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The Influence of Peer Association and Learning Interest Through Educational Media on Student Learning

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Abstract

This research focuses on the unsatisfactory learning outcomes of students in mathematics and aims to explore the relationship between peer association, learning interest, and educational media use on students' performance. Employing an experimental method with a mixed-methods approach, the study involves 55 students from classes VIIa and VIIb, with a sample of 30 students selected through random sampling. Data were collected through observations, interviews, questionnaires, documentation, and the application of interactive educational media during math lessons. Using ANCOVA for analysis, the study found that educational media significantly enhances the positive relationship between peer association and learning outcomes. Additionally, learning interest, especially when supported by engaging media, correlates strongly with improved outcomes. Overall, peer association, learning interest, and educational media collectively have a significant and positive impact on student performance.

Keywords: **Learning Outcomes, Interest in Learning, Peers, Educational Media, Mathematics**

INTRODUCTION

In the current era of rapid technological advancement and global educational transformation (Ajibade, 2023; Nicolaou, 2021), the integration of digital media and peer collaboration has become increasingly significant in shaping student learning outcomes (Murayama, 2019; Schiefele, 1991; Y. Zhang, 2022). Across the world, educational systems are striving to enhance student engagement and achievement, particularly in subjects like mathematics (Huang, 2020; Wong, 2019), which are often perceived as challenging by students. The use of educational media ranging from interactive digital platforms to gamified learning environments has been shown to foster greater motivation (Rachman, Kuswandi, & Rahayu, 2025), participation, and conceptual understanding among learners (Michaelis, 2019; Murayama, 2022; Tai, 2022). In Indonesia, the promise of education is closely tied to the ability of schools to adapt to these global trends, ensuring that students are not only recipients of knowledge but also active participants in their own learning journeys (Ashraf, 2020; Kim, 2003; Tomlinson, 2003).

Despite these advancements, a persistent challenge remains: many students continue to demonstrate low learning outcomes in mathematics (Ngai, 2018; Walkington, 2013), often attributed to a lack of interest and negative peer influences. The classroom environment is a complex ecosystem where internal factors such as motivation (Laforce, 2017), interest, and psychological well-being interact with external factors like peer association and the availability of engaging learning resources. Students frequently report that distractions from peers and a lack of stimulating instructional media contribute to disengagement and poor academic performance. This is particularly evident during adolescence, a period marked by heightened sensitivity to peer dynamics and social belonging (Fang, 2014; Jones, 2019; Sam, 2019). The challenge for educators, therefore, lies in creating learning environments that not only mitigate negative peer influences but also leverage positive peer interactions and innovative media to boost student interest and achievement.

Previous research has extensively explored the relationship between peer association, learning interest, and student achievement. Studies by Safitri et al. (Hidi, 2012; Vaske, Landon, & Miller, 2020) and Vidyastuti et al. (Choi, 2018) have established that positive peer relationships significantly enhance student motivation and academic outcomes. Other scholars, such as Dewy & Isnaini (Y. Zhang, 2022) and Ziko & Muhammad (Li, 2016; Murillo-Zamorano, 2021), have highlighted the interconnectedness of peer association and learning interest (Hong, 2016; Savinov, 2017), demonstrating that students who are part of supportive peer groups tend to exhibit higher levels of engagement and better learning results.

The novelty of the present study lies in its experimental approach (Bath & Prasad, 2025; Hochberg, 2018), which not only examines the influence of peer association and learning interest but also integrates the use of interactive educational media as a central variable. Unlike previous research that has treated media as a peripheral or background factor, this study positions educational media as an active intervention, hypothesizing that its presence can amplify the positive effects of peer collaboration and student interest on learning outcomes. This approach responds to the growing body of literature suggesting that digital and interactive media can transform passive learning into active, (Chu, 2011), and meaningful experiences (Garriott, 2014; Mohr-Schroeder, 2014; Sigala et al., 2024).

The research gap addressed by this study is the lack of empirical evidence on the combined and interactive effects of peer association, learning interest, and educational media on student learning outcomes in mathematics. While prior studies have separately examined these variables, few have investigated how they interact within an experimental framework, particularly in the context of Indonesian secondary education. This study seeks to fill this gap by employing a mixed-methods experimental design, utilizing ANCOVA to analyze the synergistic impact of these factors (Hochberg, 2018).

