Vol. 3 No. 4 Edisi Agustus - Oktober 2026 E. ISSN. 3032-2472
Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

THE USE OF PhET LEARNING MEDIA TO IMPROVE STUDENTS' MATHEMATICS LEARNING OUTCOMES AT SMAN 1 MUARA TIGA

PENGGUNAAN MEDIA PEMBELAJARAN PhET UNTUK MENINGKATKAN HASIL BELAJAR MATEMATIKA SISWA DI SMAN 1 MUARA TIGA

Ozi Ilyanda Saputra[1*], Anzora[2], Riki Musriandi[3]

[1*]Abulyatama University, Email : oziaja2254@gmail.com
[2]Abulyatama University, Email : anzora_matematika@abulyatama.ac.id
[3]Abulyatama University

*email koresponden: oziaja2254@gmail.com

DOI: https://doi.org/10.62567/micjo.v3i4.3344

Abstract

This research was motivated by the importance of improving students' mathematics learning outcomes through the utilization of innovative learning media. This study aimed to determine the effectiveness of using PhEt interactive simulation media in improving the mathematics learning outcomes of Grade XI students at SMA Negeri 1 Muara Tiga compared to conventional learning media. This experimental research involved a population of 72 students from 3 classes, with a sample of 49 students selected through a purposive sampling technique based on certain criteria. The sample was divided into an experimental group (26 students) using PhEt media and a control group (23 students) using conventional media. Data collection was carried out using a learning outcome test instrument consisting of 4 test items. The data were analyzed using a t-test. The results showed that the mean pretest score of the experimental group of 55.88 increased to 84.88 in the posttest. Meanwhile, the mean score of the control group increased from 54.83 (pretest) to 71.17 (posttest). The t-test analysis yielded a tvalue = 1.64, which led to the rejection of H0. Based on these analysis results, it can be concluded that there is a significant difference in students' mathematics learning outcomes. The application of PhEt interactive simulation media is proven to be more effective and generates significantly higher scores compared to the use of conventional learning media in mathematics instruction.

Keywords : Learning Outcomes, PhEt Interactive Simulation Media, Mathematics Learning, Purposive Sampling.

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Abstrak

Penelitian ini dilatarbelakangi oleh pentingnya meningkatkan hasil belajar matematika siswa melalui pemanfaatan media pembelajaran yang inovatif. Studi ini bertujuan untuk mengetahui efektivitas penggunaan media simulasi interaktif PhET dalam meningkatkan hasil belajar matematika siswa kelas XI di SMA Negeri 1 Muara Tiga dibandingkan dengan media pembelajaran konvensional. Penelitian eksperimental ini melibatkan populasi sebanyak 72 siswa dari 3 kelas, dengan sampel berjumlah 49 siswa yang dipilih menggunakan teknik purposive sampling berdasarkan kriteria tertentu. Sampel dibagi menjadi kelompok eksperimen (26 siswa) yang menggunakan media PhET dan kelompok kontrol (23 siswa) yang menggunakan media konvensional. Pengumpulan data dilakukan menggunakan instrumen tes hasil belajar yang terdiri dari 4 butir soal. Data dianalisis menggunakan uji-t (t-test). Hasil penelitian menunjukkan bahwa nilai rata-rata pretest kelompok eksperimen sebesar 55,88 meningkat menjadi 84,88 pada saat posttest. Sementara itu, nilai rata-rata kelompok kontrol meningkat dari 54,83 (pretest) menjadi 71,17 (posttest). Analisis uji-t menghasilkan nilai t (t-value) sebesar 1,64, yang berujung pada penolakan H0. Berdasarkan hasil analisis tersebut, dapat disimpulkan bahwa terdapat perbedaan yang signifikan pada hasil belajar matematika siswa. Penerapan media simulasi interaktif PhET terbukti lebih efektif dan menghasilkan nilai yang jauh lebih tinggi dibandingkan dengan penggunaan media pembelajaran konvensional dalam pembelajaran matematika.

