

THE EFFECT OF THE REALISTIC MATHEMATICS EDUCATION APPROACH ON THE NUMERACY LITERACY SKILLS OF PRIMARY SCHOOL TEACHER EDUCATION STUDENTS AT BATTUTA UNIVERSITY

Dichi Akbar Wahyudi

STKIP Pangeran Antasari. Veteran Ps. 4, Helvetia, Kab. Deli Serdang, Sumatera Utara, Indonesia

e-mail: dichiakbar22@gmail.com

ABSTRACT

Keywords: Mathematics Education, Numeracy Literacy, Primary School Teacher Education Students, Quantitative Research, Realistic Mathematics Education

This study aimed to examine the effect of the Realistic Mathematics Education (RME) approach on the numeracy literacy skills of students in the Primary School Teacher Education Program at Universitas Battuta. The study employed a quantitative approach using a quasi experimental method with a nonequivalent control group design. The sample consisted of 60 students, comprising 30 students in the experimental class and 30 students in the control class. The research instrument was a contextual essay test designed to measure numeracy literacy skills and had met the criteria of validity and reliability. Data were analyzed using descriptive and inferential statistics through the Independent Samples t Test after fulfilling the assumptions of normality and homogeneity. The results indicated that the experimental class achieved a higher posttest mean score of 86.27 compared to 74.13 in the control class. Furthermore, the normalized gain score of the experimental class was 0.65, while the control class obtained 0.35. The hypothesis testing revealed a significance value of 0.000 ($p < 0.05$), indicating a statistically significant effect of the Realistic Mathematics Education approach on students' numeracy literacy skills. These findings suggest that integrating real world contexts into mathematics instruction effectively enhances students' ability to understand, analyze, and apply mathematical concepts to solve contextual problems. Therefore, the Realistic Mathematics Education approach can serve as an effective instructional alternative for improving the numeracy literacy skills of prospective primary school teachers.

Abstrak

Penelitian ini bertujuan untuk menganalisis pengaruh pendekatan *Realistic Mathematics Education* (RME) terhadap kemampuan literasi numerasi mahasiswa Program Studi Pendidikan Guru Sekolah Dasar Universitas Battuta. Penelitian menggunakan

pendekatan kuantitatif dengan metode eksperimen semu (*quasi experiment*) dan desain *nonequivalent control group design*. Sampel penelitian berjumlah 60 mahasiswa yang terdiri atas 30 mahasiswa pada kelas eksperimen dan 30 mahasiswa pada kelas kontrol. Instrumen penelitian berupa tes kemampuan literasi numerasi berbentuk soal uraian kontekstual yang telah memenuhi kriteria validitas dan reliabilitas. Analisis data dilakukan menggunakan statistik deskriptif dan statistik inferensial melalui uji *Independent Samples t Test* setelah memenuhi asumsi normalitas dan homogenitas. Hasil penelitian menunjukkan bahwa rata rata nilai *posttest* kelas eksperimen sebesar 86,27 lebih tinggi dibandingkan kelas kontrol sebesar 74,13. Nilai *normalized gain* kelas eksperimen sebesar 0,65, sedangkan kelas kontrol sebesar 0,35. Hasil uji hipotesis menunjukkan nilai signifikansi sebesar 0,000 ($p < 0,05$), yang menunjukkan bahwa terdapat pengaruh yang signifikan dari penerapan pendekatan *Realistic Mathematics Education* terhadap kemampuan literasi numerasi mahasiswa PGSD Universitas Battuta. Temuan ini menunjukkan bahwa pembelajaran yang mengintegrasikan konteks nyata ke dalam proses pembelajaran matematika mampu meningkatkan kemampuan mahasiswa dalam memahami, menganalisis, dan menerapkan konsep matematika untuk menyelesaikan berbagai permasalahan kontekstual. Oleh karena itu, pendekatan *Realistic Mathematics Education* dapat dijadikan sebagai salah satu alternatif pembelajaran yang efektif dalam mempersiapkan calon guru sekolah dasar yang memiliki kompetensi literasi numerasi yang baik.

