

Empowering Indonesian Students to Enhance Numeracy Literacy Skills

Aldi Prasetyo¹, Muchamad Muchibuddin Waly², Fauzi³, Rohmad⁴

¹ Graduate School, Universitas Islam Negeri Prof. KH. Saifuddin Zuhri Purwokerto, Indonesia : aldiprasetyo150196@gmail.com¹

² Department of English Language Education, Universitas Negeri Yogyakarta, Indonesia : muchibwaly@gmail.com²

³ Graduate School, Universitas Islam Negeri Prof. KH. Saifuddin Zuhri Purwokerto, Indonesia : fauzi@uinsaizu.ac.id³

⁴ Graduate School, Universitas Islam Negeri Prof. KH. Saifuddin Zuhri Purwokerto, Indonesia : rohmad@uinsaizu.ac.id⁴

* Corresponding Author : Aldi Prasetyo

Abstract: International assessments have consistently indicated that Indonesian students' numeracy literacy skills rank relatively low, raising significant concerns for the national education system. This study employs a quantitative research approach with a quasi-experimental design conducted at two elementary schools in Indonesia. The findings demonstrate that student empowerment within the learning process contributes to improved academic performance. This empowerment strategy involves utilizing high-achieving students as peer tutors to support their classmates in understanding numeracy literacy concepts. The implementation of student empowerment strategies in the experimental classes in both schools showed positive outcomes. Initially conducted in the first school, the experimental class achieved an average score of 66.47, whereas the control class recorded a lower average of 49.36. The Mann-Whitney test result of 0.011 indicates a statistically significant difference in learning outcomes between the two groups. Similarly, in the other school, the experimental class attained an average score of 80.00, whereas the control class scored 58.75. The Mann-Whitney test result of 0.001 further confirms a significant disparity in academic performance between the experimental and control groups.

Keywords: Academic Achievement, Numeracy Literacy, Peer Tutoring, Student Empowerment

1. Introduction

Literacy and numeracy skills are fundamental to students' academic success and future opportunities. However, Indonesia continues to face significant challenges in these areas, as reflected in various international assessments. The Programme for International Student Assessment (PISA) has consistently placed Indonesia among the lowest-performing countries since it participated in 2000 (Prasetyo & Fauzi, 2022). Likewise, the Progress in International Reading Literacy Study (PIRLS) has repeatedly ranked Indonesia at a low level compared to other participating nations (Millah et al., 2022). The latest PISA 2022 results reaffirm that Indonesia's literacy performance remains below the international average, even lagging behind other Southeast Asian countries such as Malaysia and Singapore (OECD, 2018, 2022).

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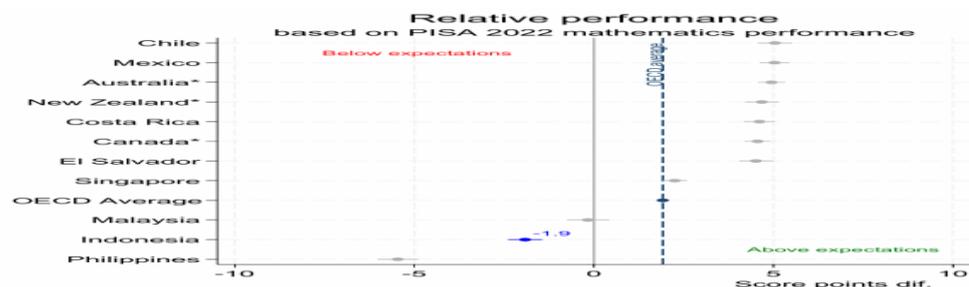


Figure 1. PISA 2022 Assessment Results

The figure above presents the most recent PISA assessment results from 2022. In response to these challenges, the Indonesian government has launched various initiatives to improve literacy and numeracy skills. Programs such as the *Gerakan Literasi Sekolah (GLS)* or School Literacy Association, introduced through Ministerial Regulation of Education and Culture No. 23 of 2015, and the *Asesmen Kompetensi Minimum (AKM)* or Minimum Competency Assessment aim to enhance students' reading comprehension and mathematical reasoning (Bano et al., 2024; Prasetyo et al., 2023). One of the key activities within GLS involves a 15-minute daily reading habit before lessons begin. However, despite these efforts, national and international assessments indicate that these programs have not yet produced significant improvements in students' literacy and numeracy outcomes.

Given these findings, this study seeks to examine whether Indonesia's poor literacy performance, as reflected in PISA results, aligns with the actual conditions in schools. To explore this, a survey was conducted among teachers of 32 elementary schools in Indonesia, with 38 respondents participating. The results revealed that 63.2% of teachers reported their students struggling with literacy and numeracy tasks, while 2.6% stated that their students were unable to complete such tasks. In contrast, only 34.2% of teachers believed their students could successfully tackle literacy and numeracy exercises.

