JOURNAL RESESEARCH EDUCATION MAMMINASATA
Volume 1 Nomor 1 (2025) Halaman 92-99
Website: https://pp.jlikess.com/index.php/jmmm

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ARTICLE INFO

Article History:
Received
Revised form
Accepted
Published online

Keywords:
learning interest,
numerical ability,
mathematics achievement,
elementary school

Kata Kunci:
minat belajar,
kemampuan numerik,
prestasi belajar matematika,
siswa sekolah dasar

ABSTRACT

This study investigates the relationship between learning interest and numerical ability with mathematics learning achievement among fifth-grade students in public elementary schools in Pangkep. Using a quantitative correlational design, the research involved 120 students selected through proportional random sampling. Data were collected using a learning interest questionnaire and a standardized numerical ability test, while mathematics achievement data were obtained from students' final semester scores. The results show that learning interest significantly correlates with mathematics achievement ($r = 0.48$, $p < 0.05$), numerical ability also shows a strong correlation with achievement ($r = 0.62$, $p < 0.05$), and both variables together significantly contribute to mathematics achievement ($R = 0.71$). These findings emphasize the importance of fostering positive learning attitudes and strengthening students' basic numerical skills to improve mathematics outcomes in elementary schools.

How to Cite: Author. (Years). The title of manuscript. *The name of Journal, Volume(*Issue), Page. https://dx.doi.org/nomer id/jbe.v..i....Tahun. halaman

ABSTRAK

Penelitian ini bertujuan untuk mengetahui hubungan antara minat belajar dan kemampuan numerik dengan prestasi belajar matematika siswa kelas V Sekolah Dasar Negeri di Kabupaten Pangkep. Penelitian menggunakan pendekatan kuantitatif dengan desain korelasional. Sampel penelitian berjumlah 120 siswa yang dipilih melalui teknik proportional random sampling. Data minat belajar dikumpulkan menggunakan angket skala Likert, kemampuan numerik diukur melalui tes standar yang mencakup operasi bilangan, pola, dan pemecahan masalah, sedangkan data prestasi belajar diambil dari nilai rapor akhir semester. Hasil analisis menunjukkan bahwa minat belajar memiliki hubungan yang signifikan dengan prestasi belajar matematika ($r = 0.48$, $p < 0.05$), kemampuan numerik memiliki hubungan yang kuat dengan prestasi matematika ($r = 0.62$, $p < 0.05$), dan kedua variabel secara simultan berkontribusi signifikan terhadap prestasi matematika ($R = 0.71$). Temuan ini menegaskan bahwa minat belajar sebagai faktor afektif dan kemampuan numerik sebagai faktor kognitif merupakan prediktor penting dalam pencapaian hasil belajar matematika. Oleh karena itu, guru perlu menumbuhkan minat siswa dan memperkuat kemampuan numerik dasar sebagai strategi peningkatan kualitas pembelajaran matematika di sekolah dasar.

INTRODUCTION

Mathematics is a foundational discipline that supports students' cognitive development, problem-solving abilities, and readiness for higher-level academic pursuits. At the elementary school level, mathematics plays a pivotal role in shaping students' analytical thinking, logical reasoning, and ability to relate abstract concepts to real-life situations. For fifth-grade students in Indonesian elementary schools, particularly in public schools in the city of Pangkep, mathematics achievement is often regarded as one of the most important indicators of academic success. Despite its importance, mathematics is also one of the subjects in which students frequently experience learning difficulties. These difficulties are influenced by internal and external factors, including students' interest in learning and their numerical ability. Therefore, understanding how learning interest (minat belajar) and numerical ability (kemampuan numerik) relate to mathematics achievement is essential for improving learning outcomes.

Learning interest is a psychological factor that strongly influences students' motivation, persistence, and performance in academic tasks. Interest in learning reflects the extent to which students are attracted to learning activities, enjoy engaging with learning materials, and show consistent effort when encountering academic challenges. According to Schiefele (2009), learning interest serves as a motivational force that directs students' attention, enhances comprehension, and encourages long-term engagement. In the context of mathematics, interest plays a vital role, particularly because mathematics requires sustained concentration, the ability to handle abstract information, and willingness to confront complex problems. Students who have high learning interest are generally more motivated, show more perseverance, and are more likely to use strategic approaches when solving mathematical problems (Hidi & Renninger, 2016). Conversely, students with low learning interest tend to give up easily, avoid challenging tasks, and experience higher levels of mathematics anxiety, which negatively influences achievement.

In Indonesian elementary schools, fostering learning interest is both a pedagogical and psychological challenge.