Kata Kunci : Hasil Belajar, Media Simulasi Interaktif PhET, Pembelajaran Matematika, Pengambilan Sampel Bertujuan (*Purposive Sampling*).

1. INTRODUCTION

Education is a crucial element in creating quality human resources. Through education, individuals enhance their abilities, develop perspectives, and prepare to face challenges in a globalized world. One of the concrete indicators of educational quality is students' achievement in understanding various scientific disciplines, including mathematics, which serves as the foundation for knowledge development (Hidayat & Sunendar, 2021). Mathematics is a vital subject because it is present in daily activities, serves as an efficient tool for communication, and fosters logical thinking and problem-solving skills (Munir, 2021).

Despite its importance, many students perceive mathematics as difficult, abstract, and intimidating. This perception leads to low interest, poor learning motivation, and mathematics anxiety, which hinders academic achievement (Suryani & Fitriani, 2020). Furthermore, learning experiences often remain teacher-centered, relying heavily on lectures, formula memorization, and routine exercises without engaging students actively (Rahmawati & Nugraha, 2021). Abstract mathematical topics, such as Trigonometry, pose significant challenges to students. Although Trigonometry has widespread real-world applications, students frequently struggle to resolve non-routine problems requiring analysis and conceptual understanding (Insani & Kadarisma, 2020; Zulfah, 2017). Observational data during field teaching practice (PLP) at SMAN 1 Muara Tiga revealed that students faced substantial difficulty visualizing trigonometric concepts solely through textbooks.

To address these issues, innovative technology-based learning media are needed to transform abstract mathematical concepts into visual and interactive representations. PhET Interactive Simulations, developed by the University of Colorado Boulder, offers free, research-based interactive simulations in science and mathematics (Perkins et al., 2006). PhET allows students to manipulate variables, observe real-time dynamic feedback, and explore concepts through inquiry learning (Adams et al., 2008; Hasanah et al., 2024).

Previous studies highlight the advantages of PhET simulations in reducing cognitive load and facilitating conceptual understanding. Rahmawati and Fitriani (2021) indicated that PhET simulations enhance mathematical problem-solving skills and long-term memory retention. Prihatin et al. (2022)

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

found that PhET-based modules improve mathematical reasoning, while Arisandy et al. (2021) demonstrated that integrating PhET into educational games fosters creative thinking. However, empirical evidence specifically addressing the effectiveness of PhET in improving Trigonometry learning outcomes in rural senior high schools like SMAN 1 Muara Tiga remains limited.

Therefore, this study aims to examine whether there is a significant difference in mathematics learning outcomes between students taught using PhET Interactive Simulations and those taught using conventional methods at SMAN 1 Muara Tiga.

Problem Formulation

Based on the background discussion, the following issues need to be addressed:

1. Is there a significant difference in mathematics learning outcomes between students taught using PhET Interactive Simulations media and those taught without PhET media at SMAN 1 Muara Tiga?
2. How effective is the improvement (N-Gain) in mathematics learning outcomes achieved through PhET Interactive Simulations compared to conventional instruction?

LITERATURE REVIEW

Theoretical Framework

Mathematics Learning Outcomes

Mathematics learning is a structured process designed to communicate abstract ideas into concrete, understandable forms (Ruseffendi, 2021). In cognitive psychology, learning mathematics involves constructing mental structures through assimilation and accommodation (Abdurrahman, 2020). Technology serves as a cognitive tool that facilitates dynamic visualization (such as sine, cosine, and tangent graphs) and active exploration (Sutiani, 2024). Learning outcomes reflect cognitive growth, conceptual mastery, and procedural fluency measured systematically before and after instructional intervention.

PhET Interactive Simulations Media

PhET Interactive Simulations is an educational technology platform offering interactive, open-ended environments for inquiry-based learning (Perkins et al., 2006). Key features of PhET include real-time simulation manipulation, multirepresentation (graphs, numerical values, visual models), and instant feedback (Adams et al., 2008). According to Cognitive Load Theory (Sweller, 2011), interactive visual media reduce extraneous cognitive load, enabling working memory to process abstract mathematical relationships more effectively.

