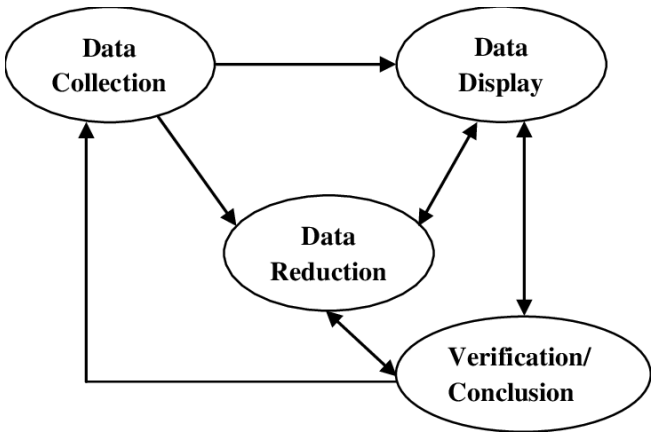

Figure 1. Interactive data analysis model

Meanwhile, qualitative data were analyzed using the Interactive model from Miles Huberman which consists of three stages, namely data reduction, data display, and conclusion drawing / verification. The Miles Huberman model can help analyze the results of a study (Anwar, 2022). In the data reduction stage, researchers will collect

as much data as possible through observation. Then the data presentation stage which can be made in the form of tables containing charts or descriptive explanatory narratives about the data that has been obtained. Then the last stage is the decision-making stage by analyzing the data that has been obtained into a result of the research. After the three stages are carried out, the researcher will find answers as research conclusions. The data analysis technique above can be shown in Figure 1.

Results and Discussion

The results showed that the administration of open-ended type problems as a whole went well and effectively. Reviewing the test results on students' numeracy skills shows an increase. The complete information related to the test results is presented in Table 3.

Table 3. Test results of students' numeracy skills

Score	Categories	First test	Presentase	Second test	Presentase
67-100	High	0	0%	6	21%
66-34	Medium	7	25%	10	36%
33-0	Low	21	75%	12	43%
Total		28	100%	28	100%

Table 2 provides information that the initial test results of students' numeracy skills categorized as high and moderate 25% while in the final results students categorized as high and moderate increased to 57%. Students after solving open-ended problems in the high category became as many as 6 people and moderate as 10 people. The data in Table 2 shows that the provision of open-ended problems is proven to be effective in improving numeracy skills. Students can solve open-ended problems because they have been given the opportunity to solve problems according to their respective abilities. While students who are categorized as basic and need special intervention, the percentage is 43%, it can be interpreted that the provision of open ended problems that continue to be developed can support students' numeracy skills. Numeracy characters include the main competencies of thinking and reasoning, argumentation, communication, modeling, representation, mathematical symbols, and tools and technology (Rizki, & Priatna, 2019). Table 2 has presented in detail the data of each category of students on numeracy skills for comprehensive comparison.

The activity of giving open-ended problems is carried out twice a week. The math content that is related to everyday life is the measurement domain of geometry data. In the first meeting, students were instructed by the teacher to look for objects that are included in flat buildings in the environment around the classroom. Students are presented with a problem, namely making frames from ropes for these objects. So that students will indirectly understand the concept of finding the perimeter of a flat shape by measuring the sides of the object. Students will understand the material and formulas of flat shapes based on the results of experiences and discoveries that they have experienced directly in groups. Then students will write the results of their measurements in a notebook in detail so that the teacher can see the way of thinking and reasoning of each student.

Figure 2. Collage of student activities measuring the length of the sides of flat objects

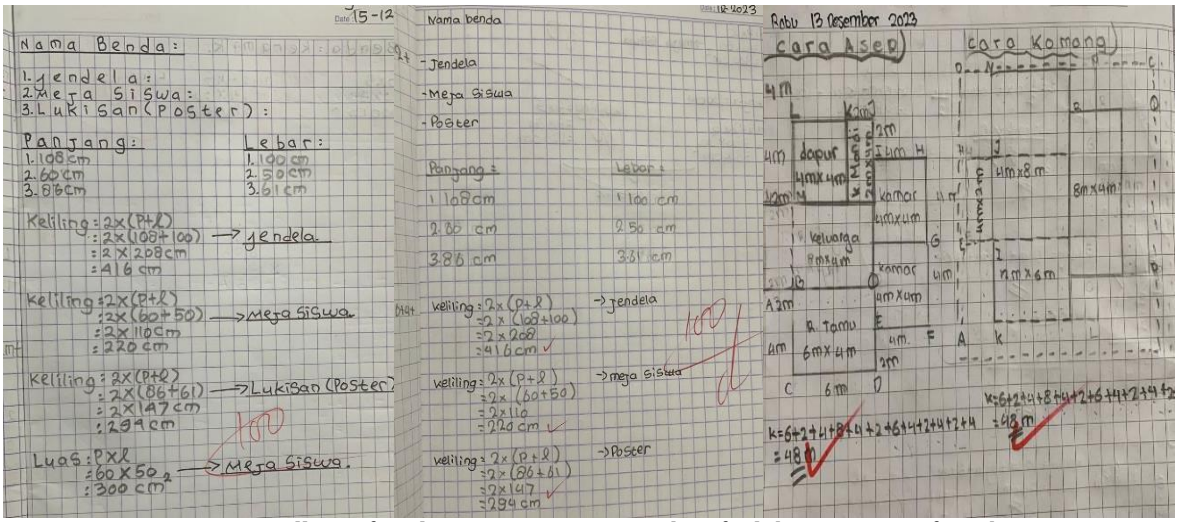

Figure 3. Collage of students' measurement work to find the perimeter of an object

In the second meeting, students were instructed to find the distance from home to school and the departure time needed to arrive at school on time. The teacher stimulates students to be able to find the concept of speed based on data and experience while going to school. So that in practice students can find the concept of speed themselves with critical reasoning skills. Then information related to distance, time, and other topics that are still related to the experience of going to school is collected by students into a complete class data. The data will be processed and presented by students in the form of diagrams. Based on the provision of open ended type problems, the teacher makes observations related to students' numeracy skills that appear. Observations were made by observing and writing down the findings based on the numeracy indicators. The findings obtained during the observation are presented in Table 4.

