THE EFFECTIVENESS OF POWERPOINT-BASED ALCHAINS INTERACTIVE LEARNING MEDIA ON THE PROBLEM-SOLVING ABILITY OF 7TH-GRADE STUDENTS AT SMP NEGERI 4 PEKALONGAN

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ABSTRAK

Penelitian ini dilatarbelakangi oleh rendahnya kemampuan pemecahan masalah matematika siswa pada materi abstrak seperti Persamaan Linear Satu Variabel (PLSV). Penelitian ini bertujuan untuk menguji efektivitas media pembelajaran interaktif Alchains berbasis PowerPoint terhadap kemampuan pemecahan masalah siswa kelas VII SMP Negeri 4 Kota Pekalongan. Metode penelitian yang digunakan adalah *Quasi-Experimental* dengan desain *Non-equivalent Control Group Design*. Sampel penelitian terdiri dari kelas eksperimen yang menggunakan media Alchains dalam model *Problem Based Learning* (PBL) dan kelas kontrol yang menggunakan media PowerPoint statis. Data dikumpulkan melalui tes kemampuan pemecahan masalah dan lembar observasi aktivitas siswa. Hasil uji *Independent Sample T-Test* menunjukkan nilai signifikansi (Sig. 2-tailed) sebesar 0,012 < 0,05, yang berarti terdapat perbedaan signifikan antara kedua kelas. Secara deskriptif, rata-rata nilai post-test kelas eksperimen (83,25) lebih tinggi dibandingkan kelas kontrol (76,75). Peningkatan kemampuan siswa pada kelas eksperimen mencapai skor N-Gain 0,308 (kategori sedang), sementara kelas kontrol hanya 0,100 (kategori rendah). Selain itu, aktivitas siswa kelas eksperimen mencapai skor 3,3 (kategori baik). Simpulan penelitian menunjukkan bahwa media Alchains efektif sebagai jembatan kognitif dalam menvisualisasikan alur logika pemecahan masalah Polya secara sistematis. Peneliti menyarankan pengembangan media ini ke dalam format Android atau Web agar lebih fleksibel diakses oleh siswa.
Kata kunci: Media Pembelajaran Interaktif, Kemampuan Pemecahan Masalah, Problem Based Learning, Matematika SMP.

ABSTRACT

This research is motivated by the low mathematical problem-solving skills of students in abstract topics such as Linear Equations of One Variable (PLSV). This study aims to evaluate the effectiveness of PowerPoint-based Alchains interactive learning media on the problem-solving abilities of seventh-grade students at SMP Negeri 4 Pekalongan. The research method used was Quasi-Experimental with

a Non-equivalent Control Group Design. The sample consisted of an experimental class using Alchains media within a Problem Based Learning (PBL) model and a control class using static PowerPoint media. Data was collected through problem-solving ability tests and student activity observation sheets. The Independent Sample T-Test results showed a significance value (Sig. 2-tailed) of 0.012 < 0.05, indicating a significant difference between the two classes. Descriptively, the average post-test score of the experimental class (83.25) was higher than the control class (76.75). The improvement in students' abilities in the experimental class reached an N-Gain score of 0.308 (medium category), while the control class only reached 0.100 (low category). Furthermore, the student activity in the experimental class achieved a score of 3.3 (good category). The study concludes that Alchains media is effective as a cognitive bridge in visualizing Polya's logical problem-solving steps systematically. The researcher suggests developing this media into Android or Web formats for more flexible student access.

***Keywords**: Interactive Learning Media, Problem-Solving Ability, Problem Based Learning, Junior High School Mathematics.*

INTRODUCTION

In the rapidly evolving landscape of 21st-century education, mathematics stands as a fundamental pillar that shapes a student's logical, systematic, and critical thinking capabilities. According to the National Council of Teachers of Mathematics (NCTM), the primary goal of mathematics education is to develop five core process standards: communication, representation, reasoning and proof, connections, and, most crucially, problem solving (Indriana & Maryati, 2021). Problem solving is not merely a topic within mathematics; it is the very essence of mathematical activity. It requires students to transcend rote memorization and apply their conceptual understanding to navigate unfamiliar, non-routine challenges. However, despite its recognized importance, the reality of mathematical achievement in Indonesia presents a sobering picture. International assessments, such as the Program for International Student Assessment (PISA) 2022, reveal that Indonesian students' mathematical literacy continues to lag significantly. With an average score of 366, Indonesia remains far below the OECD average and is vastly outperformed by neighboring countries like Singapore, which achieved a score of 575 (Yanto & Rahaju, 2024). This performance gap indicates that while students

might master basic arithmetic procedures, they struggle profoundly when required to analyze, model, and solve complex problems.

