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Numerical Literacy Ability In Learning Mathematics Based On 21st Century Skills In Primary School

Sutama, *Lecturer at Universitas Muhammadiyah Surakarta, sutama@ums.ac.id*
Meggy Novitasari, *Master in Primary Education, Universitas Muhammadiyah Surakarta, meggy151013@gmail.com*
Dan Sabar Narimo, *Lecturer at Universitas Muhammadiyah Surakarta, sabar.narimo@ums.ac.id*

Abstract. The general objective of this research is to create the model of mathematics teaching materials in a primary school in the 21st-century skills-based. The purpose of this study is to describe the profile of mathematical numerical literacy abilities in primary school students, including 1) solving problems, 2) analyzing information, and 3) interpreting the results of the analysis. This research as a whole was a research and development study. The type of this research was ethnographic qualitative research. The study was conducted at Sekolah Dasar Negeri Ngadirejo 1 Kartasura Sukoharjo, Central Java, in the academic year of 2019/2020. The data collection techniques utilized in this study were participatory observation, in-depth interviews, and document analysis. The data validation was completed by triangulating sources and time. The data analysis technique was done inductively. The results of the study regarding the profile of mathematical numerical ability literacy can be grouped into three, namely 1) Solving problems related to formulating problems, developing strategies, and questions-answers has already entrenched. 2) Analyzing information related to thinking and reasoning logically, observing sources, and using various methods still required to be cultivated. 3) Interpreting the results of the analysis related to determining the outcome of decisions and interactions with others still required to be accustomed to.
Keywords: 21st-century skills, abilities, numerical literacy, mathematics.

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INTRODUCTION

A great nation is marked by its literate society. A nation with a high literacy culture indicates the ability to collaborate and think critically, creatively, and communicatively so that it can contribute to the global competition. Literacy culture as a prerequisite for 21st-century life skills can be done through integrated education, ranging from families, schools, to the community. Mastery of six basic literacy, i.e., reading-writing literacy, numeracy literacy, scientific literacy, digital literacy, financial literacy, and cultural and citizenship literacy is strongly crucial not only for students but also for parents and all citizens.

Based on the above description, primary school mathematics teaching materials are highly significant to contain numerical literacy. Numeracy literacy is needed by students in all aspects of life, including at home, school, and community. Numerical literacy skills are needed to solve problems and interpret the results in mathematics learning. It occurs since numerical literacy requires logical thinking that makes it easier to understand mathematics (Irawan, 2016). Numerical ability is very helpful in understanding material, analyzing problems, and solving problems for students' critical thinking. The mastery of numerical literacy ability is one of the essential ways in shaping the world of education (St Clair, 2020).

In a brief, numerical literacy can be interpreted as the ability to apply number concepts and arithmetic skills in daily life and the ability to interpret quantitative information contained around students. According to Lange (2006), numerical literacy is knowledge and skills to (1) use a variety of numbers and symbols related to basic mathematics to solve practical problems in various contexts of daily life and (2) analyze the information displayed in various forms (graphs, tables, diagrams, charts) and then use the interpretation of the results of the analysis to predict and make decisions.

The numerical literacy ability of students in Indonesia is not as expected. The gap in numerical literacy ability in Indonesia can be shown from the results of PISA and TIMSS 2015. PISA results (OEDC, 2018)

confirmed that Indonesia obtained an average mathematical value of 386 from the highest average value of 490 while Singapore achieved the highest value of 564. From the result of TIMSS (2015), Indonesia obtained 397 math scores from the highest score achieved by Singapore, which was 618. Based on the mathematical scores from the PISA and TIMSS data, it is necessary to make efforts to cultivate numerical literacy skills early on in mathematics learning.

Numerical literacy requires students to solve problems in learning mathematics. The results of the PISA and TIMSS studies showed that Indonesian numerical literacy is not at a level as expected yet. One of the factors is because the ability of teachers to provide insight and design problems for critical thinking is not optimal (Baiq Rika Ayu Febrilia, 2019). To support the culture of numerical literacy, the government is trying to provide a curriculum related to the literacy component so that educators have optimal levels of literacy mastery and improve teacher quality in line with the Muscat Agreement, an agreement signed in 2014 by meeting delegations from the Global Education for All Meeting held by UNESCO (Muscat, 2015).