Table 4. Observation result of student' numeracy skills

No	Indicator	Descripsion
1	Use a variety of numbers and symbols related to basic mathematics to solve practical problems in a variety of daily life contexts.	- In the first meeting, students' abilities were seen during the activity of solving geometry domain problems. All 28 students tried to solve the problem independently to measure the length of the side based on the measurement results that had been obtained. - In the second meeting, students' abilities were seen during the activity of determining the distance and time of departure. All students calculated the distance and time of departure from home to their respective schools. However, there are still 5 students who only write information related to time and distance without calculating speed.
2	Analyze information presented in various forms (graphs, tables, charts, etc.).	- In the first meeting, all students were able to calculate and determine the perimeter of an object to be framed based on previously obtained information. - In the second meeting all students were able to find the average speed of going to school based on time and distance. Although 3 of them could calculate the speed with the guidance of teachers and friends.
3	Interpret the results of such analysis to make predictions and decisions.	- In the first meeting, 25 students were able to make decisions by finding the formula for finding the perimeter of a flat shape independently, while 3 others were assisted by the guidance of friends. - In the second meeting, all students were able to make decisions to estimate the right time to leave in order to arrive at school on time.

The observation results described in Table 4 provide important information related to the achievement of indicators on students' numeracy skills. Among them, through giving open-ended problems, all students have the ability to use numbers and symbols to solve problems independently. However, in the indicator of analyzing information and drawing conclusions, there are a small number of students who are able to achieve this indicator

with the guidance of teachers or friends. However, when viewed from the learning results at the first and second meetings, students' numeracy skills can already be categorized as good. This is evidenced by the percentage of more than 75% of students who have numeracy skills based on the indicators observed. In addition, there are numeracy skills that have been possessed by students including finding logical solutions, summarizing, and restating information or data. Students will try to solve and develop the problems they face themselves (Mansur, 2018).

Based on the test results and observations found, it explains that students generally have natural numeracy skills. However, teachers often give problems that do not hone numeracy skills such as giving problems that only have one definite answer. Numeracy skills require mathematical knowledge but if only by learning mathematics and without preparation, then numeracy skills cannot necessarily be grown in students (Cahya et al., 2021).In certain abilities, especially numeracy, students must have a meaningful learning experience by being given the opportunity to discover for themselves. Learning activities do not necessarily transfer theory alone but can connect theory with real problems that occur in order to build a meaningful learning atmosphere (Ernawati & Puji, 2022). How to think and understand something will affect students in solving problems (Ananda & Herman, 2023). These activities will greatly affect the way students think and reason when faced with various problems that must be solved in everyday life. This reinforces that mathematics subjects are very important in the context of mathematics education in schools (Panggabean, & Tamba, 2020).

Through the provision of open-ended problems, students will find it easier to find logical and systematic ways of solving problems either in the form of problems or in the form of problems that occur in real life. Numeracy is not only able to carry out procedures in solving mathematical problems but also to utilize mathematics in everyday life (Aningsih, 2018). The numeracy skills possessed by students are not only to get good learning results but also in practice will be very useful for finding alternative solutions and wise decision-making strategies and minimal risk. Students prefer context-based learning because it is easier to understand and often occurs in the real world (Dwi & Wahidin, 2021). In principle, education does not only produce a generation that only masters knowledge but must produce a generation that has a mature and superior personality, character, and morals (Putri, 2018). Thus, there is a need for changes in the preparation of more innovative questions to support the sharpening of numeracy skills in elementary school students to grow quality human resources, be able to survive amid increasingly large challenges, and compete globally.

Conclusion

Based on the results of the research, giving open-ended type problems in its implementation has gone well along with the improvement in the numeracy skills of elementary school students. Students experienced significant changes in their ability to solve open-ended problems. This is evidenced by the percentage of the average value of the test results which increased by 32%. Students experience behavioral changes in solving open ended problems in accordance with indicators that reflect numeracy skills. Teachers have created more innovative problems in accordance with open-ended characteristics.

Recommendations

The recommendations suggested for teachers are to make questions that can hone numeracy skills such as open ended type questions. The suitability in choosing the type of problem is essential because it greatly affects the ability of students to solve a problem. To facilitate students' numeracy and thinking skills, teachers need to master more deeply all elements contained in numeracy such as numbers, measurement, geometry, algebra, data, and uncertainty. Open-ended problems are a stimulus that can continue to be developed to foster numeracy skills in students. In addition, students will have skills and abilities that are useful for their lives and have a positive impact on the development of quality in the world of education.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility ofthis article published in EPESS journal belongs to the authors.

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Author Information

Sarah Mei Ambarwati
Elementary Education Program, Post Graduate School,
Universitas Pendidikan Indonesia, Indonesia
Contact e-mail: *sarahmei@upi.edu*

Al Jupri
Elementary Education Program, Post Graduate School,
Universitas Pendidikan Indonesia, Indonesia

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