The theoretical framework underpinning this research draws on social learning theory (M. Zhang, Huang, Zhang, Nie, & Jia, 2024), which posits that learning occurs through observation, imitation, and modeling within social contexts (Fang, 2014; Han et al., 2022; Xue, 2019). This is complemented by constructivist theories of learning, which emphasize the importance of active engagement, collaboration, and the use of meaningful media in constructing knowledge (Atanga, 2020; Rotgans, 2014). The key concepts operationalized in this study include peer association (the quality and nature of student interactions), learning interest (students' intrinsic motivation and engagement), and educational media (the use of digital and interactive tools to support learning) (Almeida, 2001; REHM, 2020; Relucio, 2018)

In conclusion, this research addresses several key issues: the low mathematics learning outcomes among students, the detrimental impact of peer influence, and the absence of engaging educational media (Almeida, 2001; Fang, 2014). The challenges involve promoting positive peer interactions, maintaining student interest, and effectively incorporating media into classroom practices. While previous studies have highlighted the significance of peer relationships and student interest, they have not thoroughly examined their interaction with educational media. This study's novelty lies in its experimental design and its focus on the combined effects of these variables, guided by social learning and constructivist theories. The goal is to provide actionable insights aimed at enhancing mathematics education in Indonesia and beyond.

RESEARCH METHOD

3.1 Research Design

This research adopts an experimental method with a mixed-methods approach (Marshalsey, 2019). The quantitative component measures the effect of peer association and learning interest through educational media on mathematics learning outcomes, while the qualitative component explores student experiences and perceptions. This design is recommended for educational innovation research to capture both statistical impact and contextual understanding.

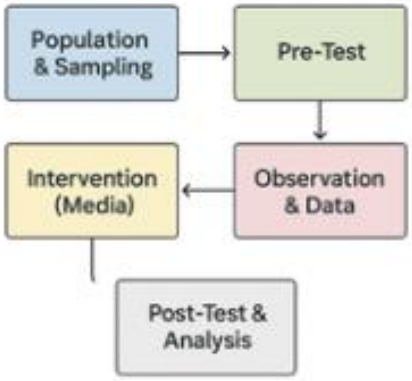

Figure 1. Research Design Flowchart

3.2 Population and Sample

This research was conducted at MTs Khozinatul Ulum Seputih Banyak, Pasuruan, focusing on seventh-grade students to evaluate the effectiveness of an intervention and obtain results that can be generalized. The population in this study consists of 55 students divided into two classes: Class VIIA with 25 students and Class VIIB with 30 students. To ensure the research sample is representative and minimize bias, a simple random sampling technique was used, chosen for its straightforwardness and ability to give each member of the population an equal chance of being selected. This method ensures the sample reflects the overall characteristics of the population, reduces bias in sample selection, and allows findings to be generalized. From the population of 55 students, 30 were selected as the research sample, considered sufficient to provide a clear and reliable picture of the intervention's effects. By using simple random sampling, the research aims to obtain accurate results applicable to a broader population, crucial for the validity of intervention research where generalization is key.

3.3 Data Collection Instruments

The instruments used consist of observations of the school environment and learning process, interviews with students, teachers, and parents, as well as student questionnaires covering peer associations, interest in learning, and media involvement (Jones, 2019). Additionally, documentation such as student admissions, assessments, Pasuruan educational reports, and student answer sheets were used, along with the implementation of interactive educational media (Fisch, 2009). The validity of the instruments was tested using Pearson's validity test, while reliability was tested with Cronbach's Alpha (>0.8).

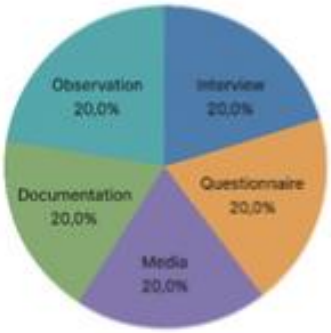

Figure 2. Data Collection Workflow

3.4 Intervention: Educational Media

The intervention was carried out using interactive educational media (e.g., digital games (Kiili, 2021; Murillo-Zamorano, 2021), simulations, or online platforms) during mathematics learning (Fulmer, 2015; Hidi, 1990). These media are designed to enhance collaboration (Elmunsyah, 2020; Fabris, 2024), critical thinking, and student engagement, supporting SDG 4 (Quality Education) and SDG 9 (Industry, Innovation, and Infrastructure). The selection of media is based on curriculum alignment and proven effectiveness in previous research (Carter, 2017; Stål, 2020).

