Perception and understanding of Madrasah Tsanawiyah teachers on numerical literacy in mathematics learning

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Abstract. Numerical literacy is an ability that equips students with the ability to apply the concept of numbers, calculated operation skills and the ability to interpret quantitative information. However, those skills have not received much attention. Understanding of numerical literacy needs to be built, starting with teachers as leader of learning processes in schools. Therefore, this research aims to explore the perception and understanding of teachers on numerical literacy on mathematics learning. It can be used as the basis for the development of relevant, applicable and comprehensive learning models. This research is an observational research conducted on 33 mathematics teachers in Central Java. The data was obtained during July-August through an online interview. The data was analyzed qualitatively descriptively. The results founded 24 people or 72.73\% had never received literacy training, and only 5 respondents had literacy. In addition, only 48.49\% of total respondents understood numeration literacy and only 21.21\% of total respondents applied it in math learning. Interesting facts have been found when all teachers have used learning media from concrete examples in environments such as interpreting integers using thermometers; measuring flagpoles with Pythagoras; and classrooms and tubes to calculate surface area and volume. But respondents assumed that what they were doing was not part of numeration literacy.

1. Introduction
Numeration literacy is a skill to apply concept of numbers and arithmetic operations in counting. Knowledge of number symbols, number sequences, and number operations is required by students as a basis for performing mathematical operations [1]. Numerical literacy also relates to how students apply the concept of numeration and mathematical operations to real objects in everyday life and develop the ability to interpret quantitative information [2]. Numeration literacy mastery is closely related to mastery of techniques in converting objects into symbols, organizing data and determining the right formula for calculating an object [3].

Numeration literacy is so important because it is a basic skill to calculate and interpret real objects such as graphs and tables that often appears in daily life. It is depicted in daily life, where students understand situation and conditions, e.g. calculating area of cut part of the cake. In that case, students should be able to decide on the correspondence one by one, between the part that is the numerator and the part that is used as the denominator. This incident form of mathematical operation through the transformation of a real object into a symbol or number and how to operate it [4]. Based on this,
difficulties in applying mathematical concepts by students' are more likely due to poor numeracy literacy [5].

Numeracy literacy is also related to data literacy, turning data into an important asset for students in facing their careers in various fields to lead meaningful lives in the future while already working [6]. Therefore, the contribution of teachers in the delivery application concept of calculation to improve students' numeracy literacy is vital. Teachers as the driving force of the education system are required to master these numeracy literacy skills, so they are able bring students more easily to apply the concept of numeracy in learning process [4]. However, teachers' perceptions and understanding of numeracy literacy in the mathematics learning process require special attention because they are not yet fully understood. Thus, this study aims to explore more deeply how the perception and understanding of mathematics teachers towards numeracy literacy, as input in the development of learning.

2. Methods
This study is an observational study of exploration to determine the perception and understanding of literacy numeracy teachers in learning Mathematics. This research was conducted by involving 33 mathematics teachers from Madrasah Tsanawiyah (MTs) as respondents who were determined randomly. Data were collected through an online questionnaire using a Likert scale. The instrument in the form of a questionnaire consists of 42 closed questions that explore understanding and perceptions of numerical literacy. Data were analyzed descriptively qualitatively and interpreted in a narrative.

3. Results and Discussion
The response data obtained shows that the majority of respondents or more than 50% have never attended literacy training activities. However, a total of 16 out of 33 respondents understood and only seven of the respondents implemented numerical literacy in learning mathematics (Table 1). In addition, teachers who do not get training also feel the need to implement numeracy literacy in the mathematics learning. This is also in line with the response of teachers' perceptions that said teachers who do not know and follow the training also feel the need to implement numeracy literacy with the use of numbers and mathematical symbols and graphics in learning to solve calculation problems.

| Aspect           | Trained | Not Trained |
|------------------|---------|-------------|
| Number of Respondent | f | % | f | % |
| Knowledge        | f | % | f | % |
| Understand       | 9  | 27.27 | 24 | 72.73 |
| Not Understand   | 2  | 22.22 | 15 | 62.50 |
| Application      | f | % | f | % |
| Applied          | 5  | 55.56 | 2  | 8.33  |
| Not Applied      | 1  | 11.11 | 5  | 20.83 |
| Doubt            | 3  | 33.33 | 17 | 51.52 |

