Pre-service mathematics teachers' numeracy in

*Acehnese* culture-based minimum competence assessment

Marhami *, Rohantizani, Iryana Muhammad, Samsidar, Intan Anggraini

Department of Mathematics Education, Malikussaleh University, North Aceh, Indonesia

*Correspondence: marhami@unimal.ac.id
© The Authors 2023

Abstract

Pre-service mathematics teachers must have good numeracy skills because this ability is needed in all aspects of life, home, work, and society. This study aims to identify the numeracy skills of pre-service teachers on the Acehnese culture-based Minimum Competency Assessment (MCA). A descriptive quantitative method was used in this study with 24 numeracy MCA questions based on Acehnese culture as an instrument. The subject was 158 mathematics education students from three Aceh universities in their fourth and sixth semesters. The data were analyzed quantitatively and categorized based on high, medium, and low levels. The results showed that the overall numeracy ability of pre-service mathematics teachers is 50.06% in the medium category. At the level of knowing and applying, they received 69.38% and 46.62%, which were in the medium category. Meanwhile, they only obtained 39.76% in the low category for reasoning level. It indicated the student’s lack of ability in higher-order thinking. These results are expected to be input for educators to arrange learning that develops the numeracy skills of pre-service teachers.

Keywords: Acehnese culture; minimum competency assessment; numeracy


Received: 19 October 2022 | Revised: 23 October 2022
Accepted: 29 November 2022 | Published: 2 January 2023
Introduction

Numeracy is the ability to understand, reason with, and apply simple numerical concepts daily. Organization of Economic Co-operation and Development (OECD, 2016) reveals that numeracy is the knowledge and skill to use a variety of numbers and symbols related to basic mathematics to solve practical problems in various contexts of everyday life and to analyze information presented in various forms. It can be concluded that numeracy is an ability and students' skills in applying knowledge of mathematics and interpreting quantitative information are essential to solving contextual problems.

Numeracy is one of the skills set by United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2006 as one of the determinants of the nation's progress (Kemendikbud, 2017). This literacy is critical for students to master because it is closely related to applying mathematics to everyday life (Marhami, Lukman, et al., 2020; Muliani et al., 2021; Novita et al., 2021). When we can apply sensitivity to numeracy, of course, we will be able to manage our natural resources, and our human resources will be able to compete with other countries to become strong nations. In other words, a country's progress is directly related to how well its people can do the math, so efforts need to be made to improve math skills (Basri et al., 2021).

Numeracy is one measure of the quality of education in a country (Kurniawati & Kurniasari, 2019). So this numeracy is included in implementing the Minimum Competency Assessment (MCA) in schools. MCA is an effort made by the government to improve the quality of education in Indonesia in the mirror of the results of international assessments such as the Program for International Student Assessment (PISA) and Trends International Mathematics and Science Study (TIMSS), which are concerning. Based on these two international assessments, Indonesia has always been in the bottom 10 with a score that has yet to be satisfactory. Even in 2018, PISA's latest score of 379 is far from the international average (OECD, 2019). It led the Ministry of Education and Culture to replace the National Examination and focus on numeracy in MCA to improve scores in PISA and TIMSS in the next period (Kemendikbud, 2020a).

The unfamiliarity of Indonesian students with solving characteristic math problems such as TIMSS and PISA questions is one of the causes of low numeracy literacy skills at the international level (Wardhani & Rumiati, 2011). It is supported by the learning climate in schools where teachers must effectively provide students with habituation in solving problems requiring high-level thinking (Hadi & Novaliyosi, 2019; Marhami, Dahlan, et al., 2022). Numeracy is the basis of higher thinking or reasoning skills, such as critical thinking and solving problems (Dinni, 2018). In addition to research on students' numeracy skills (Baharuddin et al., 2021; Perdana & Suswandari, 2021; Sari et al., 2021), the numeracy abilities of pre-service teachers also deserve further study (Anderha & Maskar, 2021; Nadjamuddin & Hulukati, 2022). It is because pre-service mathematics teachers, who will later become good facilitators for students, must have good numeracy skills to improve students' numeracy skills. Nadjamuddin and Hulukati (2022) revealed that the pre-service mathematics teachers' numeracy skills still need to improve. Their research shows that most students need to correct
Pre-service mathematics teachers’ numeracy in Acehnese culture-based Minimum Competency Assessment (MCA).

Methods

In this study, researchers wanted to identify the numeracy of pre-service teachers using MCA questions based on Acehnese culture. Therefore, this research used a descriptive quantitative method. We used descriptive quantitative because the data was presented in numerical and descriptive form. The sample in this study consisted of 158 pre-service mathematics education (86 students in the 4th semester and 72 students in the 6th semester) from three major campuses in three cities in Aceh, Indonesia. They were Malikussaleh University in North Aceh, the Institute for Islamic Religion of Lhokseumawe in Lhokseumawe City, and Al Muslim University in Bireun. They have studied several math courses and already have a mathematical mindset.

