Profile of Numeracy Literacy Skill of Junior High School Student on Motion and Force Materials in Ethnoscience Learning

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Abstract. Numeracy literacy is the ability to use basic mathematical concepts to solve various problems that are often found in everyday life related to science. This study aims to analyze the numeracy literacy achievement of junior high school students on the material of motion and force in bull racing context that students had in ethnoscience learning. The context of bull racing is closely related to the use of motion and force materials in life to win the race. This research is a preliminary study with 288 students in grade VII, where there are three classes (VII A to VII I) in SMP Negeri 1 Kamal Bangkalan. The instrument used is a test based on numeracy literacy include numbers, measurements, and data in basic mathematic domain. Based on the results of the average percentage of each indicator that is equal to 0% (proficient); 3.19% (capable); 31.38% (basic); 65.43 (special intervention required). The average result of students' numeracy literacy achievement in the aspect of competence in motion and force materials in ethnoscience learning as a whole is 49.62% including in the low category. The conclusion of this study is that the competence aspect of numeracy literacy skills in class VII students in ethnoscience learning at SMP Negeri 1 Kamal Bangkalan is in the low category with a percentage average of 49.62 %.

Keywords: Ethnoscience, Force, Motion, Numeracy Literacy.

1   Introduction

Currently, the world is facing the transition from the Industrial Revolution 4.0 (I.R) to Society 5.0. The development of the 4.0 to 5.0 era focuses on the Sustainable Development Goals/SDGs [1]. Era I.R. 4.0, Society 5.0, and SDGs signify the importance of competency. There are 4 competencies needed, including leadership, language skills, writing skills, and including literacy [2, 3].

Literacy requires HOTs to study and analyze information so it requires skills [4, 5]. Literacy skills include basic literacy, scientific literacy, and mathematical literacy [6]. Mathematical literacy has a broad definition because it includes several skills, such as spatial literacy, numeracy literacy, and quantity literacy [7, 8]. Numerical literacy skills are currently one of the focuses of developing student literacy through School Literacy Movement (SLM) program.

Numerical literacy skills can be interpreted as skills using basic mathematical concepts in analyzing and understanding a statement in an activity in manipulating symbols or language to solve various problems and determine decision-making in

everyday life [9, 10]. Numerical literacy consists of three aspects, namely arithmetic, numeracy relations, and arithmetic operations. Counting is the ability to count an object verbally and the ability to identify the number of objects. Numerical relations are related to the ability to distinguish the quantity of an object such as more, less, higher, or shorter. Arithmetic operations were the ability to carry out basic mathematical operations in the form of addition and subtraction. The three aspects of numeracy literacy above were basic aspects in learning science and mathematics which are important to introduce from an early age until children enter the lower grades [11].

Numerical literacy skills are very important for students to have because numeracy skills are often needed in various aspects of life, both in community activities and in work [12, 7]. In everyday life, it is always necessary to use basic mathematical concepts or numeracy to solve various problems. Examples of using numeracy skills in everyday life to understand various information contained in the form of graphs, charts, and tables [13].

However, in reality, there are still many students who do not master numeracy literacy skills. This can be proven by the results of tests conducted by the Program of International Student Assessment (PISA) in 2018 in Indonesia, it was found that the literacy skills of Indonesian students earned 371 points and in the field of mathematics earned 379 points. These results explained that literacy skills and mathematics students in Indonesia are still below the average score and fall into the low category which is ranked 74 out of 79 countries [14]. This is also supported by data that some junior high school students still have difficulty solving word problems [15], difficulty reading [16], and analyzing graphical information into numerical data [17].

The lack of mastery of numeracy literacy skills for junior high school students indicates the need for improvement to be improved. One way to train junior high school students' numeracy skills is to use the context of everyday life in the subject matter to make it easier for students to understand the concept of the material because students can realize directly that the material they are learning is useful and relevant to everyday life [18]. Local wisdom is the context of life that is found daily in society and can be used as a context for a subject matter so that the material is more contextual, such as style and movement [19, 20].

An example of the type of local wisdom related to the material of style and motion is bull racing (karapan sapi) [18, 21]. Bull racing can be used as a context for real examples of the application of motion and style material in everyday life to be studied further in ethnoscience learning. The concepts of force and motion are applied directly to bull races such as the concept of the speed of a running cow, the distance traveled and the time it takes the cow to run, the relationship between the mass of the rider and the speed of the cow when it is moving and so on [18].