Cognitive Load and Active Learning Principles

Integrating digital tools with guided discovery learning transforms passive reception into active knowledge construction (Moore et al., 2014; Rusman, 2023). Interactive simulations allow students to test hypotheses, self-correct errors through immediate visual feedback, and gain intuitive insights into complex topics like Trigonometry (Sidik et al., 2020; Wulandari et al., 2023).

2. RESEARCH METHOD

Research Design

This study used a quantitative quasi-experimental research design with a Pretest-Posttest Control Group Design (Sugiyono, 2021). The research framework is illustrated in Table 1:

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Experimental Class	O_1	X	O_2
Control Class	O_3	-	O_4

Source: Sugiyono (2021)

Notes: $O_1$and O_3 represent pretest scores; X represents learning using PhET Interactive Simulations;
O_2 and O_4represent posttest scores.

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Research Site and Period

The study was conducted at SMAN 1 Muara Tiga, Pidie Regency, Aceh, during the first semester of the 2025/2026 academic year (July 2026).

Population and Sample

The research population consisted of all Grade XI students at SMAN 1 Muara Tiga, totaling 79 students across three classes (XI-1, XI-2, XI-3). A purposive sampling technique was used based on the following criteria: (1) classes with similar baseline academic capability according to teacher records; (2) equal class sizes; and (3) alignment with instructional schedules. Class XI-1 (26 students) was selected as the experimental group, while Class XI-2 (23 students) served as the control group, yielding a total sample size of 49 students.

Table 2. Population and Sample Distribution

No.	Class	Total Students (Population)	Status in Research
1.	XI-1	26	Experimental Sample (PhET Media)
2.	XI-2	23	Control Sample (Conventional)
3.	XI-3	30	Non-Sample
	Total	79	49 Sample Students

Source: School Administration SMAN 1 Muara Tiga (2026)

Data Collection Techniques and Instruments

1. Achievement Test: An essay-based test consisting of 4 validated items covering Trigonometric concepts (unit circle, special angles, identities, and proofs). The pretest assessed baseline parity, while the posttest evaluated post-intervention learning outcomes.
2. Observation: Teacher activity observation sheets evaluated instructional delivery across three sessions using a 4-point scale.
3. Documentation: Official school documents, lesson plans (RPP), student response sheets, and activity photographs.

Data Analysis Techniques

1. Descriptive Statistics: Calculation of mean, minimum, maximum, and standard deviation scores.
2. Prerequisite Tests: Normality was evaluated using the Shapiro-Wilk test α = 0,05), and homogeneity of variance was tested using Levene's Test α = 0,05).
3. Hypothesis Testing: Independent Sample t-test and One-Tailed t-test were conducted to determine significant differences between groups.
4. Normalized Gain (N-Gain) Analysis: Calculated using the formula:

$$g = \frac{T_2 - T_1}{S_{max} - T_1}$$

Categories: High (g > 0,7), Moderate (0,3 ≤ g ≤ 0,7), and Low (g < 0,3).

3. RESULT AND DISCCUSSION

Teacher Activity Observation Results

The implementation of PhET-assisted guided discovery learning was evaluated over three meetings. As presented in Table 3, instructional fidelity showed continuous improvement, achieving a 100% score ("Very Good") by the final session.

Table 3. Teacher Activity Observation Results

Session	Date	Total Score Obtained	Maximum Score	Percentage	Category
Meeting 1	Saturday, July 25, 2026	29	36	80,56%	Good
Meeting 2	Monday, July 27, 2026	30	36	83,33%	Good
Meeting 3	Tuesday, July 28, 2026	36	36	100,00%	Good

Source: Primary Data Processing (2026)

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Descriptive Analysis of Student Learning Outcomes

The summary of pretest and posttest scores for both experimental and control groups is shown in Table 4:

Table 4. Descriptive Statistics of Pretest and Posttest Scores

Group	*N*	Pretest Mean	Posttest Mean	Mean Difference
Experimental Class (PhET)	26	55,88	84,88	29,00
Control Class (Conventional)	23	54,83	71,17	16,34

Source: Primary Data Processing (2026)

Before the intervention, both groups demonstrated nearly identical initial abilities, with a minor mean difference of 1,05 points. Following the intervention, the experimental group achieved a posttest mean of 84,88 (a 29,00-point increase), whereas the control group achieved a mean of 71,17 (a 16,34-point increase).