Based on the analysis, most of the respondents, especially from untrained groups, do not understand the definition of numerical literacy. It may be caused by distribution of their information related to numerical literacy among respondents were low. In addition, teachers' level of understanding in numeracy literacy training is considered high, or > 75%. Understanding related to numeracy literacy skills affects the level of application of numeracy literacy in the teaching process. Teachers who master numeracy literacy tend to apply their numeracy literacy knowledge in the learning process. However, some teachers are still not willing and doubtful the application of numeracy literacy even though they already understand numeracy literacy. Teachers who do not understand numeracy literacy do not apply and feel confused with the application of numeracy literacy. Teachers' skeptical levels indicate that basically both trained and untrained teachers do not fully understand how numeracy literacy should be applied. This is probably due to confusion in distinguishing the concept of numeracy literacy from other literacy, especially mathematical literacy (Table 2). In addition, teachers do not identify differences
between the learning process currently carried out and learning that adopts the concept of numeracy literacy.

Most teachers may have implemented numeracy literacy but teachers may feel confused in providing a definition between numeracy literacy and mathematical literacy. It is possibly caused by that numerical literacy has not been theorized much and difficult to distinguish from mathematical literacy, although the numerical literacy is wider used in various objects. Numerical literacy clearly has a difference with mathematical literacy. Numerical literacy is part of mathematical literacy but with a wider scope [7]. It is necessary to deepen the concept for teachers of both literacies so that its implementation in learning does not suffer from errors. Numeracy literacy is part of mathematics and has been used on other subjects [8]. Numeracy literacy is also used in everyday life, related to other relevant subject subjects such as 1) understanding issues in the community, 2) professional (in work), 3) recreational (e.g., understanding scores in sports and games), and cultural (as part of the in-depth knowledge and culture of human beings [9]. From the data obtained we can see that the scope of numeracy literacy is very wide, not only in mathematics subjects, but also in relation to other literacy, for example, literacy of culture and citizenship, health, economics, and others [10].

Numeracy literacy invites learners to calculate various quantitative data in daily life that come from various objects such as citizenship, history, health and so on. From this, the teacher's ability to cite literacy sources from various other literacy objects can be said to low.

On the other hand, teachers also feel that they have not been able to clearly define the relationship between problem solving and numeracy literacy and mathematical literacy. Mathematics teachers' perceptions indicate that teachers are still confused in understanding numeracy literacy, teachers are still confused in linking between numeracy literacy and problem solving (Table 2). The results of teachers' responses to numeracy literacy can be grouped into three main parts namely 1) numeracy literacy as a symbolic application; 2) numeracy literacy as tools for problem solving; and 3) numeracy literacy is considered a form of digitization concept of calculation (Table 2).

Table 2. Respondent’s Concept about numerical and mathematical literacy

| Topics            | Numerical Literacy                                                                 | Mathematical Literacy                                                                 |
|-------------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Application of Symbols | **Cluster 1:** Numerical literacy is considered as the use of numbers and mathematical symbols in solving calculation problems. The use of numbers and symbols includes the entire arithmetic sequence, all aspects of numbers and mathematical symbols and graphics. | **Cluster 1:** Mathematical literacy is interpreted as the application of mathematics in various contexts, is general in nature and contains aspects of numeration. Mathematical literacy is also associated with the ability to analyze, convey ideas, and solve problems in various situations effectively by using certain formulas or concepts. |
| Problem Solving   | **Cluster 2:** One respondent answered numeracy literacy is considered to be the application of mathematical concepts and interpretation of numbers in daily life | **Cluster 2:** Mathematical literacy only used in relation to mathematical concepts and according to educational level |
| Digitalization    | **Cluster 3:** Numeracy literacy is considered the digitization of the concept of calculation, numbers or the use of symbols | **Cluster 3:** Mathematical literacy is to formulate problems and solve problems and interpret mathematical problems. **Cluster 4:** Mathematical literacy is the ability to use potential not only in calculations but also in terms of reasoning, communication, etc. So it can be said that mathematical literacy is related to the development of ability |
Based on the results of the responses, most respondents are still confused in interpreting the concept of numeracy literacy, and have difficulty distinguishing between numeracy literacy and mathematical literacy. Respondents in this case mathematics teachers are not able to clearly distinguish between numeracy literacy and mathematical literacy. In addition, some respondents still have difficulty distinguishing between problem solving and digitizing concepts in numeracy literacy. Numerical literacy is different from mathematical competency literacy, where both are based on the same knowledge and skills, but have differences in the application of these knowledge and skills. Knowledge of concepts and mathematical literacy alone does not directly make a person have numeracy literacy skills.