Further preliminary classroom observations represented at one of the elementary schools in Central Java, Indonesia identified critical issues in instructional communication. Many students who struggled to grasp the material refrained from asking questions, leaving teachers unaware of their difficulties. Despite teachers providing opportunities for students to seek clarification, many remained hesitant due to a lack of confidence or fear of embarrassment. This communication gap hindered effective learning and reinforced students' challenges in literacy and numeracy.

To address this issue, an interactive learning approach is essential. Effective communication fosters active engagement, increases motivation, and improves learning outcomes (Bitu et al., 2024). Research suggests that peer tutoring can serve as an effective bridge to enhance student interaction. Setyanto stated that students feel more comfortable seeking help from their peers, reducing their reluctance to ask questions (Setyanto, 2017, p. 94). Schunk further emphasizes that peer interactions can serve as an effective instructional strategy, enabling students to reinforce their understanding by teaching one another (Schunk, 2020, p. 345).

Building on these abovementioned background, this study aims to enhance literacy and numeracy skills by leveraging peer tutoring as an instructional approach. Students with stronger academic abilities will be empowered to assist their peers, fostering a more interactive and supportive learning environment. Peer tutors will provide guidance, while the other peer receiving support will be encouraged to actively engage in discussions and seek clarification on concepts they find challenging. Through this strategy, the study seeks to determine the effectiveness of student empowerment in improving literacy and numeracy outcomes.

2. Proposed Method

This study aims to improve the numeracy literacy skills of Madrasah Ibtidaiyah (MI) students within LP Ma'arif NU in Banyumas Regency by empowering students who possess stronger numeracy literacy abilities to assist their peers. A quantitative approach with a quasi-experimental design was adopted for this research, which is commonly employed to determine the effects of a specific intervention (Arib et al., 2024). The research was conducted in two elementary schools in Indonesia, with fifth-grade students participating in the study. This particular grade level was chosen because these students are preparing for the Minimum Competency Assessment (AKM), a national evaluation of literacy skills.

To collect data, a numeracy literacy test comprising ten questions was administered. Prior to the administration of the test, the items underwent expert judgment validation to ensure their relevance, clarity, and appropriateness for the grade level. The expert validation process was carried out to confirm that the test items effectively measured the intended numeracy skills. After data collection, the learning outcomes of the experimental and control groups were analyzed using the Mann-Whitney U test. This statistical test was chosen because the data did not follow a normal distribution, making it an appropriate method for comparing the results between the two groups. The average scores of both the experimental and control groups were also calculated to assess the overall impact of the intervention.

The study was conducted in two phases. In the first phase, a pre-test was administered to both the experimental and control groups before the intervention. This test served as a baseline to measure the students' numeracy literacy skills. In the second phase, the intervention was implemented. In the experimental group, students with stronger numeracy literacy skills were tasked with supporting their peers by engaging in peer tutoring. These students acted as tutors, explaining numeracy concepts and assisting their classmates who had difficulties understanding the material. The control group continued with the conventional classroom teaching methods, without the peer tutoring intervention. Following the intervention, both groups took the same numeracy literacy test to assess any improvement in their skills.

The data was analyzed by calculating the post-test scores of both groups and comparing them using the Mann-Whitney U test. This test helped determine if the difference in scores between the experimental and control groups was statistically significant. A p-value of less than 0.05 indicated that the peer tutoring intervention had a significant impact on the students' numeracy literacy skills.

Several strategies were employed to ensure the validity of the study. First, content validity was ensured through the expert judgment process, where experts in the field reviewed and validated numeracy literacy. This ensured that the test items were relevant to the skills being measured. Second, the study's internal validity was addressed by using a quasi-experimental design with experimental and control groups. While random assignment was not possible, efforts were made to ensure that both groups were similar at the start of the study. Lastly, the study's external validity was supported by its potential generalizability to similar educational contexts, particularly in elementary schools in Banyumas, Indonesia.

3. Results and Discussion

Student Empowerment in the Learning Process

Student empowerment is implemented to promote collaborative learning. Collaboration is a vital 21st-century talent (Samala et al., 2024). During the learning process, students support their colleagues who are in need. This is accomplished through peer tutoring, in which students who teach their classmates are known as tutors, and those who learn from them are known as tutees. In this setting, the tutor acts as a liaison between students and teachers, especially for those who are unwilling to ask their teacher about subjects they don't comprehend owing to shame, fear, or hesitation.

Students' similarities in age, language competency, and social interactions make communication between tutors and tutees easier. Using tutors as intermediates rather than relying only on the teacher helps tutees to ask more freely about areas they struggle with. Tutees feel better at discussing topics in the same communication style they use when playing with pals. Students who are not fluent in the Indonesian language frequently struggle to articulate themselves, especially those sections of the curriculum they don't comprehend. Communication during tutoring serves as a form of teaching (Schunk, 2020, p. 345).

