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Analysis of Students' Mathematical Literacy through Minimum Competency Assessment (AKM)-Based Questions on Arithmetic Sequence

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***Abstract*— Indonesia's 2022 PISA results have declined compared to 2018, raising concerns about educational quality globally. National assessments focusing on mathematical literacy, utilizing Minimum Competency Assessment (AKM) questions, have become commonplace for students. This study aimed to investigate students' mathematical literacy skills through AKM-based questions on arithmetic sequence patterns. Employing a qualitative approach with 10th-grade students, data collection involved written tests, followed by data reduction, presentation, and conclusion drawing. Results indicate that 42.86% (12 students) demonstrated high mathematical literacy, reflecting adequate problem-solving skills. However, 35.71% (10 students) scored low, revealing significant challenges in conceptual understanding and application. These findings emphasize the need for targeted interventions to enhance mathematical literacy, particularly in contextual problem-solving and mathematical concept application.**

Keywords— ***AKM; Arithmetic Sequence; Mathematical Literacy***

I. INTRODUCTION

Mathematical literacy itself is one of the skills that helps meet global demands [1]. Mathematical literacy requires students to be able to communicate back the information or phenomena they encounter. The Ministry itself already has a program related to literacy, namely the National Literacy Movement (GLN). In this program, it is divided into six basic groups that students must possess, namely literacy in reading and writing, science literacy, numeracy literacy, digital literacy, financial literacy, and cultural and citizenship literacy. In its implementation, it is divided into three groups: the School Literacy Movement (GLS), the Family Literacy Movement (GLK), and the Community Literacy Movement (GLM).

Literacy is also closely related to PISA (The Programme for International Student Assessment). PISA is

a program from the OECD (Organization for Economic Cooperation and Development), where in this program literacy becomes an assessment to illustrate the quality of education in a country. The subjects of the PISA assessment itself are literacy tests in reading, mathematics, and science without considering the curriculum in force in the respective country. The results of a country's PISA assessment, if above average, indicate that the country has an education standard needed by the international market; conversely, if the results are below average, the country's curriculum is considered not to meet international needs [2].

Indonesia's PISA results for the last year, 2022, still scored below the OECD average. If compared to 2018, the PISA scores obtained have also decreased in mathematics, reading, and science. The score for mathematics itself is only 366 out of an average of 472, and reading ability is also only at 359 out of an average of 476. This is quite concerning for the quality of education on the global stage. This is in line with research [3] that mathematical literacy in learning is still relatively low. The efforts made to improve this are through the implementation of a national assessment focused on literacy and numeracy.

Minimum Competency Assessment (AKM) is part of the national assessment implemented in 2021. The government designed AKM to measure the basic competencies required by students. AKM focuses on reading literacy and numeracy. In AKM, reading literacy is defined as the ability of students to understand, use, evaluate, and reflect on various types of texts [4]. This ability is used to solve problems and develop students' capacities so that they can contribute to society. This assessment is conducted as an effort to review or evaluate the quality of the educational process and outcomes in Indonesia. The results will serve as a basis for improving the quality of the learning process in educational units.

There are three areas of mathematical processing abilities described by [5] , namely (1) describing situations mathematically; (2) utilizing ideas, facts, procedures, and reasoning; and (3) applying, interpreting, and evaluating mathematical results. OECD also explains that mathematical literacy is the ability of students to interpret, formulate, and use concepts, procedures, and facts found in mathematics. Literacy is used to develop students' abilities to think mathematically (numerically) and spatially in solving mathematical problems related to everyday life [6].

Mathematical literacy helps in understanding the usefulness of mathematics in everyday life, which is closely related to word problems. Mathematical literacy can be defined as the ability to identify and understand problems and then translate them into mathematical sentences [7]. Mathematical literacy in AKM itself aims to test students' abilities in mathematical logic. Students in completing the AKM numeracy (mathematical literacy) need to master the basic mathematics that have been taught by their teachers previously. The basics of mathematics usually include geometry, measurement, algebra, and data. The questions used in AKM are based on HOTS (Higher Order Thinking Skills), which require students to analyze, interpret, or translate information. These HOTS questions apply creative and innovative problem-solving methods, which subsequently create new discoveries/information from the knowledge obtained. Higher Order Thinking Skills involve complex thinking used in solving various problems so that learners can think critically [8].

Based on what has been previously presented, the abilities of Indonesian students according to PISA are still considered low. Previous research related to the questions tested in the national assessment in the form of AKM also requires a deeper ability in critical thinking and mathematical literacy. This habituation needs to be carried out, where students are accustomed to working on AKM-based questions in order to meet the basic needs of literacy. This research aims to determine students' mathematical literacy skills through AKM-based questions. This research uses the material currently being taught, namely Arithmetic Sequences.

