The Eighth Graders' Higher Order Thinking Skills in Solving Numeracy Problems-Based Minimum Competency Assessment

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Abstract

The Indonesian government makes efforts to improve students' higher-order thinking skills by implementing a Minimum Competency Assessment or Assessment Kompetensi Minimum (AKM) as a substitute for the National Examination. With the implementation of the AKM, it is necessary to find out how students can solve these questions. This research analyzed students' higher-order thinking skills in solving AKM-type math problems. The research method used is descriptive qualitative research consisting of 3 stages: the preparation stage, the implementation stage, and the data analysis stage. The research was conducted in the odd semester of the 2020/2021 academic year with the research subjects of eleven 8th grade students of SMP IT Raudhatul Ulum Sakatiga, South Sumatra, and SMPN 11 Banjarbaru, South Kalimantan. Data collection techniques used are tests, documentation, observation, and interviews. The data were analyzed qualitatively. The results showed that students with high abilities could solve several questions that required analytical power but were still weak in solving questions that required evaluation. Other students still need to improve their analytical and evaluation skills.

Keywords: higher-order thinking skills; numeracy problems; a minimum competency assessment.

I. Introduction

Higher-Order Thinking Skill (HOTS), which includes the ability to think at the level of analyzing, evaluating, and creating ideas, is an essential ability for achieving 21st-century competencies consisting of critical, creative, collaborative, and collaborative and communicative thinking skills, which is indispensable for the needs of students in solving problems they face in everyday life (Grifin & Care, 2015). The importance of higher-order thinking skills for students affects the orientation and structure of the curriculum in Indonesia so that the Indonesian government enforces the 2013 Curriculum by setting graduation standards that expect graduates with critical, productive, independent, collaborative, and communicative thinking skills (Kemendikbud, 2016). The 2013 curriculum emphasizes 21st-century competencies, which include the ability to think and solve problems through observing, asking, listening, and communicating answers to problems (Putri & Dolk, 2015; Putri & Zulkardi, 2018).

Achievement data on PISA results showed that Indonesian students' mathematics score was still low (OECD, 2019). Indonesian students' low high-order thinking ability is

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generally caused because students are not familiar with solving HOTS questions in learning (Abdullah et al., 2015; Oktiningrum & Hartono, 2016).

To be able to support students' higher-order thinking skills in learning mathematics, teacher efforts are needed to able to design learning activities that contain teaching materials, media, and even evaluation tools that can be used in training higher-order thinking skills (Devina et al., 2021; Novita & Hartono, 2012). Several studies have been conducted to improve students' high-level thinking skills by applying various learning models (Choridah, 2013; Syahbana, 2012). The others have researched the development of questions to measure students' higher-order thinking skills (Alika et al., 2018; Suhady et al., 2020). In addition, the Indonesian government made a policy to abolish the National Examination and replace it with a Minimum Competency Assessment, called Assessment Kompetensi Minimum (AKM).

AKM contains questions that are oriented to students' higher-order thinking skills. One type of AKM problem is numeracy problems which are problems measuring numeracy ability. It is the ability to understand and work with numbers (de Lange, 2003; Filho et al., 2020; Luit & M Schopman, 2000; Yustitia et al., 2021). It is not only the ability to use numbers, to add, subtract, multiply and divide but also encompasses the ability to use mathematical understanding and skills to solve problems and meet the demands of day-to-day living in complex social settings (Anney, 2016; Davis, 2013; Gal et al., 2020; Sellars, 2017; Westwood, 2004; Yustitia et al., 2021). Basic research related to the description of students' higher-order thinking skills in solving AKM questions type numeracy has not been done much. This is important to formulate other policies that can support the development of students' higher-order thinking skills. Thus, this study aimed to analyze the high-order thinking skills of high school students. Based on the description above, the problems that will be answered in this research are: How is the high-level thinking ability of high school students in solving AKM standard math problems? This research aims to get an overview of the high-level thinking skills of high school students in solving math problems for AKM students.

II. Research Method

This study is descriptive qualitative research that aims to describe the high-order thinking skills of high school students in solving numeracy problems of AKM.