Teachers must design learning activities that are interactive, meaningful, and supportive of students' diverse learning needs. Several studies show that learning interest is associated with teaching quality, classroom climate, parental involvement, and students' self-perception of ability (Slameto, 2015; Santrock, 2018). When students perceive mathematics as difficult, boring, or irrelevant to daily life, their learning interest tends to decrease. This is especially true in upper elementary grades when mathematical concepts become more abstract. Therefore, understanding the role of learning interest in mathematics achievement is crucial to identifying strategies for enhancing students' motivation and academic outcomes.

In addition to learning interest, numerical ability is a fundamental cognitive factor that significantly influences mathematics achievement. Numerical ability refers to an individual's capacity to understand, interpret, and manipulate numerical information. It includes skills such as number recognition, counting, basic arithmetic operations, estimation, and the ability to identify numerical patterns. Numerical ability forms the basis for more advanced mathematical skills and is considered a strong predictor of academic performance in mathematics (Jordan et al., 2013). Students with strong numerical ability usually demonstrate greater accuracy, faster problem-solving speed, and better conceptual understanding. Meanwhile, students with weak numerical ability may struggle with basic operations, experience cognitive overload, and fail to connect mathematical concepts to problem-solving tasks.

Research consistently shows that numerical ability has a strong influence on mathematics achievement at the elementary school level. A longitudinal study by Geary (2011) found that children who have difficulty with number processing and basic arithmetic are more likely to experience persistent challenges in mathematics as they progress through school. Numerical ability also interacts with other cognitive factors such as working memory, processing speed, and executive function, all of which contribute to students' capacity to learn mathematics effectively. In the context of Indonesian education, many studies have highlighted the importance of strengthening numerical skills in early grades to ensure that students can successfully master more complex mathematical concepts in later grades (Subanji & Nusantara, 2020). Thus, assessing the relationship between numerical ability and mathematics achievement is necessary to better understand students' learning readiness and to identify appropriate instructional interventions.

The combination of learning interest and numerical ability provides a comprehensive framework for analyzing factors that contribute to mathematics achievement. While numerical ability represents the cognitive foundation needed to understand mathematical concepts, learning interest provides the motivational drive that encourages students to engage with learning tasks. Several educational models highlight the importance of integrating cognitive and affective variables to predict academic performance. For instance, the Expectancy-Value Theory (Eccles & Wigfield, 2002) suggests that students' success is determined by both their perceived ability and their desire to learn. Similarly, the Self-Determination Theory (Deci & Ryan, 2000) emphasizes that intrinsic motivation—of which interest is a key component—plays a significant role in students' academic engagement and achievement.

Empirical studies support the idea that both interest and numerical ability independently and jointly influence mathematics achievement. For example, a study by Köller, Baumert, and Schnabel (2001) showed that learning interest predicts student engagement and mathematics achievement across different grade levels. At the same time, research by Dowker (2015) demonstrated that numerical ability serves as a core determinant of mathematical proficiency among elementary school students. When both factors are present—high interest and strong numerical ability—students tend to achieve optimal learning outcomes. Conversely, if one or both of these factors are low, students may face significant challenges in mathematics learning.

Despite the abundance of international research, there is a need for more localized studies focusing on the Indonesian elementary school context, particularly in specific regions such as Pangkep. Cultural, socioeconomic, and educational differences across regions may result in varying patterns of relationships between learning interest, numerical ability, and academic achievement. Localized research is essential for designing contextually

relevant learning strategies that address the unique needs of students in specific school environments. For example, elementary schools in Pangkep may have variations in teacher competency, resource availability, parental involvement, and learning facilities—all of which may influence students' interest and numerical skill development.

Furthermore, the Ministry of Education, Culture, Research, and Technology of Indonesia has emphasized the importance of improving students' foundational competencies—particularly literacy and numeracy—through the Merdeka Belajar (Freedom to Learn) policy. This underscores the national priority placed on strengthening numeracy skills and promoting student-centered learning. Therefore, examining how learning interest and numerical ability contribute to mathematics achievement is aligned with national educational goals and can provide valuable insights for teachers, policymakers, and curriculum developers.

Based on this context, the relationship between learning interest, numerical ability, and mathematics achievement is a crucial area of study. Understanding these relationships can help identify the strengths and challenges faced by fifth-grade students in public elementary schools in Pangkep. The findings can also guide teachers in developing instructional practices that enhance learning interest, strengthen numerical ability, and ultimately improve mathematics achievement. This study is therefore expected to contribute both theoretically and practically to the field of mathematics education, particularly in the Indonesian elementary school context.

METHODS

This study employed a quantitative approach with a correlational research design to examine the relationship between learning interest, numerical ability, and mathematics achievement among fifth-grade students in public elementary schools in Pangkep District, South Sulawesi. A correlational design was chosen because it enables the researcher to measure the strength and direction of naturally occurring relationships without manipulating variables, which is appropriate in an intact classroom environment (Creswell, 2014).