Numeracy literacy is taught using a variety of mathematical symbols. Many students despise mathematics (Prasetyo, 2021). Therefore, mathematics training should be provided comfortably and interestingly. Involving peers as tutors contributes to a less stressful learning environment. This is because learning with peers simulates a comfortable and playful

environment. The use of peer tutors is also appropriate for numeracy literacy training(Schunk, 2020).

The learning process follows a typical instructional format. The teacher begins by teaching or guiding all students to understand the content being studied. The teacher then assigns assignments to measure pupils' comprehension. When pupils finish the exercises, the teacher checks their answers. Based on the students' responses, the teacher determines who has mastered the content and who requires additional help. The next phase is to select pupils who have understood the topic as tutors, while the rest become tutees. After selecting the tutor and tutee, the teacher assigns extra exercises for the tutoring session. To promote a comfortable and conducive learning atmosphere, tutees are free to choose their tutors. The teacher's responsibility is to facilitate and organize learning, ensuring that tutors guide tutees through the learning process rather than merely providing answers. Tutors must adhere to a set of guidelines when assisting tutees.

There are three major rules for tutors. First, tutors must be patient when guiding tutees. Second, tutors should not provide direct solutions but rather outline the actions that the tutee should do. Third, tutors must write down any queries they are unable to answer. The third rule allows the teacher to assist tutors with any questions that they are unable to answer. Throughout the tutoring process, the teacher goes about the classroom to supervise the sessions and ensure that they follow the stated rules. Furthermore, the teacher assists tutors who need additional clarification when their tutees have questions they cannot answer.

Learning Outcomes of the Experimental and Control Classes

Based on data collected through tests, the experimental class achieved better learning outcomes than the control class. The experimental class received an intervention in which students were empowered to help one another in understanding the material. In contrast, the control class relied solely on teacher explanations and a question-and-answer process between the teacher and students. The results of this comparison can be seen in the following image.

| | | Statistics | |
|---|--------------------|------------------|-----------------|
| | | kelas eksperimen | Kelas Kontrol |
| N | Valid | 17 | 16 |
| | Missing | 0 | 1 |
| | Mean | 66.47 | 49.38 |
| | Std. Error of Mean | 4.692 | 3.705 |
| | Median | 70.00 | 50.00 |
| | Mode | 70 ^a | 30 ^a |
| | Std. Deviation | 19.346 | 14.818 |
| | Variance | 374.265 | 219.583 |
| | Range | 60 | 40 |
| | Minimum | 30 | 30 |
| | Maximum | 90 | 70 |
| | Sum | 1130 | 790 |

a. Multiple modes exist. The smallest value is shown

Figure 2. Average Scores of the Experimental and Control Classes at a Primary School in Cipete

Based on the image above, it can be seen that the experimental class, which involved empowering students in the learning process, achieved a higher average score than the control class. The average score of the experimental class was 66.47, while the average score of the control class was only 49.38. The experimental class consisted of 17 students, while the control class had 16 students. This result indicates that empowering students by involving those with better abilities to teach their peers, allowing them to better understand the material being studied together, positively impacted the students' learning outcomes.

The results of the statistical test using the Mann-Whitney test showed significant findings. In this statistical analysis, the researcher used IBM SPSS Statistics 23, with a result of 0.011. The decision rule is that if $Asymp. Sig. (2-tailed) < 0.05$, the result shows a significant difference. Comparing the values, the calculated result of 0.011 is less than 0.05, meaning there is a significant difference between the test scores of the experimental class and the control class.

The implementation at a primary Islamic school in Dawuhanwetan demonstrated similar results, where the learning outcomes of the experimental class were higher than those of the control class. The average score for the experimental class was 80, while the control class had an average score of only 58.75. The experimental class consisted of 15 students, whereas the control class comprised 16 students.

These findings further reinforce that empowering students to assist their peers who have not yet fully grasped the material has a positive impact on student learning outcomes there. The calculated results are clearly presented in the following figure.

| | | Statistics | |
|--------------------|---------|------------------|---------------|
| | | kelas eksperimen | Kelas Kontrol |
| N | Valid | 15 | 16 |
| | Missing | 1 | 0 |
| Mean | | 80.00 | 58.75 |
| Std. Error of Mean | | 4.577 | 3.966 |
| Median | | 80.00 | 65.00 |
| Mode | | 70 ^a | 70 |
| Std. Deviation | | 17.728 | 15.864 |
| Variance | | 314.286 | 251.667 |
| Range | | 70 | 50 |
| Minimum | | 30 | 30 |
| Maximum | | 100 | 80 |
| Sum | | 1200 | 940 |

a. Multiple modes exist. The smallest value is shown

Figure 3. Average Scores of the Experimental and Control Classes at a primary Islamic school in Dawuhanwetan

The statistical test using the Mann-Whitney method also showed significant results. Statistical analysis, conducted using IBM SPSS Statistics 23, yielded a significance value of 0.001. The decision-making basis is that if the Asymp. Sig. (2-tailed) is less than 0.05, the results indicate a significant difference. In this case, the calculated result of $0.001 < 0.05$ confirms a significant difference between the test scores of the experimental and control classes.