Prerequisite Test Result

1. Normality Test: The Shapiro-Wilk test yielded p = 0,572 for the experimental posttest and p = 0,945 for the control posttest. Since both p-values exceeded 0,05, the data followed a normal distribution.
2. Homogeneity Test: Levene's test produced F = 3,834 with p = 0,056 > 0,05, confirming that variances between groups were equal (homogeneous).

Hypothesis Testing (Independent Sample t-Test)

To determine whether the observed differences were statistically significant, an Independent Sample t-test was conducted.

Table 5. Independent Sample t-Test Analysis

Test Data	*t*count	*df*	Sig. (2-tailed)	Sig. (1-tailed)	Decision
Pretest	0,915	47	0,365	0,183	H0 Accepted (No Baseline Difference)
Posttest	13,635	47	< 0,001	< 0,001	H0 Rejected, Ha Accepted (Significant Difference)

Source: SPSS v27 Output (2026)

The pretest *t*-test produced *t*count = 0,915 (p = 0,365 > 0,05), confirming baseline equivalence between groups. Posttest analysis yielded *t*count = 13,635 (p < 0,001), which is well below the significance threshold of 0,05. One-tailed testing confirmed that p < 0,001 < 0,025, proving that students taught using PhET Interactive Simulations achieved significantly higher learning outcomes than those taught conventionally.

Normalized Gain (N-Gain) Analysis

N-Gain analysis was performed to measure the relative effectiveness of the instructional methods.

Table 6. Summary of Normalized Gain (N-Gain) Results

Group	*N*	Mean N-Gain	Category	N-Gain High (%)	N-Gain Moderate (%)	N-Gain Low (%)
Experimental Class	26	0,66	Moderate	26,92%	73,08%	0,00%
Control Class	23	0,36	Moderate	0,00%	100,00%	0,00%

Source: SPSS v27 Output (2026)

The experimental class achieved a mean N-Gain score of 0.66 (Moderate category), with 26,92% of students reaching High improvement (g > 0,7) and 73,08% in the Moderate category. Conversely, the control class recorded a mean N-Gain of 0,36, with 100% of students concentrated in the Moderate category. Independent t-testing on N-Gain scores yielded *t*count = 24,957 (p < 0,001), confirming a significantly higher improvement rate in the PhET-assisted group.

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

DISCUSSION AND ANALYSIS OF FINDINGS

The statistical findings confirm that integrating PhET Interactive Simulations into Trigonometry instruction significantly enhances student mathematics achievement. Four core mechanisms explain this improvement:

1. Transforming Abstract Concepts into Visual Representations

Trigonometry concepts, such as angle rotation, unit circles, and trigonometric function graphs, are inherently abstract. PhET simulations provide dynamic, real-time visual models that allow students to observe how changing angle parameters instantly alters graph waveforms and ratio values. This visual grounding bridges abstract mathematical symbols and conceptual understanding.

2. Instant Feedback and Misconception Mitigation

During simulation exploration, PhET offers immediate visual feedback whenever students adjust numeric parameters or angles. This immediate response allows students to test hypotheses and perform self-correction independently, resolving mathematical misconceptions prior to formal evaluations.

3. Active Student Engagement via Guided Inquiry

Combining PhET simulations with guided discovery learning worksheets shifts the classroom dynamic from passive listening to active inquiry. Students manipulate variables, discover mathematical relationships, and formulate conclusions, leading to deeper cognitive retention.

4. Reduction of Math Anxiety and Increased Motivation

The interactive, game-like interface of PhET creates an engaging, low-stress learning environment. Reducing mathematics anxiety fosters student confidence, encouraging active participation and higher academic performance.