Numerical literacy includes the skills to apply mathematical concepts and rules in real life situations. This concept is applied to both structured and unstructured problems, has many ways of solving, or even does not have a complete solution, and is related to non-mathematical factors. Even though teachers do not fully understand the concept of numeracy literacy and the majority are hesitant or feel they do not implement the concept, in fact all respondents have used objects in the school and home environment as learning media (Figure 1). The teacher has given lessons using props from nearby learning media sources. However, teachers still cannot manage the learning media into contextual learning media. For example, teachers have not used school data such as the frequency of borrowing books, or teachers have not been able to manage project-based mathematics learning. Figure 1 shows that the teacher implements literacy only from the school environment but not from the digital environment. However, the teacher gave response that numeracy literacy was a digitization of the concept of calculation. This means that the source of calculation training can come from digital information consisting of various objects in everyday life.

![Figure 1. Number of respondents who using mathematics learning media based on material sources](image)

Props and mathematics learning media are learning resources to help teachers explain learning materials. A real learning resource is an example of the application of numeracy literacy that gives the meaning of the concept so that it is easier to remember and easy to apply by students [11]. All teachers have used the physical environment around students to help visualize and apply mathematical concepts. Objects and the environment in schools are real media and teaching aids for learning mathematics so that they can facilitate students to understand abstract material more easily[12]. Converting real objects to symbols and numbers then defining formulas and interpreting calculation results is a high-level numeracy literacy skill. Therefore, teachers who apply numeracy literacy can actually practice the ability to interpret quantitative information by students. The application of numeracy literacy through learning media and props can build meaningful learning for students because the concept of learning can be applied directly in life [13].

In addition to containing the meaning of numeracy literacy with learning resources from the surrounding environment also develops the ability of high order thinking skills (HOTS) students. Numeracy literacy skills are explicitly taught in mathematics, but students are given the opportunity to use them outside of mathematical materials and learning or in a variety of situations. This is in line with the application of HOTS in learning [14]. One of the main features of numeracy literacy is practical.
This means that learning that applies numeracy literacy focuses on the use of media and learning resources that are real and come from around the life of students. Thus, it can be said that the scope of numeracy literacy is very wide, not only in mathematics subjects, but also in relation to other literacy, for example, literacy on health data, school accounting, and technology. Some of these literacy sources can be used as learning media so that the learning situation does not seem abstract but real [15].

Props and learning media can stimulate students in learning activities and reduce students' misunderstanding of the explanations given by educators [14]. Selection of props and learning media must be adjusted to the level of needs and characteristics of students. The selection of learning media and teaching aids around the school by the teachers shows their understanding of the impact of their use on students, in other words, learning media and teaching aids can be a learning experience with direct interaction between teachers, students, and their environment which can be used as a source of numeracy literacy. It can be said that the teacher has mastered the use of instructional media and teaching aids around the school as a source of numeracy literacy.

Numerical literacy is a tool to improve problem solving skills in everyday life, such as measuring a thermometer, reading tables and interpreting data [5]. Increasing students' problem solving skills can be implemented by implementing a problem-based learning model based on numeracy literacy [16]. Therefore, the combination of numeracy literacy with other subjects is also important to be implemented in learning. Teachers must ensure that students integrate content and skills, which are organized and adapted to the topic in solving problems. teaching with the concepts of numeracy literacy, content and skills must be integrated into every problem in real life, which is not necessarily structured according to the material being taught [17].

Understanding related to numeracy literacy as a tool to hone students' problem-solving skills needsto be improved. Because if the teacher's understanding in numeracy literacy is wrong then the great probability in applying numeracy literacy is also wrong. The application of numeracy literacy needs to consider the ability of students. Special skills are needed to collaborate between numeracy literacy and problem solving including: 1) identification, determination, organizing, linking, and restating; 2) construct, abstract, evaluate, justify, explain, and defend opinions; 3) interpretation, make assumptions, criticize, refute, classify. Therefore, the development of teachers' abilities in this area needs to be improved, because basically increasing the implementation of problem solving will also increase students' numeracy literacy/mathematical literacy.

4. Conclusion
Based on this result of this study, it can be concluded that teachers' perceptions of numeracy literacy do not yet have a complete understanding, but still not able to distinguish between numeracy literacy and mathematical literacy. Teachers already understand the use of learning media and props around as a source of learning numeracy literacy.

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