Kata kunci: Literasi Numerasi, Mahasiswa Program Studi Pendidikan Guru Sekolah Dasar, Pendidikan Matematika, Pendekatan *Realistic Mathematics Education*, Penelitian Kuantitatif

INTRODUCTION

The advancement of science, technology, and the increasing demands of twenty-first century competencies have transformed the paradigm of mathematics education from a procedure-oriented approach toward the development of higher-order thinking skills. One of the key competencies emphasized in both national and international educational policies is numeracy literacy. Numeracy literacy refers to an individual's ability to apply mathematical concepts, procedures, facts, and reasoning to solve problems encountered in everyday life. This competency extends beyond computational proficiency to include

the ability to interpret quantitative information, analyze data, construct logical arguments, and make evidence-based decisions using mathematical reasoning (OECD, 2023). Such competencies equip learners with the essential skills needed to address the challenges of daily life, the workplace, and an increasingly data-driven society (Barus et al., 2023).

The importance of numeracy literacy has also become a major focus within the Indonesian education system. The implementation of the National Assessment positions numeracy literacy as one of the primary indicators for evaluating educational quality. This policy reflects a shift in mathematics education from merely achieving academic performance toward enabling students to apply mathematical concepts in authentic real-life situations. Nevertheless, various evaluation reports indicate that the numeracy literacy of Indonesian students continues to require serious attention. This condition is primarily attributed to instructional practices that remain dominated by abstract concept delivery, formula memorization, and limited integration between mathematical content and students' real-life experiences (Saputra & Saraswati, 2026).

The issue of numeracy literacy is not confined to primary and secondary education but is also evident in higher education, particularly in teacher education programs. Students enrolled in the Primary School Teacher Education (PGSD) program are prospective teachers who will be responsible for establishing the mathematical foundations of young learners. Therefore, PGSD students are expected not only to possess a theoretical understanding of mathematical concepts but also to demonstrate the ability to apply these concepts in diverse contextual situations. Such competence enables them to design meaningful learning experiences for elementary school students and constitutes an essential component of the professional and pedagogical competencies required of future teachers.

As prospective elementary school teachers, PGSD students are expected to develop instructional practices that integrate authentic experiences with mathematical concepts. Teachers who possess strong numeracy literacy are better equipped to select appropriate instructional strategies, develop effective learning media, and guide students in solving contextual problems. Conversely, inadequate numeracy literacy among prospective teachers tends to result in mechanistic instructional practices, in which students merely memorize procedures without developing a deep understanding of

mathematical concepts. Ultimately, this condition contributes to the low quality of mathematics instruction at the elementary school level.

Numerous studies have demonstrated that low levels of numeracy literacy are associated with teacher-centered instructional approaches. Conventional instruction generally positions students as passive recipients of information, thereby limiting opportunities to explore ideas, engage in discussion, and construct knowledge independently. Consequently, students often experience difficulties when confronted with problems requiring the interpretation of information, the selection of appropriate solution strategies, or the application of mathematical concepts to real-life situations. Therefore, instructional approaches capable of connecting mathematical content with authentic experiences are needed to make learning more meaningful (Nurwahid et al., 2025).

One instructional approach considered effective in fostering numeracy literacy is Realistic Mathematics Education (RME). This approach is founded on the perspective that mathematics is a human activity; consequently, the learning process should begin with problems closely related to students' everyday experiences. Within the RME approach, real-world contexts serve as the starting point for constructing mathematical concepts through the process of mathematization. Students are encouraged to explore multiple solution strategies, discuss their findings collaboratively, and reflect upon the concepts they have developed. As a result, learning is directed not only toward obtaining correct answers but also toward understanding the underlying mathematical thinking processes (Nurwahid et al., 2025).

Previous studies have consistently reported the positive impact of the RME approach on the development of numeracy skills. A literature review conducted by Firza et al. concluded that RME-based instruction consistently improves numeracy literacy by connecting mathematical concepts with everyday contexts, thereby enabling students to develop a deeper understanding of the concepts being learned (Firza et al., 2026). Similarly, a study by Saputra and Saraswati (2025) found that the implementation of RME significantly enhanced students' numeracy literacy because it provided contextual, active, and reflective learning experiences.