The object in the bull race is a pair of cows participating in the race, jockeys, and the tools used to unite the two cows. The movement of the bull race occurs when the cow participating in the race changes at a certain time. These changes were observed based on the reference point, namely the bull race audience. The trajectory of the bull race is in the form of a straight line from the start line to the finish line [21]. The context of bull racing is closely related to the use of motion and force materials in life to win the race.

The movements and styles contained in science material contain abstract concepts so they require other knowledge and skills such as the use of basic mathematical

concepts, multi-representation, scientific reasoning, and metacognition so that students can fully understand these concepts [22]. Mathematics has an important role in science. This is due to the use of many mathematical equations, numbers, symbols, and symbols in natural science concepts [23]. The results of several previous studies found that students' basic math skills have an influence on students' understanding of concepts in science subjects, especially in materials that require mathematical equations to learn them [24, 25, 26, 23]. Therefore, new information is needed through research related to "Profile of numeracy literacy skills of junior high school students on motion and force materials in ethnoscience learning". This study aims to analyze the numeracy literacy achievement of junior high school students on the material of motion and force in the bull racing context that students had in ethnoscience learning.

2   **Methodology**

This study is a quantitative descriptive research, involving 288 students of SMP Negeri 1 Kamal in grade VII from class A to I in the academic year of 2022/2023 as the subjects of the research. The number of samples in this study was determined using the Slovin formula with an error tolerance of 5%, and the sampling technique used simple random sampling because it was not based on a particular rank or category so the population tended to be homogeneous. Data were collected by using a test based on numeracy literacy including numbers, measurements, and data in the basic mathematic domain. This instrument consists of 10 questions with the type of multiple choice questions with 4 choices with 1 correct answer, complex multiple choice questions with many choices and more than 1 correct answer, and true-false test questions adopted from Pusmenjar [31]. The results obtained in this study were analyzed using a quantitative descriptive method. The results of students' numeracy literacy skills were calculated by the formula equation [27] as follows:

$$L = \frac{n}{N} x 100 \frac{\Sigma s}{[n(c-1)]} \tag{1}$$

Information:
    L   = total final value of numeracy literacy skills
    n   = total score obtained
    N   = maximum number of scores

    The results of the final scores of students' numeracy skills will be categorized using the categorization according to **Table 1.**

Table 1. Categorization of numerical literacy skills [24].

Results	Category
95 < L ≤ 100	Proficient
80 < L ≤ 95	Capable
55 < L ≤ 80	Basic
L ≤ 55	Special Intervention Required

3   Results and Discussion

The results obtained in this study indicated that the literacy numeracy skills of students in classes A to I required special intervention, showing an average of 49.62 (**Table 2**). Furthermore, it can also be seen that the percentage of numeracy literacy skills was based on the domain of basic mathematics which includes numbers, data, and measurements (**Figure 1**).

Table 2. Percentage of Number of Students based on Level of Numeracy Literacy Skills

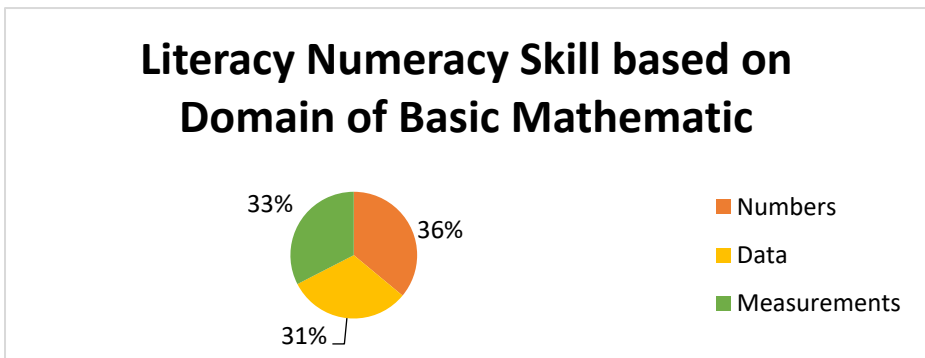| No.	Category	Number of Students	Percentage (%)
1.	Proficient	0	0
2.	Capable	6	3.19
3.	Basic	59	31.38
4.	Special Intervention Required	123	65.43
	Total	188	100

Fig. 1. Students' Literacy Numeracy Skill based on Domain of Basic Mathematics.