The research procedure carried out by the researcher consisted of three stages, namely, the preparation stage, the implementation stage, and the data analysis stage. In the preparatory stage, the researcher made several preparations, including selecting research subjects and preparing research instruments. This study's instruments used to collect data were observation sheets and interview guidelines. Then, the researcher asked for help from two experts to validate the observation sheets and interview guidelines that had been prepared. In the implementation phase, the research was conducted offline at SMP IT. RU Sakatiga and online at SMPN 11 Banjar baru. Observations were made to see the students' higher-order thinking skills in working on AKM standard questions. Video recording is done when students participate in learning activities and observations made by researchers. Next, the researcher conducted interviews with students to dig up information not captured at the time of observation and clarify the results of the researcher's interpretation of the observations made. The data analysis stage is the last stage, where data collection carried out in the previous stage is then analyzed.

The study involved 11 8th grade students of SMP IT Raudhatul Ulum Sakatiga, South Sumatra, and SMPN 11 Banjarbaru, South Kalimantan, who were approximately 14 years old. Data were collected through tests and documentation which consists of 13 questions, observation, and interviews. Then, the data is analyzed qualitatively.

III. Results and Discussion

The researcher arranged research instruments using observation sheets and interview guidelines in the preparation stage. As for the test instrument, the researcher used the AKM numeracy questions compiled by Pusmenjar. Then, two colleagues in the Mathematics Education study program at FKIP Sriwijaya University validated the research instrument. In addition, at this stage, the researcher has determined the research subjects, as many as 6 people with low, medium, and high mathematical ability categories based on recommendations from the class teacher.

The research was carried out through the provision of AKM numeracy questions, observations, and interviews. The research was carried out from September 13 to October 30, 2021. The following is an example of AKM numeration questions given to research subjects. Questions are given to see students' higher-order thinking skills when solving the problem. The AKM questions given are questions sourced from the Pusmenjar website in 2021.

Figure 1. One of the AKM questions on the Pusmenjar website

Figure 2. 8th grade students of SMP IT RU was working on AKM questions

Figure 3. The 8th grade students of SMPN 11 Banjar are just working on the AKM questions and being observed online

Observations were made while students were completing the AKM numeracy questions. There were 3 observers, namely students of Mathematics Education FKIP Sriwijaya University, involved. During learning, the observer is behind. During the learning process, the observer observed the values of higher-order thinking skills and the difficulties of class VIII students by walking around the class while looking at the students' work. If the students' high-order thinking skills and difficulties appeared on the students, they would be given a checklist according to the existing descriptors on the observation sheet.

From the results of observational analysis, students are given a rank according to the number of higher-order thinking abilities and difficulties that arise. After that, the names of the selected students were submitted for a recommendation from the mathematics teacher for class VIII. After being selected, the researcher asked about the student's willingness to be interviewed, so 3 subjects were selected who were

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willing to be interviewed. Interviews were held on October 4, 2021, face-to-face for research subjects at SMPIT RU Sakatiga and on October 30, 2021, online for research subjects at SMP 11 Banjarbaru, South Kalimantan.

Interviews were conducted in the computer lab for students of SMPIT RU Sakatiga since the instruction activities were done offline. During the interview, the researcher asked questions about the students' higher-order thinking skills and emerging difficulties. Interviews were conducted face to face by asking questions based on the steps in the students' worksheets and the evaluation questions they did during the lesson. This interview aims to see the truth of the data and get information to support all the data obtained during the observation. Figure 4 shows the pictures of the interview in SMPIT RU Sakatiga.

Figure 4. Interview with one of the 8th grade students of SMP IT RU South Sumatra

R　: From questions no 1 to 13 were there unanswered ones?
S　: Yes, there were
R　: what numbers were they?
S　: Number 10 and 11.
R　: Why?
S　: I did not know what to do. I did not know the formula and how to calculate it.
R　: Did you know what mathematical topic in the questions?
S　: volume?

From interview transcript above, students could not solve AKM problems especially question number 10 and 11 which were related to volume. The questions require students' analytical

ability in finding the solution. It is also similar results with students in SMPN 11 Banjarbaru
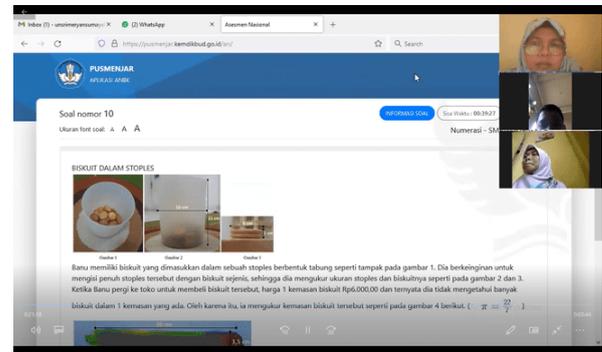
Figure 5. Interview with 8th grade students of SMPN 11 Banjarbaru, South Kalimantan

Figure 5 is a snapshot of online interview with students of SMPN 11 Banjarbaru. The interview transcript as follow.