The results of a preliminary study conducted by researchers at Sekolah Dasar Negeri Ngadirejo 1 Kartasura Sukoharjo showed that students are able to analyze data from tables, diagrams and graphs well, but are not optimal in solving a problem (Analysis of student work documents, March 17th, 2020). The observation results of mathematics learning at Sekolah Dasar Negeri Ngadirejo 1 Kartasura Sukoharjo indicated that teachers tended to use conventional lecture methods. It can be interpreted that numerical literacy has not been optimally utilized in the learning of mathematics in primary schools where the research was conducted.

The results of the interviews showed that students in the study area tended to have difficulty in interpreting quantitative information contained in everyday life. It is supported by the results of research conducted by Mahmud, M., R, & Pratiwi, I., (2019), which presented that numerical literacy of students includes difficulty understanding questions; lack of student understanding of prerequisite material; difficulty building a resolution strategy; and difficulty in drawing conclusions. Therefore, numerical literacy in primary schools in this research site needs to be developed.

In increasing numerical literacy, students are required to solve problems in everyday life and are accustomed to analyzing information and drawing conclusions. It is reinforced by Annisa Indrawati (2019), which explained that the success of education is not in the mastery of science but in the real work of students who are consistent and practice through mathematical numerical habituation. Besides, Kus (2018) confirmed that educators who fulfill their main tasks and functions to teach mathematics with high interdisciplinary will produce students who are skilled in numeracy. Another alternative is for students to be able to master mathematical numerical literacy is accustoming to working on HOTS problems that are full of challenges. Students who can work on HOTS-oriented problems will lead the numerical literacy ability of students to be optimal (Larasati & Isnani, 2017). It is also supported by Novitasari, M., Sutama, Narimo, S., Fathoni (2019), which claimed that mathematics learning is one of the implementations of integrated activities (providing stimulus knowledge, technology, values, and skills) to develop potential and abilities (including numerical) of students.

Concerning accustoming students to working on HOTS questions, the Minister of Education and Culture Regulation No. 23 of 2015 declared that students work on HOTS questions with a collaboration system between friends and teachers. Therefore, educators must have optimal abilities to make decisions and solve problems. It will be useful in facilitating students to be confident and create something creative that is innovative in learning mathematics.

Mathematical critical thinking skills can be improved through regular exercises of numerical abilities and verbal abilities. Every teacher needs to analyze the level of numerical ability and verbal ability of students so the teacher can direct students to be more critical in completing mathematics (Irawan, 2016).

The ability of numerical literacy in primary school mathematics learning can be observed from indicators of problem-solving, analyzing information, and interpreting the results of analyzes. It is similar to Chrisyarani (2017) who identified indicators of numerical literacy ability, i.e., 1) solving problems related to formulating problems, developing problem strategies and questions and answers; 2) analyzing information related to logical reasoning, observing sources and using various methods; and 3) interpreting the results of the analysis related to determining the results of decisions and interactions with others.

Based on the above description, the general objective of this research and development model is to develop 21st-century skills-based mathematics teaching materials in primary school. The purpose of this research is to describe the numerical literacy abilities of mathematics in primary students. Numerical literacy ability profiles are broken down into three aspects, i.e., 1) solving problems, 2) analyzing information, and 3) interpreting the results of the analysis.

RESEARCH METHODS

This research as a whole was a research and development study. The type of this research was a qualitative ethnographic study. Ethnographic qualitative research guides researchers to explore and photograph social situations (Sutama, 2019) about the numerical literacy abilities of mathematics commonly practiced by primary school students. The study was conducted at Sekolah Dasar Negeri Ngadirejo 1 Kartasura Sukoharjo, Central Java, in the academic year 2019/2020.