Levels of Numeracy Literacy Skills in Students. From the research results obtained in **Table 1**, out of 288 people, only 9 students (3.19%) had numeracy literacy skills in the capable category, 91 students (31.38%) were in the basic category, and the remaining 188 students (65.43%) were included in the special intervention required category. In this study, it was found that there were no students who had numeracy literacy skills in the proficient category.

One hundred and eighty-eight students had numeracy literacy skills in the category of special intervention required, indicating that students only have limited knowledge related to basic mathematics because the concepts mastered by students were not thorough, and had limited calculation skills. Ninety-one students who had basic numeracy literacy skills showed that students have knowledge of basic mathematics, have basic calculation skills on direct equations, and were able to solve simple, not complex, mathematical problems. Nine students had proficient levels of numeracy literacy skills, indicating that students could apply the knowledge they have regarding basic mathematics in a variety of contexts and more diverse problems, including bull racing [28].

With these results it can be seen that the overall average score for numeracy literacy skills was 49.62%, which was in the low category, so special intervention is needed. This means that almost half of the total research sample still has limited knowledge related to basic mathematics because the concepts mastered by students were not thorough and had limited calculation skills [28]. This is in accordance with the educational report cards for students throughout the Bangkalan Regency Junior High School level in 2022 showing that numeracy literacy skills were still below the minimum competency which affects their learning achievement [26]. The research findings obtained are in line with the results of previous research [24] that literacy and numeracy skills were important aspects of student achievement in science so if students have good literacy and numeracy skills, students will also perform well in science learning.

Numerical Literacy Skills based on Basic Mathematical Domains. When looking in detail at each domain of basic mathematics which includes numbers, data, and measurements, the numeracy literacy skills of SMP Negeri 1 Kamal Bangkalan students were obtained according to **Figure 1.** In order of the basic mathematical domains of numbers, data, and measurements, an average of 58.51% was obtained; 51.06%; and 52.88%. The highest average percentage was in the number domain and the lowest percentage was in the data domain. These results are in accordance with previous research [29]; the highest student numeracy skills were in the number domain, while the lowest was in the data domain [30].

The mastery of junior high school students in solving math problems from the results of the Trends in International Mathematics and Science Study (TIMSS) was also the highest in the algebra and number domain and the lowest in the data and probability domain. This was because in the number domain students can carry out thinking processes to solve a problem by using number concepts such as the representation of signs in numbers and types of numbers and can perform number operations such as addition, subtraction, multiplication, and division [17, 28, 31]. Competence in the data domain, namely when students have not been able to carry out the thinking process in solving a problem by using data concepts and data representations such as understanding information contained in various types of representations such as tables, bar charts, and pie charts and can interpret data from one representation to other representations [17, 28, 31]. Meanwhile, in the measurement domain, students can carry out thought processes in solving a problem by using concepts, procedures, or facts related to measurement in various units and quantities [28, 31].

Students' numeracy literacy skills based on the basic math domain obtained in this study were in line with previous research [24]. The results of a previous study [24] stated that the sequence of students' numeracy literacy skills from highest to lowest was the domain of numbers, measurement, and data. They also continued their research in 2021 which found a positive relationship with a strong correlation between student achievement in mathematics and student achievement in science [24]. This is because mathematical concepts, symbols, and equations are also used in science numbers, data, and measurements. When measuring concepts, symbols, and equations with specific numbers to get data, numerical literacy based on the domain of mathematics has a profound impact on the subject of Natural Sciences.

Based on the results and discussions discussed above, local knowledge can be used in the learning process in both theory and practice. By using local wisdom, the concepts contained in a material can be more contextual because students can know the actual use of these concepts in everyday life [32]. The use of the context of local wisdom in the learning process can be carried out, one of which was in learning ethnoscience in junior high schools. Because in reality, the original knowledge possessed by a community as a belief in the form of local wisdom in certain areas (indigenous knowledge) was sometimes not in accordance with knowledge that has been scientifically proven (scientific knowledge) [33]. The use of local wisdom contexts in junior high school ethnoscience learning can improve students' understanding of concepts, literacy, and thinking skills because they can collaborate science concepts that are scientifically tested with indigenous knowledge of the local community [34].