4. CONCLUSION

Based on the empirical findings and statistical analyses, the following conclusions are drawn:

1. There is a statistically significant difference in mathematics learning outcomes between students taught using PhET Interactive Simulations media and those taught using conventional methods at SMAN 1 Muara Tiga ($t$count = 13,635, $p < 0{,}001$).
2. The implementation of PhET Interactive Simulations is significantly more effective in improving student achievement, as evidenced by an experimental posttest mean of 84.88 compared to 71,17 in the control group.
3. The improvement rate (N-Gain) for the experimental class averaged 0,66 (Moderate category, with 26,92% achieving High improvement), which is significantly higher than the control group's average N-Gain of 0,36.

5. REFERENCES

Abdurrahman, M. (2020). *Memahami dan Mengatasi Kesulitan Belajar Matematika Siswa.* Jakarta: Rineka Cipta.

Adams, W. K., Reid, S., LeMaster, R., McKagan, S. B., Perkins, K. K., Dubson, M., & Wieman, C. E. (2008). A study of educational simulations: Part 1—Engagement and learning. *Journal of Interactive Learning Research*, 19(3), 397–419.

Arifin, M. M., Prastowo, S. B., & Harijanto, A. (2022). Efektivitas penggunaan simulasi PhET dalam pembelajaran online terhadap hasil belajar siswa. *Jurnal Pembelajaran Fisika*, 11(1), 16–40.

Arsyad, A. (2017). *Media pembelajaran*. Jakarta: Rajawali Pers.

Birck Fröhlich, A., & Paz Meggiolaro, G. (2021). Utilização do simulador PhET Colorado para aulas de química. *Revista Triângulo*, 14(3), 113–122.

Bito, N., & Masaong, A. K. (2023). Peran media pembelajaran matematika sebagai teknologi dan solusi dalam pendidikan di era digitalisasi dan disruption. *Jambura Journal of Mathematics Education*, 4(1), 88–97.

Farida, F., Supriadi, S., & Kurniawati, D. (2021). Integrasi Media Pembelajaran Berbasis Teknologi

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

untuk Meningkatkan Kualitas Pembelajaran Matematika di SMA. *Jurnal Inovasi Pendidikan Matematika*, 9(1), 75–86.a

Gerlach, V. S., & Ely, D. P. (1980). *Teaching and media: A systematic approach*. Englewood Prentice-Hall.

Hasanah, N., Ambarsari, I. F., Astindari, T., & Aisyah, S. (2024). Pengembangan e-modul FlipHTML menggunakan media *PhET* untuk meningkatkan kemampuan literasi matematika dan pengaruhnya terhadap antusiasme mahasiswa dalam belajar materi trigonometri. *Academy of Education Journal,* 15(1), 196–203.

Heinich, R., Molenda, M., Russell, J. D., & Smaldino, S. E. (2022). *Instructional media and technologies for learning.* Pearson Education.

Hidayat, R., & Sunendar, D. (2021). Peran pendidikan dalam meningkatkan kualitas sumber daya manusia. *Jurnal Ilmu Pendidikan*, 19(2), 101–110.

Insani, N. N., & Kadarisma, G. (2020). Analisis Kesulitan Siswa SMA dalam Menyelesaikan Soal-Soal Trigonometri. *Jurnal Pembelajaran Matematika Inovatif,* 3(4), 385-394.

Lira, R. M., Silva, J. A., & Oliveira, M. P. (2022). Continuous innovation in science teaching: Visualizing abstract theories using PhET interactive simulations. *Ciência e Natureza*, 44, e18, 1–15.

Moore, E. B., Herzog, J. M., & Perkins, K. K. (2014). Interactive simulations as implicit support for active-learning classrooms. *Chemistry Education Research and Practice*, 15(2), 141–149.

Munir, M. (2021). Peran Matematika dalam Kehidupan Sehari-hari dan Pengembangan Berpikir Logis Siswa. *Jurnal Edukasi Matematika*, 5(2), 101–112.

Noormandiri, B. K. (2021). *Matematika untuk SMA/MA Kelas X*. Jakarta: Erlangga.