Twenty-four questions with the Acehnese culture-based MCA were used in this study. The test items were taken from the book of Marhami and Rohantizani (2021), which experts have validated, tested on high school students, and tested for instruments such as validity, reliability, difficulty level, and differentiation. Question items were arranged based on three cognitive levels: knowing, applying, and reasoning. The aspects of these three levels were: (1) Knowing level: remembering, identifying, classifying, counting, retrieving/obtaining, and measuring; (2) Applying level: choosing strategies, stating/modeling, applying/executing, and interpreting; and (3) Reasoning level: reasoning analyzing, integrating, evaluating, inferring, and justifying (Kemendikbud, 2017).
The data were analyzed in three categories: high, medium, and low abilities based on cognitive levels. The grouping of numeracy abilities based on test results, as shown in Table 1.

**Table 1. Interpretation of the percentage of numeric MCA test**

<table>
<thead>
<tr>
<th>Score Range (%)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>71 - 100</td>
<td>High</td>
</tr>
<tr>
<td>41 - 70</td>
<td>Medium</td>
</tr>
<tr>
<td>≤ 40</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Results**

This research was conducted on students in the fourth and sixth semesters from three significant campuses in three districts or cities in Aceh. The data on the results of Acehnese culture-based numeracy skills for pre-service mathematics teachers at three major campuses in Aceh can be seen in Table 2.

**Table 2. Scores on MCA numeration questions based on Acehnese culture**

<table>
<thead>
<tr>
<th>Students</th>
<th>Descriptive Statistics</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; Semester</td>
<td>n: 86, 16.477, 5.085, 53.151</td>
<td>Medium</td>
</tr>
<tr>
<td>6&lt;sup&gt;th&lt;/sup&gt; Semester</td>
<td>n: 72, 14.375, 5.680, 46.371</td>
<td>Medium</td>
</tr>
<tr>
<td>Overall</td>
<td>n: 158, 15.519, 5.449, 50.061</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Ideal Maximum Score = 31

Table 2 above shows the MCA value or score for numeracy based on Acehnese culture, which is 15.519, half of the ideal maximum score of 31, and with a percentage of 50.06%. It illustrates that the numeracy skills of pre-service mathematics teachers are still in the moderate category. In the fourth semester, students' numeracy skills on the Acehnese culture-based MCA questions obtained a higher percentage value of 6.78% than the students' abilities in the sixth semester.

The Aceh culture-based MCA questions given to research subjects contained three cognitive levels of pre-service teachers: knowing, applying, and reasoning. The results of the scores or values of 158 pre-service mathematics teachers on the MCA numeracy questions based on the Acehnese culture in terms of cognitive level can be seen in Figure 1 below.
Pre-service mathematics teachers’ numeracy in Acehnese culture-based ...

Figure 1. Percentage of cognitive MCA numeracy of pre-service mathematics teachers

Level of knowing aims to assess students’ ability to recognize facts and concepts and identify processes and procedures for using mathematics in solving problems presented in the contextual form. At this level, students as pre-service mathematics teachers got 69.38% in the medium category. It means that most pre-service teachers can understand and solve the problem well. At the level they are applying, students are also in the medium category with a value of 46.62%, but the value is still below 50%. At the last level of reasoning, students still have difficulty solving problems that require reasoning ability, which is also one of the higher-order thinking skills (Dahliana et al., 2019; Marhami, Rohantizani, et al., 2020). It is shown in the average score obtained, which is a percentage of 39.76% in the low category.

The ability of pre-service mathematics teachers to MCA numeracy in this study based on Acehnese culture showed differences in students in the fourth and sixth semesters. It is shown in Table 3 below.

Table 3. Scores of numeracy MCA questions from the cognitive level in the fourth and sixth semester

<table>
<thead>
<tr>
<th>Cognitive Level</th>
<th>4th Semester</th>
<th>6th Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>Knowing</td>
<td>86</td>
<td>5.77</td>
</tr>
<tr>
<td>Applying</td>
<td>86</td>
<td>5.74</td>
</tr>
<tr>
<td>Reasoning</td>
<td>86</td>
<td>4.97</td>
</tr>
</tbody>
</table>

In Table 3 above, almost all are in the medium category. The high category, with an average percentage of 72.09%, is shown by 4th-semester students at the knowing level. In contrast, the low category, with an average percentage of 33.33%, is at the reasoning in the sixth semester.

Discussion

This study aims to identify the numeracy skills of pre-service mathematics teachers for the Acehnese culture-based Minimum Competency Assessment (MCA). The instrument used in this study was 24 MCA numeracy questions based on Acehnese culture, distributed to 158 pre-service mathematics teachers. It showed that the numeracy skills of pre-service teachers on
MCA questions based on Acehnese culture were moderate, with a percentage of 50.06%. Although classified as moderate, this value shows that students still do not have good numeracy skills, in line with research by Basri et al. (2021), Nadjamuddin and Hulukati (2022), and (Ayuningtyas & Sukriyah, 2020). At the same time, as future mathematics teacher candidates, students must have good numeracy skills to develop their students’ numeracy in the future.