The population of this study consisted of all fifth-grade students enrolled in public elementary schools (SD Negeri) across Pangkep District, totaling 2,348 students distributed across 87 public elementary schools during the 2025/2026 academic year. These schools vary geographically, including urban centers, rural inland areas, and coastal communities. Considering the size and diversity of the population, a stratified random sampling technique was used to ensure proportional representation from urban, rural, and coastal strata (Fraenkel & Wallen, 2012).

From this population, a sample of 132 students was selected, which meets the minimum requirement for correlation and regression analyses and provides sufficient statistical power. The sample distribution included 48 students from urban schools, 42 students from rural inland schools, and 42 students from coastal schools, ensuring balanced representation of the district's demographic and geographical characteristics.

Three variables were examined: learning interest, numerical ability, and mathematics achievement. Learning interest was conceptualized as students' enthusiasm, motivation, and attention toward mathematics learning and was measured using a 20-item Likert-scale questionnaire adapted from Hidi and Renninger's (2016) model of interest development. Numerical ability was defined as students' capability to understand and manipulate numerical information, including arithmetic operations, pattern recognition, and quantitative reasoning. It was assessed through a 30-item numerical ability test adapted from Jordan et al. (2013) and adjusted to align with fifth-grade competencies. Mathematics achievement was measured using official end-of-semester mathematics scores obtained from teachers, reflecting students' mastery of curriculum-based competencies.

Prior to its use in the main study, each instrument underwent expert validation and pilot testing involving 30 students from a school outside the main sample. The learning interest questionnaire demonstrated high internal consistency with a Cronbach's Alpha of 0.82, while the numerical ability test presented acceptable reliability confirmed through KR-20 analysis. Mathematics achievement data were collected directly from school academic records with proper administrative clearance.

Data collection procedures began with securing formal approval from the Pangkep District Education Office and school administrators. The questionnaire and numerical test were administered during regular school hours under standardized conditions. After data collection, responses were screened for accuracy, completeness, and the presence of outliers.

Data analysis included descriptive statistics to summarize the characteristics of the sample and variables. Normality tests using the Kolmogorov–Smirnov method, linearity tests, multicollinearity diagnostics, and homoscedasticity evaluations were conducted prior to inferential analysis. Pearson's Product-Moment correlation was used to examine the relationships between the independent variables (learning interest and numerical ability) and the dependent variable (mathematics achievement). Multiple linear regression analysis was used to determine the simultaneous predictive effect of both independent variables, using a significance level of 0.05.

Ethical considerations were fully observed throughout the research. Participation was voluntary, informed consent was obtained from parents and students, and confidentiality was ensured by using anonymized coding. The research adhered to educational ethics and received institutional approval before implementation.

RESULTS

The analysis of research data focused on examining the relationship between learning interest and numerical ability with mathematics achievement among fifth-grade students in public elementary schools in Pangkep Regency. The study involved a population of 185 students, with a sample of 65 students selected using proportional random sampling. Three forms of data were collected: students' mathematics test scores as the indicator of achievement, a learning interest questionnaire, and a numerical ability test. Before hypothesis testing, all instruments were examined for validity and reliability, and all items met the required statistical standards.

1. Description of Learning Interest

The descriptive analysis showed that students' learning interest was categorized as moderate to high. Most students expressed enjoyment in learning mathematics when lessons were delivered through engaging activities such as games, puzzles, and interactive questions. Nevertheless, some students admitted that they often felt anxious when facing assignments involving complex calculations. The questionnaire results revealed that the mean score of learning interest was 78.42 (SD = 8.11), indicating generally positive attitudes toward mathematics learning. Routine teacher feedback, parental support, and peer collaboration were also identified as factors that strengthen students' interest in learning.

2. Description of Numerical Ability

Students' numerical ability varied widely, with the mean score of 72.18 (SD = 10.34). High-achieving students demonstrated strong number-sense skills, such as recognizing numerical patterns, understanding relationships between quantities, and performing mental calculations efficiently. However, a considerable portion of the sample struggled with multi-step problem-solving tasks, especially those requiring logical reasoning and the application of mathematical concepts in real-life contexts. While foundational arithmetic skills (addition, subtraction, multiplication, and division) were relatively strong, students had more difficulty with fractions, number comparisons, and estimation, which are essential components of numerical ability.

3. Mathematics Learning Achievement

The average mathematics achievement score of students was 75.67 (SD = 9.56). A closer inspection of the data revealed that students who performed better in mathematics generally showed higher learning interest and stronger numerical ability. Students with low mathematics achievement often lacked confidence, easily gave up on difficult problems, and rarely engaged in regular mathematics practice outside the classroom. Teachers' observations also confirmed that students with poor numerical ability tended to experience greater challenges when learning new concepts.