Oktaviyanthi, R., Herman, T., & Dahlan, J. A. (2018). How does pre-service mathematics teacher prove the limit of a function by formal definition? *Journal on Mathematics Education*, 9(2), 195–212.

Perkins, K., Adams, W., Dubson, M., Finkelstein, N., Reid, S., Wieman, C., & LeMaster, R. (2006). PhET: Interactive simulations for teaching and learning physics. *The Physics Teacher*, 44(1), 18–23.

Rahman, A., Juandi, D., & Sabandar, J. (2022). Pengembangan Lembar Kerja Peserta Didik Adaptif Berbasis Media Interaktif untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika. *Jurnal Elemen*, 8(2), 345–358.

Rahmat, A., Suryadi, D., & Turmudi, T. (2022). Analisis Kelebihan dan Tantangan Penggunaan PhET Interactive Simulations dalam Pembelajaran Matematika Berbasis Digital. J*urnal Inovasi Pendidikan Matematika,* 10(1), 112–124.

Rahmawati, D., & Nugraha, A. (2021). Efektivitas Pembelajaran Berpusat pada Siswa untuk Meningkatkan Pemahaman Konsep dan Kemampuan Berpikir Kritis Matematika. *Jurnal Pendidikan Matematika*, 12(2), 145–156.

Ruseffendi, E. T. (2021). *Pengantar kepada Membantu Guru Mengembangkan Kompetensinya dalam Pengajaran Matematika untuk Meningkatkan CBSA.* Bandung: Tarsito.

Rusman. (2023). Integrasi teknologi dalam pembelajaran matematika untuk meningkatkan pemahaman konsep dan hasil belajar siswa. *Jurnal Inovasi Teknologi Pendidikan,* 10(1), 45–58.

Santoso, S. (2015). *Statistik parametrik*. Jakarta : Elex Media Komputindo.

Sari, I. P., Meliyana, M., & Septian, A. (2022). Pengaruh Media Pembelajaran Simulasi *PhET* Terhadap Pemahaman Konsep Matematika Siswa. *Jurnal Ilmiah Pendidikan Matematika*, 10(2), 215–226.

Sidik, H. M., Nana, N., & Sulistyaningsih, D. (2020). The effectiveness of the *PhET* Colorado simulation on electrical measurement materials and the application of direct current electricity using the POE2WE model. *Jurnal Inovasi Pendidikan IPA*, 7(2), 50–56.

Sugiyono. (2014). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif, dan R&D.*

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Alfabeta.

Sundayana, R. (2020). Pemanfaatan media berbasis teknologi dan kemandirian belajar dalam meningkatkan hasil belajar matematika siswa. Mosharafa: *Jurnal Pendidikan Matematika*, 9(3), 463–474.

Suryani, L., & Fitriani, M. (2020). Penerapan kecemasan matematika terhadap hasil belajar siswa. *Jurnal Pendidikan Matematika*, 8(1), 25–33.

Sutiani, A. (2024). Pengembangan Media Pembelajaran Digital dan Teknologi Simulasi Interaktif dalam Pembelajaran Matematika. *Jurnal Teknologi Pendidikan Matematika,* 6(1), 45–58.

Sweller, J. (2011). Cognitive load theory. In J. P. Mestre & B. H. Ross (Eds.), *Psychology of learning and motivation: Cognition in education* (Vol. 55, pp. 37–76). Academic Press.

Wulandari, R., Suhendra, S., & Prabawanto, S. (2023). Pemanfaatan Media PhET Interactive Simulations dalam Pembelajaran Matematika untuk Meningkatkan Pemahaman Konseptual Siswa. *Jurnal Cendekia: Jurnal Pendidikan Matematika,* 7(1), 512–524.

Zulfah, Z. (2017). Pengaruh Penerapan Model Pembelajaran Kooperatif Tipe Think Pair Share Terhadap Pemampuan Pemahaman Konsep Matematika Siswa. *Jurnal EDUCATIO: Jurnal Pendidikan Indonesia,* 3(1), 48–54.