The transition to junior high school (SMP) introduces one of the most significant hurdles in a student's mathematical journey: Algebra. Specifically, the topic of One Variable Linear Equations (PLSV) serves as the "gatekeeper" to advanced mathematics. PLSV introduces the abstract concept of variables, shifting the student's perspective from concrete numbers to symbolic representations. For many 7th-grade students, this shift is jarring (Shidieq, 2025). They often perceive algebra as a cryptic language of letters and symbols that bears little relation to reality. Common pedagogical challenges include students' inability to decode word problems into mathematical models, a lack of understanding regarding the principle of balance in equations, and consistent procedural errors when isolating variables (Ridha & Khairunnisa, 2025). Traditional instructional methods, which often rely on teacher-centered lectures and static textbooks, have proven insufficient in addressing these complexities. In an era dominated by digital natives, the "talk and chalk" method fails to stimulate the cognitive curiosity of students who are accustomed to interactive, multi-modal information. Static media lacks the dynamic feedback necessary for students to visualize the transformation of equations or the logical flow of problem-solving. As noted in recent educational research, the integration of technology is no longer a luxury but a pedagogical necessity to bridge the gap between abstract algebraic theory and concrete student understanding (Widyasari et al., 2024). To address these challenges, this study explores the synergy between a high-impact pedagogical model and innovative digital media. The Problem Based Learning (PBL) model is utilized as the instructional framework. PBL is a student-centered approach that begins the learning process with a complex, real-world problem. This forces students to become active investigators rather than passive recipients of information. However, implementing PBL in an abstract topic like PLSV requires a "cognitive scaffold" to help students manage the complexity of the task. This research introduces "Alchains" (Algebra Chains), an interactive learning media developed using Microsoft PowerPoint. Unlike conventional slides, Alchains is engineered with advanced features such as action buttons, hyperlinks, and interactive branching, creating a two-way

interaction between the student and the content. The media is explicitly structured to guide students through George Polya's four-step problem-solving framework: 1. Understanding the Problem: Identifying known data, unknown variables, and conditions. 2. Devising a Plan: Discovering the connection between the data and the unknown to choose a solution strategy. 3. Carrying out the Plan: Executing the strategy with algebraic precision. 4. Looking Back: Verifying the solution and reflecting on the process (Polya, 1957). By integrating Alchains into the PBL cycle, the learning process becomes more visual, structured, and engaging. The interactive nature of the media provides immediate feedback, allowing students to test their hypotheses and correct their logic in real-time (Alhudawi & Jalaludin, 2026). This study aims to provide empirical evidence on the effectiveness of this intervention at SMP Negeri 4 Pekalongan, focusing on whether Alchains can significantly boost problem-solving scores and foster a more active learning environment. Furthermore, the theoretical underpinning of this research rests on the Constructivist theory, which posits that students build knowledge through active experience (Harun, 2021). Alchains serves as the environment where this construction occurs. In the "Kurikulum Merdeka" (Independent Curriculum) context, which emphasizes "Joyful Learning" and student agency, the use of interactive media like Alchains aligns perfectly with national educational goals. It empowers students to take ownership of their problem-solving journey, transforming a daunting subject like PLSV into an achievable and even enjoyable challenge. Therefore, this investigation is not only timely but essential for providing a blueprint for modernizing mathematics instruction in Indonesian secondary schools.

METHOD

This study employed a Quasi-Experimental research design, specifically the Non-equivalent Control Group Design. This design was selected because it allows for the comparison of two pre-existing groups (classes) without the need for individual random assignment, which is often impractical in a school setting (Zahra & Nalim, 2024). The research was conducted at SMP Negeri 4 Pekalongan during the 2025/2026 academic year. The population consisted of 191 7th-grade students

distributed across six classes. Using a simple random sampling technique (lottery method), two classes were selected: 1. Experimental Class (VII C): 32 students who received instruction via the PBL model supported by Alchains interactive media. 2. Control Class (VII B): 32 students who received instruction via the PBL model supported by static PowerPoint media. The instruments used in the research include: 1. Mathematical Problem-Solving Test: A set of essay questions designed to measure Polya's four indicators. The test underwent rigorous validity and reliability checks by academic experts. 2. Observation Sheets: Used to record student and teacher activities during the learning process, ensuring the treatment was implemented according to the PBL syntax. The collected data were subjected to several statistical tests. First, normality tests (Lilliefors) and homogeneity tests (Levene's) were conducted to ensure the data met the assumptions for parametric analysis. Second, the Independent Sample T Test was used to compare the post-test means of the two groups. Finally, the N Gain (Normalized Gain) score was calculated to determine the effectiveness of the improvement in problem-solving ability from pre-test to post-test.