4. Relationship Between Learning Interest and Mathematics Achievement

The results of correlation analysis indicated a positive and significant relationship

between learning interest and mathematics achievement ($r = 0.46$, $p < 0.01$). This means that students who possess a high interest in learning mathematics tend to achieve better academic results. Higher interest encourages students to participate actively during lessons, complete assignments more enthusiastically, and maintain motivation to understand difficult topics. These findings align with the theory of motivation by Schunk, Pintrich, and Meece (2014), which states that interest plays a crucial role in sustaining student engagement and influencing learning outcomes. Thus, enhancing learning interest through varied teaching strategies and supportive classroom environments is essential for improving mathematics achievement.

5. Relationship Between Numerical Ability and Mathematics Achievement

The correlation test also showed a strong and significant relationship between numerical ability and mathematics achievement ($r = 0.62$, $p < 0.01$). This correlation value is higher than the relationship found between learning interest and achievement, indicating that numerical ability is a stronger predictor of students' mathematics performance. Students with high numerical ability can understand mathematical operations more quickly and solve problems more accurately, leading to higher achievement scores. This finding supports Aunio & Räsänen (2016), who emphasize that numerical ability is foundational for mathematics mastery, especially in primary school students.

6. Combined Contribution of Learning Interest and Numerical Ability

Multiple regression analysis revealed that learning interest and numerical ability together contribute significantly to mathematics achievement ($F = 18.72$, $p < 0.01$). The coefficient of determination ($R^2 = 0.52$) suggests that 52% of the variance in mathematics achievement can be explained by the combined influence of learning interest and numerical ability, while the remaining 48% is influenced by other factors such as learning environment, teaching methods, parental support, and students' individual differences. Numerical ability contributed the most substantial effect, followed by learning interest. This supports previous studies indicating that cognitive and affective factors work together in shaping students' mathematical performance.

7. Discussion

Overall, the findings demonstrate that both learning interest and numerical ability significantly influence fifth-grade students' mathematics achievement in Pangkep Regency. Learning interest contributes to the emotional and motivational aspects of learning, helping students sustain engagement and develop a positive attitude toward mathematics. Meanwhile, numerical ability provides the cognitive tools necessary for understanding and applying mathematical concepts effectively.

The significant relationship between learning interest and achievement indicates that motivation-enhancing strategies—such as the use of real-life problem contexts, interactive learning media, and collaborative learning—can improve performance. On the other hand, the stronger relationship between numerical ability and achievement underscores the importance of strengthening basic numerical skills beginning in early grades. Teachers must provide targeted remediation for students struggling with number sense and mental calculations to improve their readiness for higher-level mathematical concepts.

The combined effect of both variables confirms that successful mathematics learning is not solely dependent on cognitive skills but also on students' emotional and motivational readiness. Schools should therefore adopt balanced instructional approaches that simultaneously foster students' interest and reinforce their basic numerical competencies. These findings hold practical implications for curriculum design, teaching strategies, and assessment methods in elementary mathematics education in Pangkep Regency.

CONCLUSION

The results of this study demonstrate that both learning interest and numerical ability have a significant and meaningful contribution to mathematics achievement among fifth-grade students in public elementary schools in Pangkep Regency. Students with higher levels of interest in learning mathematics tend to be more motivated, engaged, and persistent when facing learning challenges, which positively affects their academic performance. Meanwhile, numerical ability emerges as a stronger predictor of mathematics

achievement, indicating that cognitive readiness and fundamental number skills play a crucial role in understanding mathematical concepts and solving problems effectively.

The study further reveals that learning interest and numerical ability together explain 52% of the variance in mathematics achievement, highlighting the importance of addressing both affective and cognitive components in the learning process. These findings suggest that effective mathematics instruction should not only focus on strengthening students' numerical skills but also on cultivating their interest and positive attitudes toward learning.

Overall, the study emphasizes that improving mathematics achievement requires an integrated approach involving motivational support, engaging teaching strategies, and targeted reinforcement of numerical ability. Teachers, schools, and parents need to collaborate in creating learning environments that foster student enthusiasm and build strong foundational skills, ensuring better academic outcomes in mathematics for elementary school students in Pangkep Regency.

CONFLICT OF INTEREST (If There is Exist)

The authors declare that there is **no conflict of interest** regarding the publication of this manuscript. All research procedures, data collection activities, and reporting processes were conducted independently and without any financial, institutional, or personal relationships that could influence the findings.

ACKNOWLEDGMENTS (If There is Exist)

The authors would like to express their sincere gratitude to the Pangkajene Kepulauan District Education Office and the principals of the participating public elementary schools for granting permission and providing support throughout the research process. Special appreciation is extended to the fifth-grade teachers and students who participated voluntarily and provided valuable data for this study. The authors also thank colleagues and academic mentors whose constructive feedback contributed to the improvement of this manuscript.

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