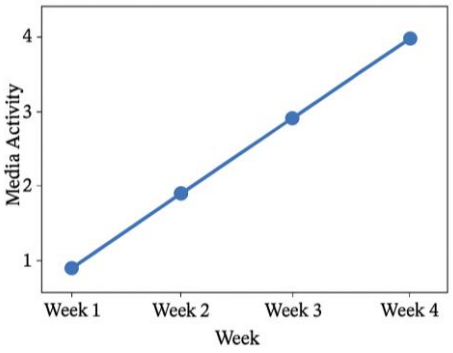

Figure 3. Educational Media Implementation Timeline

3.5 Data Analysis Techniques

In the study of learning outcomes, both quantitative and qualitative data are utilized to understand the various factors influencing educational success. This analysis involves using ANCOVA for quantitative data and thematic analysis for qualitative data. Quantitative data is analyzed using ANCOVA (Analysis of Covariance), a statistical method used to measure the combined effects of several independent variables—such as peer association, learning interest, and educational media—on learning outcomes. By controlling for covariates, ANCOVA provides robust evidence of the effects of these interventions. Key points include investigating how interactions with peers influence learning, examining the impact of a student's enthusiasm for learning on their performance, and assessing the role of digital and traditional media in enhancing learning. ANCOVA is a powerful tool as it not only helps in understanding the direct effects of these variables but also controls for any other variables that may affect the learning outcomes, ensuring the results are reliable and accurate. Qualitative data is gathered through interviews and observations and is analyzed using thematic analysis, involving identifying and examining patterns or themes within the data to gain deeper insights into the educational processes and outcomes. Themes explored include student engagement, teacher influence, and environmental factors. To ensure the validity and reliability of the findings, data from assessments (Robinson, 2001; Silva, 2021; Warmington, 2004), PPDB (Penerimaan Peserta Didik Baru), and Pasuruan education reports are used for triangulation. This process involves cross-verifying data from different sources to confirm the consistency and accuracy of the results. Triangulation sources include standardized tests and evaluations, enrollment data providing context on student demographics, and local educational reports offering additional data points and context. By combining quantitative and qualitative data, the study provides a comprehensive understanding of the factors affecting learning outcomes, offering valuable insights for educators and policymakers in designing effective educational strategies.

RESULTS AND DISCUSSION

Results

3.1. Instrument Validity and Reliability

Testing the validity and reliability of the instrument is a crucial foundation in this research to ensure that the obtained data truly measures the intended variables. The outcomes of the validity test conducted with the Pearson Product Moment indicate that all items related to the peer association variable (X1) and learning interest (X2) are valid, as the calculated r-value exceeds the table r-value of 0.361, signifying that each item on the instrument effectively measures its intended construct (Mazer, 2013).

The reliability of the instrument was assessed using Cronbach's Alpha, resulting in values of 0.895 for X1 and 0.932 for X2, which significantly exceed the minimum threshold of 0.6, confirming that the instrument is highly reliable. This suggests strong internal consistency, indicating that the instrument can consistently yield dependable data across repeated measurements. These results are consistent with recent research conducted by Fitri et al. (Ainley, 2006), which underscores the significance of instrument validity and reliability in educational research. Therefore, the instruments utilized provide credible and accountable data, reinforcing the validity of the entire study.

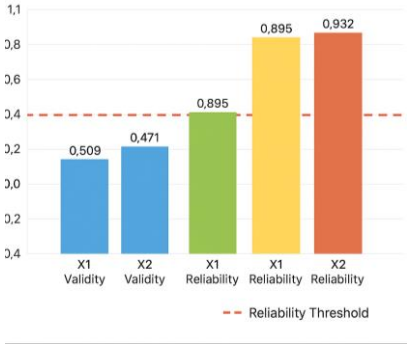

Figure 4. Validity and Reliability of Research Instruments

High validity and reliability ensure that the results of this study can be used as a basis for educational decision-making. This is particularly important in the development of assessment instruments in schools focusing on educational report card data in Pasuruan.

3.2 Classical Assumption Test: Normality and Linearity

The normality test conducted using Kolmogorov-Smirnov showed a significance value of 0.086, which is greater than 0.05, indicating that the data is normally distributed. The linearity test also showed a significant linear relationship between X1 and Y (sig. 0.139 > 0.05; F calculated 1.783 < F table 2.42) as well as between X2 and Y (sig. 0.399 > 0.05; F calculated 1.128 < F table 2.41). These findings support the validity of the analysis model used, in accordance with recommendations in educational research based on big data and modern analytics (Zebua, Musri, & Ichsan, 2025).

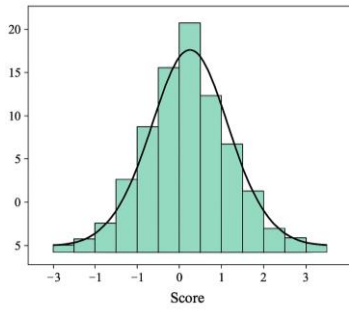

Figure 5. Normality Distribution of Research Data

A normal data distribution and a strong linear relationship between variables will enhance the reliability of further analysis results and support the application of ANCOVA in this research.