II. METHOD

This type of research is a descriptive study with a qualitative approach, conducted by describing the mathematical literacy abilities of students through AKM-based questions on the topic of arithmetic sequence patterns. The subjects of this research are tenth-grade high school students from one of the schools who have studied the material on arithmetic sequence patterns. The data collection technique used was written tests, and the instrument employed was AKM-based arithmetic sequence pattern questions. The data analysis used includes data reduction, data presentation, and conclusion drawing.

III. RESULTS AND DISCUSSION

This study involved 28 students who worked on the Minimum Competency Assessment (AKM) questions, which consisted of five items designed based on mathematical literacy indicators. Mathematical literacy, as defined by the Organisation for Economic Co-operation and Development (OECD) in the Programme for International Student Assessment (PISA), is an individual's ability to formulate, apply, and interpret mathematics in various real-life contexts. The main indicators of mathematical literacy that form the basis for the preparation of these questions include: formulating mathematical problems from real-world situations (formulating), applying mathematical concepts, facts, and procedures to solve problems (employing), and interpreting and evaluating the results in the initial context (interpreting) [9]. Based on the test analysis results, a variation in abilities among students was found, indicating a distribution of mathematical literacy skills at various levels.

Here is a sample of students categorized by low, medium, and high ability levels.

TABLE 1

RESULTS OF STUDENTS' MATHEMATICAL LITERACY ABILITY ON AKM QUESTIONS

No	Name	Score					Total Score	Criteria
		Question 1	Question 2	Question 3	Question 4	Question 5		
1	Agustin Dwi Putra	0	12	20	10	5	47	LOW
2	Andika Pratama	10	20	20	20	5	75	MEDIUM
3	Annisa Anggraeni R.	20	16	20	20	20	96	HIGH
4	Cahyaningrum Anastita	20	20	20	20	20	100	HIGH
5	Dian Aidil F	10	20	20	20	5	75	MEDIUM
6	Dian Sholeha	20	12	20	0	5	57	LOW
7	Dimas A.P	10	20	20	20	20	90	HIGH
8	Dwi Andika	0	20	20	20	20	80	HIGH
9	Fares Fajry Ababi	20	16	20	20	20	96	HIGH
10	Fathar Rizky Ramadhan	10	20	20	20	20	90	HIGH
11	Fuad Fathin	20	20	10	20	20	90	HIGH
12	Juhaini	20	12	20	0	5	57	LOW
13	Latifatuz Zahro	20	20	10	20	20	90	HIGH
14	Liviana Aulia	20	12	20	20	20	92	HIGH
15	Lukman	0	20	20	20	5	65	MEDIUM
16	M.Ghazy Zaidan	20	20	20	20	20	100	HIGH
17	Nadindra Mahdi	0	20	20	20	5	65	MEDIUM
18	Najwa Aliah Salihah	20	12	20	20	20	92	HIGH
19	Nayya Putrii	20	12	20	0	5	57	LOW
20	Ranum Aprillia	20	12	20	0	5	57	LOW
21	Rita Febriani	20	12	20	0	5	57	LOW
22	Robert Daniyago	0	20	20	20	5	65	MEDIUM
23	Shifa Nur Fajriyah	0	20	20	20	5	65	MEDIUM
24	Sinta Nuriah	20	12	20	0	5	57	LOW
25	Syafa Okta Alifiyah	0	12	20	20	5	57	LOW
26	Vita Leviana Devy	20	12	20	0	5	57	LOW
27	Yuliana Jati Leksono	20	12	20	0	5	57	LOW
28	Zal Sabillah Rheva	20	20	20	20	20	100	HIGH

The results of the distribution of students' mathematical literacy abilities in the three categories can be seen in the table below:

TABLE 2 TABLE OF MATHEMATICAL LITERACY ABILITY

No	Categori	Score	Number of Student	Presentation
1	High	80-100	12	**42.86%**
2	Medium	60-79	6	**21.43%**
3	Low	0-59	10	**35.71%**

Based on the results of the data analysis, students' mathematical literacy abilities show variation, with 42.86% in the high category, 21.43% in the medium category, and 35.71% in the low category. The majority of students fall into the high category with a score range of 80-100, comprising 12 students, which reflects adequate mathematical literacy skills in understanding and solving AKM questions. However, a significant percentage in the low category, namely 35.71% or 10 students with a score range of 0-59, indicates a significant challenge in understanding concepts and applying mathematical literacy. In addition, 6 students fall into the moderate category with a score range of 60-79, which requires improvement to reach a higher level of proficiency. These findings encourage the researchers to conduct follow-up actions in the form of observation and in-depth analysis of the AKM test results completed by the students. This effort aims to identify specific obstacles faced by students, especially those in the low category, and to design appropriate interventions to improve their mathematical literacy skills.