R　: What did you think about AKM type numeracy given in Pusmenjar web?
S　: They were hard enough to be answered, Mam.
R　: I saw that you could not answered question from number 9 until 13.
S　: Yes, Mam
R　: Why?
S　: Time was up, Mam.
R　: If there was enough time then you could answer them, couldn't you?
S　: I am not sure, Mam. Since I did not know how to answer them.

From online interview transcript above, the student did not have enough time to solve all AKM questions. if time is added, students still cannot solve the problem. It is because they could not specify the problem and the steps to solve it.

In the data analysis stage, the researcher analyzed the students' thinking skills that emerged based on the results of observations during learning and the answers of the research subjects when answering the evaluation questions and the results of interviews that had been conducted. The following table contains the number of questions students can answer from the 13 AKM questions on the Pusmenjar website.

Table 1.
The number of AKM questions that students can answer

No.	Students' Initial	Ability category	The number of AKM questions answered correctly
1	MAM	High	7
2	NMD	High	6
3	MRN	High	5
4	MSS	High	5
5	FYN	Medium	3
6	SDK	Medium	2
7	NFM	Medium	2
8	QG	Medium	2
9	BWS	Low	2
10	OSH	Low	1
11	KAR	Low	1

Table 1 shows that all students cannot solve all AKM questions. Only students with high ability categories can solve quite some AKM questions. Most of the students solved the problem, as shown in Figure 1.
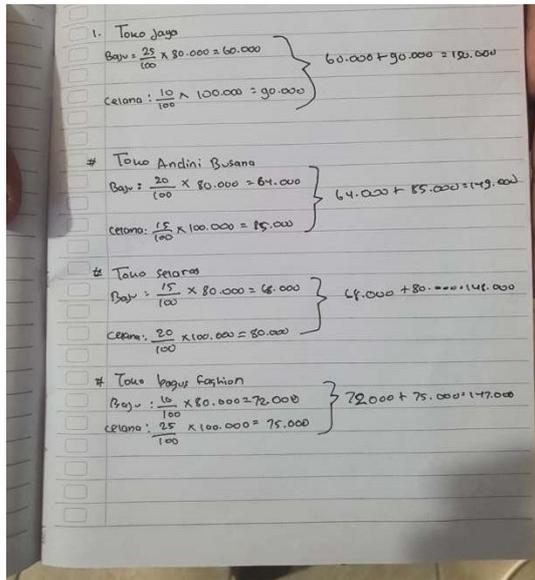
Figure 6. One of the answers of high ability students

Figure 6 shows that students can solve procedural problems by applying the percentage formula and calculating the result of subtraction between the price of goods and the discount, adding up the two prices of goods, and determining the lowest price after the calculation.
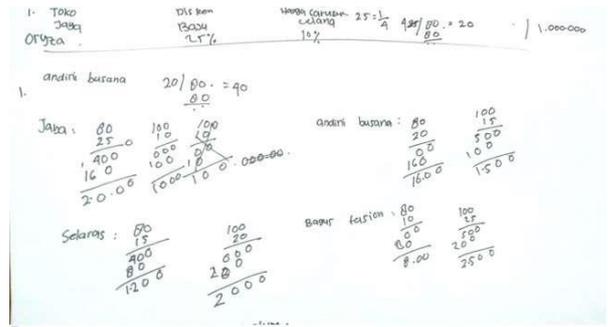
Figure 7. One of the Answers of Low Ability Students