Data collection techniques utilized in this study were participatory observation, in-depth interviews, and document analysis. The participatory observation was conducted during the process of learning mathematics. It was implemented to observe both students' and teacher's activities in the learning process, related to student abilities and teacher's skills regarding numerical literacy. An in-depth interview was conducted with the teacher and students. It was related to the ability of numerical literacy aspects including solving problems, analyzing information, and interpreting the results of the analysis. Interviews with the teacher included strategies for civilizing numerical literacy in the aspects of solving problems, analyzing information, and interpreting the results of the analysis. Document analysis was performed to analyze the archives related to the implementation of the lesson plan, learning media, and the results of students' mathematical work.

Validation of research data was done by triangulating sources and time. Research data analysis was applied inductively with the process of data collection, data reduction, data presentation, and reciprocally drawing conclusions (Sutama, 2019). The data collection activities to the data analysis in this research article are illustrated in Figure 1.

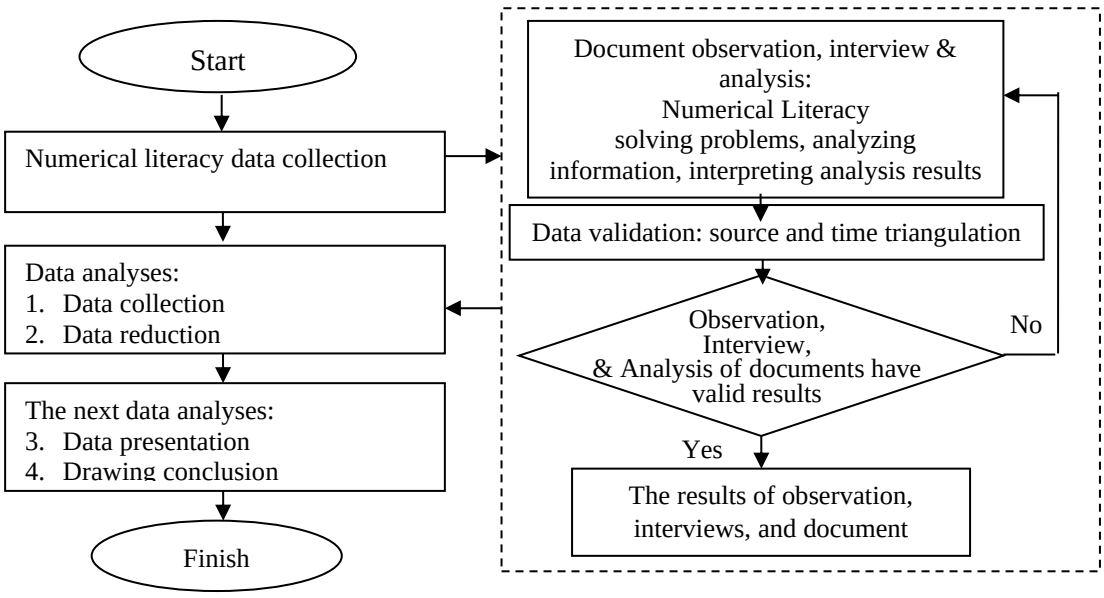


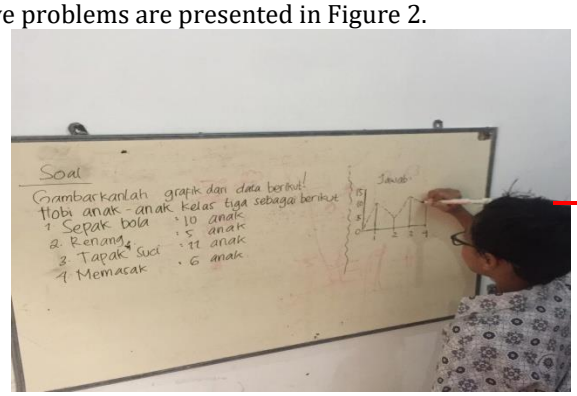
Figure 1. *Data collection activities to data analysis*

RESULTS AND DISCUSSION

The ability of numerical literacy in the process of learning mathematics contributed positively to students, especially in the ability to count and the ability to interpret data. The numerical ability profile in this article consisted of 1) Solving problems related to formulating problems, developing strategies and asking questions; 2) Analyzing information related to thinking and reasoning logically, observing sources and using various methods; and 3) Interpreting the results of the analysis related to determining the outcome of decisions and interactions with others. The three profiles of mathematical numerical literacy skills in primary school students in the study are outlined below.