Results of the Analysis of Students with Low Mathematical Literacy Skills

Based on the results of the mathematical literacy test, there are 10 students categorized as low with a score range of 0–59. Analysis of the answers to the Minimum Competency Assessment (AKM) questions and direct classroom observations revealed several main challenges faced by students in this group. One of the biggest challenges is the difficulty in understanding case-based or story-based questions. Students often struggle to identify important information in the questions, which affects their ability to determine the appropriate steps for solving them. Moreover, the limited mastery of basic mathematical operations such as addition, subtraction, multiplication, and division leads to significant calculation errors. The tendency to answer questions directly without considering further systematic steps indicates weak analytical skills and a lack of logical reasoning.

This difficulty also reflects the limitations of students in applying mathematical concepts to solve more complex problems that require in-depth analysis. Some students even seem to be less meticulous in reading and understanding the questions, making mistakes due to a lack of attention to detail a common occurrence. Based on the mathematical literacy indicators adapted from OECD [9], students in this category show difficulties in three main indicators.

First, Formulating: Students face significant obstacles in understanding important information from story-based or real-life case problems, causing them to fail in translating the problems into appropriate mathematical representations. Second, Employing: Limited mastery of basic mathematical operations causes students to be unable to apply the appropriate procedures to solve problems. Third, Interpreting: Students are less able to evaluate the results of problem-solving logically, so the answers given are often not relevant to the context of the problem.

This fact indicates that a more structured intervention is needed to strengthen students' abilities in mathematical literacy, such as providing intensive training on case-based questions, deepening understanding of basic mathematical operations, and enhancing analytical skills and logical reasoning.

Results of the Analysis of Students with Moderate Mathematical Literacy Skills

Students have a moderate level of mathematical literacy (numeracy) with scores ranging from 60 to 79. Questions about AKM were posed to students who had never heard of AKM, so during the research activities, the researcher briefly explained the basics of AKM to the students. In the activity, the researcher asked about the difficulties related to the provided AKM questions, and there were students who responded that they did not experience much difficulty in solving the given questions. Students also stated that they prefer questions with complex components because, in solving these questions, they can complete and understand the tasks given as they relate to the students' daily lives. Based on the results of the observation, students demonstrated a moderate level of ability, capable of preparing themselves to complete the given AKM questions. Students in this category must first study and practice exercises related to AKM questions.

The mathematical literacy (numeracy) skills possessed by students at the moderate level from the research results show a range between 65 to 75. The results of the research conducted show that there are 6 students categorized at the moderate level, with a percentage of 21.43%. Students in this category show greater readiness to face AKM questions in order to expand their knowledge scope and develop their understanding.

Results of the Analysis of Students with High Mathematical Literacy Skills

The mathematical literacy (numeracy) skills possessed by students in the high category received scores ranging from 80 to 100. Questions related to AKM were presented by the researcher, and the students already understood the AKM. Students also perform better on the questions. Students with a high category level have quite good abilities in solving AKM questions, so to be more prepared in facing AKM questions, students classified as having high abilities are expected to practice AKM questions more frequently and extensively.

The mathematical literacy (numeracy) ability of students in the high category during the research activities received scores ranging from 80 to 100. From the research results, it shows that the completion of AKM questions has very satisfactory results. This is shown by the research results that the majority of students in the class fall into the high category, with 12 students totaling 42.86%. Thus, students in the high category need to continuously improve their mathematical literacy (numeracy) skills through in-depth practice, such as solving problems and exposing themselves to AKM-related exercises.

IV. CONCLUSIONS

Based on the research data that has been conducted, literacy (numeracy) skills show a dominance in the high category, with 12 students scoring above 80, accounting for 42.86% of the total. This means that the students are already able to solve AKM questions and possess good mathematical literacy skills. The research results also show that there are still 10 students who have low mathematical literacy (numeracy) skills with a score range of only 47 to 57, and there are also 6 students who still fall into the moderate category with a score range of 65 to 75. This is indicated by the percentage of students who still fall into the low and moderate categories, respectively, at 35.71% and 21.43%. Based on the research data results, it can be concluded that the mathematical literacy (numeracy) skills of tenth-grade students at one of the high schools have a dominant high level of ability, although there are still students with moderate or low levels of ability.

The limitations of this study include the small sample size of 10th-grade students from a single school, so the generalization of the research results is still limited. In addition, the qualitative approach used may not fully capture the variation in mathematical literacy skills at a broader level.

For future research, it is recommended to involve a broader and more diverse sample, both in terms of educational levels and school locations, in order to obtain a more comprehensive picture. In addition, the use of mixed methods can provide a deeper understanding of the factors influencing students' mathematical literacy. Learning interventions that focus on strengthening concepts and contextual applications also need to be developed to comprehensively improve students' mathematical literacy.

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