These findings further legitimize that a learning approach emphasizing student involvement in the learning process can have a positive impact on learning outcomes (Rohmah & Hermawan, 2025; Subekti et al., 2024). The role of an educator is not limited to the classroom teacher alone; rather, a creative teacher can empower students with strong academic abilities to serve as peer tutors. Through collaborative learning between tutors and tutees, cognitive development can be enhanced (Alifah & Selaras, 2024).

The learning environment plays a crucial role in student progress. A positive environment can encourage disengaged students to become more interested in learning, while a less supportive environment can demotivate even diligent students. Student empowerment in learning fosters an ideal learning atmosphere. Encouragement from peer tutors contributes to a stimulating learning environment, where both the surrounding environment and peers facilitate knowledge construction (Roopnarine & Johnson, 2011, p. 248).

From Vygotsky's perspective, students require scaffolding to actualize their highest potential (Musthofa et al., 2024). This assistance should come from individuals with more advanced skills. Scaffolding refers to support that enhances students' abilities by linking their existing knowledge with what is needed to understand or solve problems (Saputra et al., 2024). However, scaffolding does not involve simply providing ready-made answers; rather, it is adapted to the student's level, guiding them toward independent problem-solving.

In this study, peer tutoring refers to students who have already grasped the material helping their classmates who are still struggling. The assistance provided by the tutor enhances the tutee's learning ability (Rohman et al., 2024). Cognitive development is further supported

by shared age, classroom setting, social interactions, and daily communication, all of which contribute to a comfortable and engaging learning environment. The similarity in language proficiency between tutors and tutees also facilitates effective communication.

For tutors, the experience of teaching their peers reinforces their own understanding of the material. The act of teaching helps them solidify their knowledge and reach their own learning goals (Hutauruk et al., 2024). Before tutoring, they review the material to ensure they can address any questions from their tutees. Meanwhile, tutees benefit from a more open learning environment. They tend to feel more comfortable asking questions of a peer tutor they trust, particularly one they have chosen themselves. Peer tutoring also allows tutees to ask repeated questions without hesitation, unlike in traditional classroom settings where students often claim to understand a teacher's explanation even when they do not out of fear of appearing unknowledgeable.

Empowering students to teach their peers fosters intrinsic motivation for learning. The tutoring process creates a supportive learning environment, encourages a sense of responsibility, and deepens understanding through tutor-tutee discussions (Lathifa et al., 2024). Student empowerment in the learning process also enhances active participation. According to Setyanto, explanations provided by peers create a more enjoyable learning experience and reduce feelings of intimidation (Prasetyo, 2019, p. 27).

To ensure the success of peer tutoring, careful selection of tutors is essential. According to Wulandari, six key criteria should guide tutor selection: (1) the student has a stronger grasp of the material than their peers, (2) the student is willing to help others, (3) the student can collaborate effectively, (4) the student is accepted by their peers, (5) the student is humble and patient rather than authoritative or harsh toward the tutee, (6) the student can explain concepts clearly and patiently, (7) the student has a strong understanding of the material, and (8) the student is highly motivated to teach others (Prasetyo, 2019, p. 31).

Selecting the right tutor is critical, as a poor choice may discourage tutees from engaging in learning. Therefore, in this study, students were allowed to choose their own tutors from a pre-selected group identified by the teacher. This approach ensured that tutees could select a tutor they felt comfortable communicating with, reducing the risk of conflict between tutor and tutee due to a lack of familiarity.

4. Conclusions

The research findings indicate that student empowerment is carried out by encouraging students who have already understood the material to assist their peers who have not yet grasped it. The learning process is designed based on peer tutoring, which is rooted in collaborative learning. The active participation of students helps create an effective learning environment. The experimental results show that this approach, empowering students who have mastered the material to support their peers, has a positive impact. Learning outcomes using this design are superior to learning that does not incorporate student empowerment. In an experiment conducted at a primary Islamic school in Cipete, the average learning outcome in the experimental class was 66.47, while the control class achieved an average of only 49.38. A statistical test using the Mann-Whitney method yielded a significance value of 0.011, indicating a significant difference between the learning outcomes of the experimental and control classes. Similarly, in an experiment at another primary Islamic school in Dawuhanwetan, the experimental class achieved an average score of 80.00, whereas the control class scored only 58.75. The Mann-Whitney statistical test showed a significance value of 0.001, confirming a significant difference in learning outcomes between the two groups.

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