Students were able to formulate identified problems, develop problem strategies related to data processing, and ask questions and answers in numerical literacy skills in aspects of being able to solve

problems. The examples of student work results that showed numerical literacy skills in aspects of being able to solve problems are presented in Figure 2.



Students were able to formulate problems, develop problem strategies, and ask question and answer.

Figure 2. *Solving problems*

Interview excerpt with students when solving problems are presented as follows (A=researcher; B=Students).

A: Are you able to understand the problem given?

B: Yes, the problem must be solved by drawing a graph, determining the coordinates of the points.

A: What do you do to be able to understand the problem given?

B: Find identified data, several types of data, and graphic formulas used and needed in x and y coordinates.

Based on Figure 2 and the interview excerpt, students grouped the data that was known and understood into a keyword, which can demonstrate the ability of numerical literacy on indicators of problem-solving. Students were able to solve problems shown by most students such as the ability to understand numbers and patterns that have been entrenched systematically so it will impact learning outcomes in mathematics better. It is reinforced by Utami et al. (2019), which argued that the application of problem-based learning and concept assignments can improve students' numerical literacy abilities.

The results of interviews with Primary School teachers explained that numerical literacy skills in aspects of being able to solve problems explicitly familiarized in learning mathematics but students were allowed to use outside of mathematics subjects, such as the contents of the subjects of Natural Sciences, Social Sciences, and Indonesian in various situations. It is supported by Culture (2017), which declared that using cross-subject mathematical skills enriches learning in other fields of study and contributes to broadening and deepening numerical understanding.

Furthermore, the teacher in this study expressed that to cultivate the numerical literacy of students, the teacher tried to enrich the problem-based learning strategy and project-based learning that involved problems in everyday life. The teacher in this study also practiced how to select, create, and modify everyday problems that can be used in classroom learning and for assessment. Furthermore, the teacher also developed assignments through guided student worksheets that can involve family members in numeracy literacy. Systematics of this guided student worksheet includes 1) concept development through guided discovery, 2) guided training with the assistance of family members, and 3) guided self-training. It is supported by the results of research, which indicated that teacher needs to train, accustom, and civilize students' critical thinking processes to improve numerical literacy by providing written exercises (As'ari, Kurniati, & Subanji, 2019).

In addition to what was stated above, the primary school teacher in this study also delivered at the beginning of each learning, students were always accustomed to understanding letter symbols and numeracy skills in numerous subjects such as the Mathematics, Natural Sciences, Social Sciences, and Indonesian Language. It is reinforced by the results of research, which concludes that to improve numerical literacy skills (Alkema, 2020), students are accustomed to understanding letter notation and are skilled at mathematics in learning. It was further conveyed that the teacher's skills in learning and the availability of adequate learning facilities were also highly supportive of the success of mathematics numerical literacy skills in elementary school students.

The description of numerical literacy ability in problem-solving aspects, which is related to formulating problems, developing strategies, and questioning for students in this study can be interpreted as already entrenched. It means that most primary school students in this study were able and accustomed to formulating

problems, developing strategies, and asking questions when solving problems.

The students in this study were entrenched in the ability of numerical literacy in problem-solving aspects. The teacher expressed that to create the majority of students capable and accustomed to formulating problems, developing strategies, and asking questions during problem-solving is not as easy as turning the palm. It required commitment and always stimulated students to think critically, creatively, and innovatively in a pleasant atmosphere. The teacher further stated that to cultivate mathematics learning, the students' mindset should be changed first. The teacher regularly reminded students that mathematics is challenging and fun. Learning mathematics is always challenged to solve problems from simple to complex in various ways. If students solve problems from easy to difficult even with the teacher's assistance, students will feel happy by celebrating their success with friends. It is supported by Baiduri (2019), which confirmed that planning math lessons will greatly assist the ability of numerical literacy if it starts with those students already know and seeks to build bridges to new content.