The subject, fourth semester and sixth semester of pre-service mathematics teachers, was chosen because students in that semester had taken numerous mathematics courses and thus had a mathematical mindset. So, based on these two student levels, it is discovered that pre-service teacher students in the 4th semester have a more extraordinary numeracy ability with a percentage of 53.15% compared to 6th-semester students with a value of 46.37%, and both are in the medium group.

Students must use various cognitive skills to answer existing issues in the Minimum Competency Assessment (MCA). The cognitive level of MCA numeracy is divided into three levels: knowing, applying, and reasoning. These three levels are linked together like the rungs of a ladder.

The first level is the level of knowledge. The goal of school mathematics is mentioned in Principles and Standards for School Mathematics (NCTM, 2000) that pupils study mathematics with knowledge. Deep understanding can assist students in developing new knowledge based on existing knowledge or experience (Marhami, Hutabarat, et al., 2022; Pangesti, 2018). In this study, an average of 69.38% of pre-service mathematics teachers could identify facts, methods, concepts, and procedures for employing mathematics in problem-solving. This cognitive capacity reaches 72.09% in the high group among fourth-semester pupils.

Meanwhile, in the sixth semester, the score in the medium category was 66.15%. With this high level of understanding (more than 50%), it will be easier for students to use the ideas, facts, and processes they have learned to solve real-world problems. It is called level applying.

The next step after knowing is to apply what you have learned. Problems at the applying level aim to assess students’ ability to apply mathematical concepts, facts, procedures, and processes in solving contextual problems, for example: perform arithmetic calculations, solve equations, make logical deductions from mathematical statements, perform mathematical manipulations, interpret information from tables and graphs, represent and manipulate form in space (Marhami, Lukman, et al., 2020). These 11 students out of 158 are applying in the high category. As a result, the average application rate in the medium category is 46.62%.

The third level is the reasoning level. Higher-order thinking skills, such as reasoning, are commonly referred to as higher-order thinking skills (Brookhart, 2010). The capacity will be examined in the PISA questions (OECD, 2016). The significance of this skill is inversely proportional to the outcomes of pre-service mathematics teachers’ thinking ability, which is an average of 39.76% in the low category. This skill has the most significant level but the lowest score attained by pupils compared to other levels. Pre-service teacher students’ inadequate reasoning ability demonstrates a lack of ability to examine information, synthesize, and draw conclusions in contextual difficulties (Akuba et al., 2020; Asdarina & Ridha, 2020; Herizal et al., 2022).
The Ministry of Education and Culture divides numeracy contexts into personal, sociocultural, and scientific (Kemendikbud, 2020b). Only one set is used in this study, the sociocultural context. Acehnese culture is used, with dances, costumes, and decorations incorporated into the MCA questions that assess pupils’ numeracy skills. Because the culture exists around the student environment, incorporating Acehnese culture with MCA questions makes numeracy questions more contextual. On the other hand, students will be more interested in some long-forgotten Acehnese cultures (Rohantizani et al., 2022). As a result, students will be more interested in MCA numeracy problems based on Acehnese culture, which will indirectly boost students’ understanding of Acehnese culture. As we know, cultural actors are not required to sustain a culture alone; any community can be a pioneer in conserving culture. As a result, incorporating Acehnese cultural elements into mathematics subject matter, particularly in Minimum Competency Assessment questions, can be an option for exposing Acehnese culture that incorporates arithmetic and numeracy skills.

**Conclusion**

Pre-service mathematics teachers’ numeracy toward Aceh culture-based minimum competence assessment (MCA) is in the medium category. At the level of knowing and applying, their numeracy is also in the medium category. Meanwhile, they get a low category for the reasoning level. It shows the pre-service teachers’ inability to perform higher-order thinking tasks such as processing information, synthesizing, and drawing conclusions in contextual circumstances.

This research is limited to the number of samples that could be more representative. There is a need for more comprehensive research on pre-service mathematics teachers at all Aceh universities. Then further research on learning that can improve the numeracy skills of pre-service math teachers can have implications for improving students’ numeracy skills in Aceh and Indonesia.

**Acknowledgment**

The authors would like all participants to be involved in this research.

**Conflicts of Interest**

The authors declare no conflict of interest regarding the publication of this manuscript.

**Funding Statement**

The Institute for Research and Community Service (LPPM) of Malikussaleh University supported this research under the non-tax state revenue budget (PNBP) in 2022, under the Expert Assistant Distributed Project [grand number 176/PPK-2/SPK-JL/2022]
Author Contributions

**Marhami:** Conceptualization, writing - original draft, methodology, and visualization; **Rohantizani:** Writing - review & editing, formal analysis; **Iryana Muhammad:** Editing and supervision. **Samsidar and Intan Anggraini:** Investigation.

References


116


Kurniawati, I., & Kurniasari, I. (2019). Literasi matematika siswa dalam menyelesaikan soal PISA konten space and shape ditinjau dari kecerdasan majemuk [Students' mathematical literacy in solving PISA questions on space and shape content based on multiple intelligences]. Mathedunesa, 8(2), 441–448.