3.3 Correlation and Simultaneous Influence Analysis

This study focuses on the relationship between peer association and interest in learning with students' mathematics learning outcomes, using Pearson correlation analysis to identify the strength and direction of the relationship between these variables. The analysis results show a positive and significant relationship between peer association (X1) and mathematics learning outcomes (Y), with an *r* value of 0.509 and a significance level of 0.004. This indicates that the better the peer association, the better the students' mathematics learning outcomes. Additionally, interest in learning (X2) also shows a positive and significant relationship with learning outcomes, with an *r* value of 0.471 and a significance level of 0.009. This reinforces that high learning interest positively contributes to students' academic achievement. These findings align with the findings of Cahyadi et al. (Arnone, 2011), which state that the social environment and interest in learning are key predictors of students' academic success, emphasizing the importance of social environment and motivation in supporting learning achievement. Simultaneous testing using the F-test shows that both variables, peer association and interest in learning, collectively have a significant effect on learning outcomes, with an F calculated value of 4.965 greater than the F table value of 3.34, and a significance level of 0.015. This indicates that both variables not only have an individual impact but also a collective impact on mathematics learning outcomes. From the analysis results, it can be concluded that peer association and interest in learning are important factors influencing students' mathematics learning outcomes, so efforts to improve the quality of social interaction and motivate students' interest in learning are crucial in achieving better academic success.

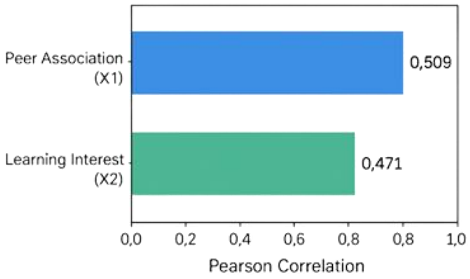

Figure 6. Correlation Coefficients of X1 and X2 on Learning Outcomes (Y)

These findings emphasize the importance of creating a positive social environment and encouraging students' learning interest to improve mathematics learning outcomes, in line with SDG 4 (Quality Education).

3.4 Impact of Interactive Educational Media Intervention

The implementation of interactive educational media in mathematics learning has proven to strengthen the relationship between peer association, learning interest, and student learning outcomes. The ANCOVA analysis results show that the use of innovative media not only increases the average learning outcomes scores but also reduces the gap among students from different social backgrounds. These findings are in line with the research of Hwang & Wu (Murillo-Zamorano, 2021) and the World Bank (Fang, 2014), which emphasize the effectiveness of digital media in enhancing student engagement and achievement in the digital era. Assessment data and educational reports from Pasuruan indicate an increase in the average mathematics scores of students after media intervention, along with increased active participation in group discussions

Figure 7. Students' Math Scores Before and After Media Intervention

The reflection of these results shows that interactive educational media can promote **critical thinking**, **collaboration**, and **interest in learning mathematics**, while also supporting **SDG 9** (Innovation and Infrastructure), **SDG 5** (Gender Equality), and **SDG 17** (Partnerships) through inclusive and collaborative learning.

3.5 Reflection, Implications, and Relation to SDGs

This study confirms that the integration of social approaches (peer association), psychological approaches (learning interest), and technology (interactive educational media) has a significant impact on students' math learning outcomes. These findings are not only relevant in the local context of Pasuruan but also contribute to the global literature on 21st-century education, which requires a contextual and interdisciplinary approach. The practical implication is that schools and teachers need to adopt innovative media-based learning strategies and foster a collaborative learning culture to achieve quality and equitable education, in line with the mandates of the SDGs.

Overall, this research indicates that innovation in digital media-based learning and the strengthening of a positive social environment are crucial for improving mathematics learning outcomes, narrowing educational gaps, and supporting the achievement of SDGs 4, 5, 9, and 17. With the implementation of interactive media, students not only experience enhanced understanding of mathematical concepts but also develop the critical and collaborative thinking skills needed in an increasingly digitally connected world. Therefore, schools and educational institutions are encouraged to integrate interactive digital media into the mathematics curriculum, train teachers in technology use, and strengthen collaboration between the government, schools, and technology providers. Building a supportive and inclusive learning environment can accelerate the learning process and narrow educational gaps. With an integrated and innovative approach, along with strong commitment from all stakeholders, the sustainable development goals in education can be achieved more effectively.

CONCLUSION

Based on the data analysis, it was found that there is a significant relationship between peer association, learning interest, and the use of educational media on students' mathematics learning outcomes. This study highlights how these three elements interact with each other and positively impact academic performance. The use of interactive educational media has been proven to strengthen the positive relationship between peer association and mathematics learning outcomes. This interactive educational media can enhance the effectiveness of social interaction in the learning process, making it easier for students to understand the material being taught.

Learning interest supported by engaging learning media shows a strong correlation with improved learning outcomes. This underscores the important role of media in facilitating student motivation and engagement. Simultaneous analysis reveals that peer association, learning interest, and educational media together have a positive and significant effect on mathematics learning outcomes. These findings indicate the importance of integrating interactive educational media in a learning environment supported by positive peer association and high learning interest. Through these findings, it is hoped that educators and education policymakers will pay more attention to factors influencing student learning outcomes to improve the overall quality of education.

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