These findings are further supported by the study conducted by Lubis and Siregar (2022), which demonstrated that students who learned through the RME approach achieved greater improvements in numeracy literacy than those who participated in

conventional instruction. Learning activities initiated with authentic real-world problems encouraged students to construct mathematical models independently, resulting in a deeper conceptual understanding. Likewise, Fauziyah and Wantika (2024) reported that the implementation of RME had a significant positive effect on students' mathematical numeracy skills by habituating them to connect mathematical concepts with everyday life situations.

At the elementary education level, Barus et al. (2023) reported that the application of the RME approach not only improved students' numeracy literacy but also enhanced their active participation throughout the learning process. Learning based on authentic contexts enabled students to better understand the relationship between mathematical concepts and their lived experiences, thereby making learning more meaningful. Similar findings were reported by Andini and Wijaya (2025), who developed technology-assisted RME learning materials and demonstrated that integrating authentic contexts with educational technology effectively improved students' numeracy literacy.

Although numerous studies have established the effectiveness of the RME approach in enhancing numeracy literacy, most have focused on students at the elementary, junior secondary, and senior secondary levels. Research investigating the implementation of RME among students enrolled in Primary School Teacher Education (PGSD) programs remains relatively limited. This is noteworthy because PGSD students are future teachers who will play a central role in mathematics instruction at the elementary school level. Therefore, strengthening numeracy literacy among PGSD students is strategically important, as it will directly influence the quality of mathematics instruction they provide upon entering the teaching profession. This research gap provides a strong rationale for examining the effectiveness of the Realistic Mathematics Education approach in improving the numeracy literacy of Primary School Teacher Education students at Battuta University.

METHODS

This study employed a quantitative approach using a quasi-experimental design to examine the effect of the Realistic Mathematics Education (RME) approach on the numeracy literacy skills of Primary School Teacher Education (PGSD) students at Battuta University. The research adopted a Nonequivalent Control Group Design, as the

participants were not randomly assigned but were selected from existing classes. This design was chosen to enable a comparison of the improvement in numeracy literacy between students who received instruction through the RME approach and those who participated in conventional instruction.

The study was conducted in the Primary School Teacher Education (PGSD) Program at Battuta University during the second semester of the 2025/2026 academic year. The research population consisted of all fourth-semester PGSD students enrolled in the Elementary Mathematics Instruction course. The sample was selected using purposive sampling, considering the similarity of students' academic characteristics, learning outcomes, and class size. The final sample comprised 60 students, with 30 students assigned to the experimental group and 30 students assigned to the control group.

The independent variable in this study was the Realistic Mathematics Education (RME) approach, while the dependent variable was students' numeracy literacy skills. The implementation of the RME approach followed five major stages: (1) understanding contextual problems, (2) exploring various solution strategies, (3) constructing mathematical models, (4) discussing alternative solutions collaboratively, and (5) reflecting on the solutions obtained. In contrast, the control group received conventional instruction, consisting of lectures, question-and-answer sessions, and problem-solving exercises, which reflected the instructional practices commonly implemented in the program.

The research instrument was a context-based essay test designed to assess students' numeracy literacy skills. The instrument was developed based on key numeracy literacy indicators, including the ability to interpret numerical information, apply mathematical concepts and procedures, employ mathematical reasoning to solve contextual problems, analyze solution outcomes, and communicate solutions logically. Prior to administration, the instrument was validated by three experts, including two mathematics education lecturers and one educational evaluation specialist. The validation results indicated that all test items possessed satisfactory content validity and were appropriate for use in the study. Subsequently, the instrument was pilot-tested on students outside the research sample to examine its empirical validity, reliability, item difficulty, and discrimination index. The reliability analysis using Cronbach's Alpha yielded a coefficient of 0.887, indicating that the instrument possessed high internal consistency.