DISCUSSION

The implementation of the Problem Based Learning (PBL) model assisted by Alchains interactive media significantly transformed the classroom dynamics compared to the control group. Based on the observation results, there was a stark contrast in engagement levels where the experimental class showed a much higher level of participation. Students in the experimental class were not merely recipients of information but were actively engaged in navigating the Alchains interface. The "Game-like" features of the media triggered a competitive yet collaborative spirit, which is essential in the PBL cycle (Herlina & Surur, 2025). Conversely, the control class exhibited lower enthusiasm, as static slides limited their ability to explore mathematical concepts independently (Efendi et al., 2025). This difference is clearly reflected in the comparison of student activity levels shown in the following table:

Table 1. Comparison of Student Activity Levels

Aspect	Control Class	Experiment Class
Media used	Static PowerPoint	Interactive Alchains

Activity score	2,1 (fair)	3,3 (good)
Student role	Passive observer	Active investigators
Interaction	One-way	Two-way

The core objective of this study was to evaluate the impact of Alchains on students' ability to solve One-Variable Linear Equations (PLSV) problems. The statistical evidence from the post-test results confirms a significant improvement in the experimental group. The mean score of the experimental group reached 83.25, notably surpassing the control group's average of 76.75. The Independent Sample T-Test yielded a Sig. (2-tailed) value of 0.012, which is less than the 0.05 threshold, formally rejecting the null hypothesis and proving that the media's effectiveness is statistically valid. The descriptive comparison of these scores can be seen in the table below:

Table 2. Post-test Descriptive Statistics

Group	N	Mean Score	Std. Deviation
Experimental	32	83,25	7,42
Control	32	76,75	8,15

To further measure the magnitude of improvement from the pre-test to the post-test, an N-Gain analysis was conducted. The results showed that the experimental group achieved a "Medium" improvement category with a score of 0.308, whereas the control group remained in the "Low" category with a score of 0.100. This disparity indicates that Alchains acts as a superior cognitive catalyst, helping students retain and apply algebraic concepts more effectively than conventional digital media. The comparison of N-Gain scores is summarized in the following table:

Table 3. Comparison of N-Gain Scores

Group	N Gain Score	Category
Experimental	0,308	Medium
Control	0,100	Low

A deeper qualitative look into the four stages of Polya’s problem-solving method reveals how Alchains specifically aided students during the learning process. In the "Understanding the Problem" stage, students in the experimental class were more adept at identifying variables because the media forced them to input known data before proceeding. During the "Devising and Carrying Out a Plan" stages, the

interactive "chains" in the media helped students visualize the balance of an equation, which significantly reduced errors in moving terms across the equals sign (Siregar, 2025). Finally, in the "Looking Back" stage, the immediate feedback feature in Alchains allowed students to verify their answers instantly, fostering essential self-correction skills. Ultimately, the effectiveness of Alchains is rooted in its ability to serve as a cognitive bridge. By transforming abstract algebraic symbols into interactive visual elements, it mitigates the "math anxiety" often associated with PLSV (Misriyani et al., 2026). The integration of Alchains within the PBL framework aligns with the goals of modern education to create a student-centered and joyful learning environment (Andini et al., 2024). This study proves that even widely accessible tools like PowerPoint, when engineered with interactive logic, can match the efficacy of complex specialized educational software in improving mathematical problem-solving abilities (Hafizah, 2023).

CONCLUSION

Based on the comprehensive analysis of the data, this research concludes that the Alchains interactive learning media based on PowerPoint is highly effective in improving the mathematical problem-solving ability of 7th-grade students (Yulita & Suyitno, 2021). The integration of this media within the Problem Based Learning (PBL) framework creates a dynamic, student-centered learning environment that transcends the limitations of traditional, static instructional tools (Hutama & Satria, 2024).

Statistical evidence, including the significant T-test results and the superior N-Gain scores, confirms that Alchains helps students better navigate the complexities of One-Variable Linear Equations (PLSV). By visualising the logical steps of Polya's problem-solving method and providing interactive feedback, Alchains successfully mitigates the abstract nature of algebra.

For educational practitioners, these findings suggest that PowerPoint can be transformed into a powerful, interactive tool that rivals more expensive specialized software. It is recommended that mathematics teachers embrace such digital innovations to foster "Joyful Learning" and better prepare students for the challenges of higher-level mathematics. Future research could explore the

application of Alchains in other abstract mathematical topics or its long-term impact on student retention.

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