Several students were able to reason logically and observe sources while when using a variety of methods, they still required to be cultivated in the ability to numerical literacy on the indicators of analyzing information. Physical evidence showing numerical literacy on indicators analyzing information is illustrated in Figure 3.

Figure 3. *Analyzing information*

Based on Figure 3, some students were able to analyze information related to logical reasoning, observing sources, and using various methods with the teacher's assistance. Some students were able to analyze the information displayed in various forms (graphs, tables, charts, pictures) and then use the interpretation of the results of the analysis to predict and make decisions but others were not. It means that it still required to be cultivated.

Numerical literacy on the aspect of analyzing information can be observed from the activities of skilled-students in understanding the process of developing logical thinking and reasoning strategies in daily activities. It is reinforced by Umbara & Suryadi (2019) who explained that numerical literacy in the aspect of analyzing information will make students think more systematically and structurally in understanding the process of learning mathematics.

The results of an interview with one of the primary school students showed that he had difficulty when presenting information in a pie chart compared to presenting information in bar charts and tables. The student claimed that he forgot the steps to draw a circle diagram. The results of this interview can be interpreted that the student was not accustomed to presenting data in the form of pie charts that need to calculate the angle of each data element.

The results of interviews with the teachers indicated that the less optimal ability of students in numerical literacy on aspects of analyzing information on the most dominant factors causing teachers less accustomed students both in learning mathematics and the content of other subjects. First, the teacher did not accustom students to making tables. The example was in Social Sciences material about types of interactions. Making a table will make it easier for students to understand the material. If the students are already accustomed to making tables, then the mathematics material about presenting student data will be easier. Second, on some Indonesian language content materials, the teacher was less asking students to make a concept map chart. Third, teachers were not used to making graphics. For example in a Natural Science experiment about changing

forms, students should be accustomed to learning to make graphs with the time variable and the amount of ice that was melting.

In general, the implementation of numerical literacy in IV grade of primary school did require teacher creativity. The teacher was required to read, sort, select, and bring the material in the form of graphs, tables, charts, or pictures accordingly. If this continues, certainly the ability of numerical literacy in the aspect of analyzing information will be entrenched as expected. It would be better if students are accustomed to learning various concepts and applications of mathematics in other learning content. It is in line with the statement of Rizki & Priatna (2019), which declared that numerical literacy on aspects of analyzing information can improve mathematical thinking and reasoning in the process of learning mathematics and the content of other subjects.

Literacy culture needs to be built through learning patterns. Teachers' pedagogical competencies must be utilized to integrate numerical literacy in challenging but fun learning. Consistency in building a literate culture is indeed a challenge. However, numerical literacy culture can also be familiarized with collaborative learning based on humanistic social. For example, with adequate pedagogical conferences, the teacher accustomed students to learn in groups to work together respecting one another. Students were encouraged to think and express their ideas critically. Through this humanistic social-based collaborative learning, students will build creativity. If numerical literacy ability increases, students will feel confident in presenting the results of their work. It is in line with the results of the study that concluded that numerical literacy ability can improve the pedagogical competence of students and educators (Fiangga, M. Amin, Khabibah, Ekawati, & Rinda Prihartiwi, 2019). It means that efforts to cultivate numerical literacy can be done by organizing fun innovative learning.

The ability of numerical literacy on indicators to interpret the results of analyzes related to determining the outcome of decisions and interactions with others still needed to be accustomed to. The example of student work results that showed indicators interpreting the results of the analysis is presented in Figure 4.