The research procedure began with the administration of a pretest to both groups to determine students' initial numeracy literacy levels. The experimental group then participated in learning activities based on the Realistic Mathematics Education approach for six instructional sessions, while the control group received conventional instruction covering the same mathematical content. At the conclusion of the intervention, both groups completed a posttest consisting of an equivalent instrument to measure improvements in their numeracy literacy skills.

The collected data were analyzed using both descriptive and inferential statistics. Descriptive statistical analysis was employed to calculate the mean, standard deviation, maximum score, minimum score, and students' learning improvement using the normalized gain (N-gain). Before hypothesis testing, the data were examined for normality using the Kolmogorov–Smirnov test and for homogeneity of variance using Levene's test. After all statistical assumptions had been satisfied, the research hypothesis was tested using an Independent Samples t-test at a 0.05 significance level to determine whether there was a statistically significant difference in numeracy literacy skills between the experimental and control groups. All statistical analyses were performed using IBM SPSS Statistics version 26.

Through this research procedure, the study sought to provide empirical evidence regarding the effectiveness of the Realistic Mathematics Education (RME) approach in improving the numeracy literacy skills of Primary School Teacher Education students at Battuta University. The findings are expected to contribute to the development of more effective mathematics instruction within elementary teacher education programs and to provide practical implications for preparing prospective elementary school mathematics teachers.

RESULTS AND DISCUSSION

This study aimed to examine the effect of the Realistic Mathematics Education (RME) approach on the numeracy literacy skills of students in the Primary School Teacher Education (PGSD) Program at Battuta University. The study involved two groups: an experimental group, which received instruction using the Realistic Mathematics Education (RME) approach, and a control group, which received conventional instruction. Each group consisted of 30 students.

Students' numeracy literacy skills were assessed through a pretest administered before the intervention and a posttest administered after the intervention. The descriptive analysis indicated that the initial numeracy literacy levels of the two groups were relatively comparable. Following six instructional sessions, both groups demonstrated improvements in their numeracy literacy skills. However, the improvement achieved by the experimental group was substantially greater than that of the control group.

Table 1. Descriptive Statistics of Students' Numeracy Literacy Skills

Group	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	N-Gain
Experimental	30	60.43	7.62	86.27	5.84	0.65
Control	30	59.97	8.05	74.13	6.71	0.35

As shown in Table 1, the mean pretest score of the experimental group was 60.43, while that of the control group was 59.97. This small difference indicates that the initial numeracy literacy skills of the two groups were relatively comparable before the intervention. Following the instructional treatment, the mean posttest score of the experimental group increased to 86.27, whereas the control group achieved a mean score of 74.13. The normalized gain (N-gain) for the experimental group was 0.65, which falls within the moderate category, while the control group obtained an N-gain of 0.35, also classified as moderate, but substantially lower than that of the experimental group. These findings suggest that the implementation of the Realistic Mathematics Education (RME) approach resulted in greater improvements in students' numeracy literacy skills than conventional instruction.

Before conducting hypothesis testing, the data were examined for normality and homogeneity of variance to ensure that the assumptions for parametric statistical analysis were satisfied. The results of the Kolmogorov–Smirnov normality test indicated that all datasets were normally distributed, with significance values greater than 0.05. Furthermore, the Levene's Test demonstrated that the variances of the two groups were homogeneous. The results are presented in Table 2.

Table 2. Results of the Normality and Homogeneity Tests

Test	Significance Value	Criterion	Conclusion
Normality Test (Experimental Group)	0.200	> 0.05	Normally Distributed
Normality Test (Control Group)	0.187	> 0.05	Normally Distributed
Homogeneity Test	0.296	> 0.05	Homogeneous

Since all statistical assumptions were met, the research hypothesis was tested using an Independent Samples t-test. The results are presented in Table 3.