The use of bull racing as a context for motion and style material because through bull racing students can know directly that the material they are studying can be used in real life. The concept of motion and style that is relevant to bull racing, among other things, the concept of distance traveled can be seen from the distance traveled on the field when the race takes place. The concept of displacement can be known through the displacements made by cows during the race from the start line to the finish line. The concept of time can be known through the travel time required by the cow to cross the race track to reach the finish line. Concepts related to speed, speed, and acceleration can be known when the cow starts running. The concept of force can be known through the attachment to choosing the mass of the jockey or the tool used to accelerate the cow while running [18, 21]. This can then trigger students to construct their thinking to link the concepts of motion and style obtained at school with the local wisdom of bull racing so that students will find the right formula to win bull racing [34]. The thought constructions obtained train students to be skilled in numeracy literacy.

The low numeracy literacy skills of Bangkalan students, including at SMP Negeri 1 Kamal Bangkalan, in the material of style and motion in ethnoscience learning in the context of bull racing which is still below the minimum can be caused by various factors. First, the orientation of learning and teaching from the teacher to the students was still textual and teacher-centered so the teacher does not yet have complete knowledge and a real picture of the material correlation of style and motion in bull racing. Second, students were rarely trained to work on problem-based questions because the questions that were often used were remembering and memorizing, without analyzing and constructing formulas of motion and style in bull racing. Third, there was a feeling of laziness for students when they encountered reading questions that were quite long in a certain context because they were not used to practicing literacy and

numeracy in bull racing. Fourth, students still have difficulty understanding explicit and implied reading in math and science sentences in certain contexts. Fifth, students have not been able to interpret the contents of tables, graphs, and mathematical diagrams of the results of motion and force treatment on bull racing so it was difficult to make conclusions and determine the right formula.

The results obtained and the causes of the low numeracy skills of students who were still below the minimum were consistent with previous research [10], which stated that students' numeracy literacy skills during the Covid-19 pandemic were very low. Other studies stated that students' numeracy literacy skills were still minimal because students rarely worked on problem-based questions [35, 25]. This is supported by the previous research [11, 36, 16] that found students are not familiar with literacy and numeracy activities, especially in understanding contextual questions, mathematical operations, and mathematical data.

Therefore, it is necessary to make efforts to upgrade students' numeracy literacy skills in the material of style and motion in ethnoscience learning in the context of bull races. Efforts that can be made include: 1) students need to get used to thinking complexly from various kinds of views and perspectives with certain contexts to construct problems and alternative solutions to problem decisions from many sides [37]; 2) students need to be given exercises on long text questions that are contextual and socio-scientific issues to trigger literacy and numeracy skills [25]; 3) students needed to be given practice reading data from tables, graphs, mathematical diagrams and then be trained to interpret the data presented and ask to predict and make construction decisions based on certain considerations [17].

Efforts that can be made as a way of upgrading students' numeracy literacy skills are in accordance with the learning theories of Gagne, Ausubel, and Gestalt. Gagne's theory explains basic skills, such as counting from measurement and presenting and interpreting data and numbers on numeracy literacy skills that need to be possessed to master various complex things [38]. Ausubel's theory explains that in order for students to understand the concept as a whole and comprehensively, basic skills are needed, such as numeracy literacy skills through associating the material concepts of motion and style with the context of bull races so that they are useful and integrated in everyday life [39]. Gestalt theory emphasizes that mastery of a certain skill can be done through repeated experiments on mathematics, but also science [40].

4   **Conclusion**

According to the findings of this study, it can be concluded that the competence aspect of numeracy literacy skills in class VII students in ethnoscience learning at SMP Negeri 1 Kamal Bangkalan is in the low category with a percentage average of 49.62 % so special intervention is needed. This research has implications for contributing to the improvement of junior high school science ethnoscience learning in the context of certain local wisdom so as to provide information about numeracy literacy skills and the factors that influence them, as well as the relationship between numeracy literacy skills and understanding the concept of a particular material contained in local wisdom.

5   Suggestions

In line with the research that has been done, it can be suggested that 1) it requires careful planning and comprehensive knowledge from the teacher about local wisdom which is used as a science learning context so that it makes it easier for students to understand the concepts of the material being taught and skilled in numeracy literacy from local wisdom; 2) personal, socio-cultural, and scientific knowledge of students about a certain local wisdom is also very necessary to have a complete picture as numeracy literacy of the concepts of the material being taught; 3) the next research is expected to review numeracy literacy skills from the analysis of cognitive styles, learning styles, conceptual understanding, multiple intelligence, and student multi-representation.

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