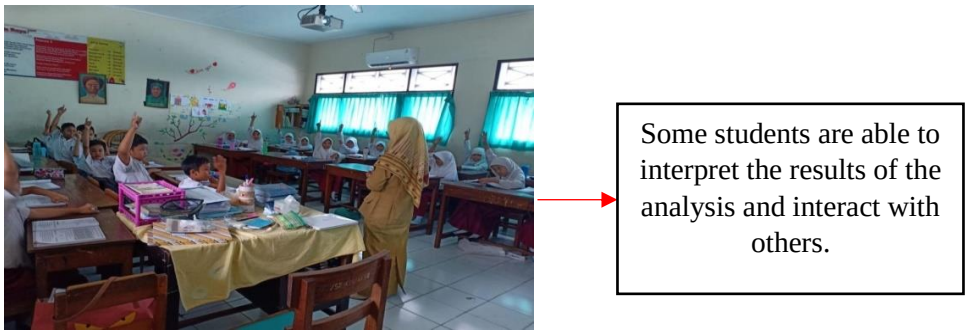


Figure 4. *Interpreting the results of the analysis*

Figure 4 shows some students were able to interpret the results of the analysis, related to determining the outcome of decisions and interactions with others. Determine the results of decisions both deductively and inductively and interaction with others means being able to communicate by showing the work process from beginning to end. Numerical literacy on indicators of the ability to interact with others indicated some students were enthusiastic in expressing opinions on the reflection process. Students still needed to be familiarized with the numerical literacy ability profile on aspects of interpreting the results of the analysis.

In the interview, the teacher stated that interpreting is used in the definition of mathematical literacy, which focuses on the ability of students to reflect on mathematical solutions and interpret problems in real-life contexts. Students involved in this process can build and communicate explanations and arguments in the context of the problem, which is reflected in the process and its results. Cultivating communication regarding the basic math skills of students required to be built regularly. This basic skill can control itself. It is in line with the argument of Novitasari et al. (2020), which stated that students who have more basic skills can elaborate answers by induction and deduction and can decide the right actions in interaction with others. It means that the teacher's effort to form numerical literacy skills in the aspects of interpreting the results of the analysis by optimizing basic skills that are more complete and in line with their knowledge and experience is a very crucial action.

Furthermore, the teacher explained that the process of interpreting mathematical results in a real-world context has been done through problem-based learning. This effort is felt to be not optimal in its

implementation since the teacher realized that he was not yet proficient in constructing contextual mathematical problems. Thus, as to familiarize students with numerical literacy skills in aspects of interpreting the results of the analysis, the teacher was aware of the shortcomings. However, the teacher always encouraged students to communicate with others so that the students' positive method was increased. It is supported by the results of research by Hayati & Kamid (2019), which clarified that the mathematical numerical literacy ability is closely related to interpreting contextual problems into mathematical language that can be interacted with others. The results of the study of Sutama, Anif, Prayitno, & Sari (2019) concluded that students' achievements who have metacognition knowledge will be more optimal than students who do not have metacognition knowledge. It means that even though a teacher has limitations, it is good not to give up. He must keep trying so that students are not left behind with others.

CONCLUSION

The 21st-century skills-based mathematics teaching materials developed in primary schools contain numerical literacy. Profile of numerical literacy abilities of mathematics in IV grade of at Sekolah Dasar Negeri Ngadirejo 1 Kartasura Sukoharjo, Central Java, in the of the academic year 2019/2020 are grouped into three, i.e., 1) solving problems, analyzing information, and 3) interpreting the results of the analysis. The profile results of each aspect of numerical literacy are described briefly below.

Profile of problem-solving skills related to formulating problems, developing strategies, and question and answer have been entrenched. Numeracy literacy skills on problem-solving aspects were explicitly familiarized in mathematics learning but students were allowed to use outside mathematics, such as the content of Natural Sciences, Social Sciences, and Indonesian subjects in various situations.

The ability to analyze information related to thinking and reasoning logically, observing sources, and using various methods still needed to be cultivated. Efforts to cultivate numerical literacy on aspects of analyzing information were completed by organizing fun innovative learning. For this reason, teacher pedagogical competence required to be improved following the demands.

Profile ability to interpret the results of the analysis related to determining the outcome of decisions and interactions with others still required to be familiarized. Optimizing basic skills that were more complete in line with their knowledge and experience was a very significant act to accustom numerical literacy to aspects of the ability to interpret the results of the analysis.

The limitation of the study was this study only explored a few issues related to numerical literacy in primary school mathematics learning. There are many other literacies in primary school learning that still need to be further investigated. Based on the limitations of this study, the next researcher can develop literacy-based teaching materials in addition to numerical literacy related to knowledge, technology, character values, and skills that need to be developed in primary school students.

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