However, not all students can answer correctly. Figure 7 shows that students only see a considerable percentage value of one item in determining the lowest purchase price. Of the 13 AKM questions that students do, several questions are difficult for students to solve. Some of them are shown in Figures 8 and 9.
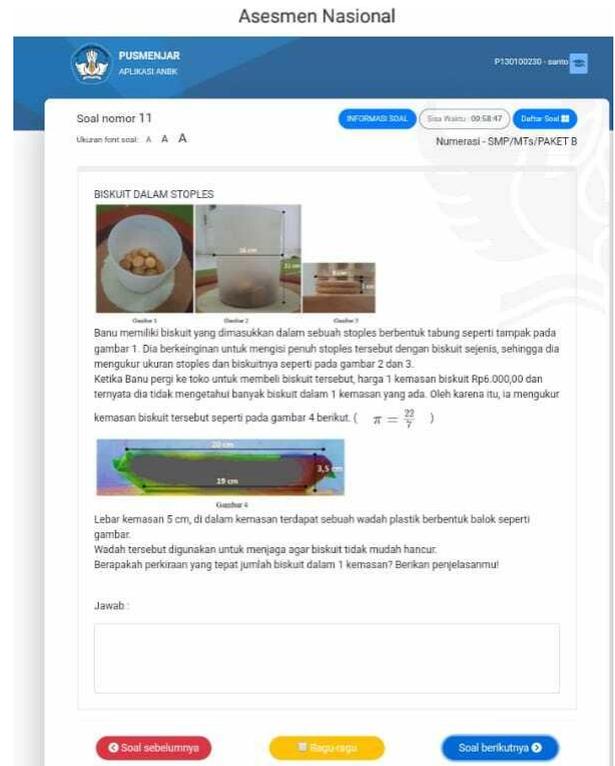
Figure 8. AKM question no. 11

Problem number 11 in Figure 8 is a type of analysis requiring students to master the concepts of tube volume and block volume and use the relationship between the two to determine the number of biscuits in the package. However,

none of the students' answers correctly solved the problem.
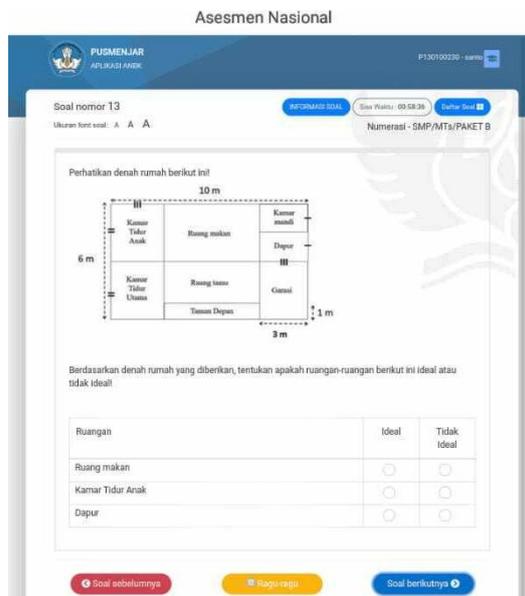
Figure 9. AKM question no. 13

Problem number 13 in Figure 9 is also one of the questions that all students cannot solve. This question is an evaluation level question that requires students to check the ideal or non-ideal conditions from the given room plan.

Some AKM questions require students to be able to use analytical skills where students can master several mathematical concepts and use the relationships between these concepts. Evaluation ability is also needed by students in solving AKM questions where students need to check the consistency and errors of a statement. Analytical and evaluation skills are higher-order thinking skills (Krathwohl & Anderson, 2010). The low level of high-order thinking skills of students in solving AKM questions is in line with the results of the PISA of Indonesian students, which show that Indonesian students are still weak in analyzing skills, evaluating skills, and creating skills (OECD, 2019; Stacey et al., 2015) and in line with research on high-order thinking skills of junior high school students who are still low (Kurniati et al., 2016; Meryansumayeka et al., 2021; Meryansumayeka et al., 2020,). However, teachers can help students develop their math skills through math tasks that stimulate students to think (van Galen & van Eerde, 2018; Watson &

Ohtani, 2015). Therefore, giving math assignments categorized as HOTS assignments is also an excellent way to support students in developing higher-order thinking skills (Fatimah et al., 2019; Kurniati et al., 2016).

IV. Conclusion

The AKM numeracy questions given to most students are at the level of analysis and evaluation. Students' higher-order thinking skills still need to be improved. High-ability students can solve several questions that require analytical power but are still weak in solving questions that require evaluation. Other students still need to improve their analytical and evaluation skills.

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