Table 3. Results of the Independent Samples t-Test

Variable	<i>t</i> Value	<i>t</i> Critical	Sig. (2-tailed)	Decision
Numeracy Literacy	7.184	2.001	0.000	Reject H_0

The results revealed that the calculated *t* value (7.184) exceeded the critical *t* value (2.001) at the 0.05 significance level, with a two-tailed significance value of 0.000. Therefore, the null hypothesis (H_0) was rejected, and the alternative hypothesis (H_1) was accepted. These findings indicate that the Realistic Mathematics Education (RME) approach had a statistically significant effect on the numeracy literacy skills of Primary School Teacher Education (PGSD) students at Battuta University.

The findings further demonstrate that students who participated in RME-based instruction exhibited superior abilities in identifying mathematical information, relating mathematical concepts to contextual situations, selecting appropriate problem-solving strategies, and interpreting solutions based on the given context. These improvements can be attributed to the RME approach, which encourages students to construct mathematical concepts independently through the process of mathematization, beginning with authentic real-world problems. Rather than emphasizing procedural mastery alone, the approach promotes mathematical reasoning, critical thinking, and reflective learning. These findings are consistent with those reported by Barus et al. (2023), who concluded that the RME approach enhances numeracy literacy by utilizing contexts closely related to students' everyday experiences, thereby facilitating a deeper understanding of mathematical concepts.

The present findings also reinforce the study conducted by Saputra and Saraswati (2025), which reported that Realistic Mathematics Education provides more meaningful learning experiences because students actively explore multiple solution strategies before formal mathematical concepts are introduced. Such learning experiences encourage the development of critical thinking, logical reasoning, and the ability to connect multiple mathematical representations when solving numeracy-related problems.

Furthermore, Lubis and Siregar (2022) argued that the processes of horizontal mathematization and vertical mathematization embedded in the RME approach enhance students' ability to transform contextual problems into appropriate mathematical models. Similar patterns were observed in the present study, where students in the experimental group demonstrated greater proficiency in constructing mathematical models, selecting appropriate solution procedures, and interpreting their solutions than those in the control group.

The findings of this study also support those of Agustina et al. (2022), who reported that the Realistic Mathematics Education approach positively influences the development of numeracy literacy because instruction begins with authentic contexts that are closely connected to students' learning experiences. This process enables students to construct knowledge independently, resulting in more meaningful learning and stronger long-term retention of mathematical concepts.

Moreover, the results are consistent with the review conducted by Budianti et al. (2024), which emphasized that the effectiveness of the RME approach in improving numeracy literacy is strongly influenced by collaborative discussion, active participation, and reflective learning throughout the instructional process. Through these activities, students not only arrive at correct answers but are also able to justify their reasoning and explain the mathematical principles underlying each solution. Such competencies represent essential indicators of numeracy literacy as emphasized in the PISA framework.

Overall, the findings of this study demonstrate that the Realistic Mathematics Education (RME) approach exerts a significant positive effect on the numeracy literacy skills of Primary School Teacher Education students at Battuta University. The approach promotes more active, contextualized, and meaningful learning, enabling students not only to master mathematical concepts procedurally but also to apply these concepts effectively in analyzing and solving real-world problems. These findings provide further

evidence that student-centered instructional approaches grounded in authentic contexts constitute an effective strategy for improving the quality of mathematics education in elementary teacher preparation programs.

CONCLUSION

Based on the findings of this study, it can be concluded that the Realistic Mathematics Education (RME) approach has a positive and statistically significant effect on the numeracy literacy skills of Primary School Teacher Education (PGSD) students at Battuta University. This is evidenced by the higher mean posttest score of the experimental group (86.27) compared with that of the control group (74.13), as well as the higher normalized gain (N-gain) achieved by the experimental group (0.65) relative to the control group (0.35). Furthermore, the results of the Independent Samples t-test revealed a significance value of 0.000, which is lower than the 0.05 significance level, indicating that the research hypothesis was accepted.

These findings demonstrate that instruction based on the Realistic Mathematics Education (RME) approach effectively enhances students' ability to understand, analyze, and apply mathematical concepts to a variety of contextual problems. Therefore, the Realistic Mathematics Education approach can be recommended as an effective instructional alternative for Primary School Teacher Education (PGSD) programs to strengthen the numeracy literacy skills of prospective elementary school teachers.

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