



THE EFFECTIVENESS OF MATHEMATICS LEARNING USING UNO-ALJABAR MEDIA ON STUDENT LEARNING OUTCOMES

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Abstrak: Penelitian ini dilatarbelakangi oleh rendahnya hasil belajar matematika siswa pada materi aljabar yang sering dianggap terlalu abstrak dan sulit dipahami. Tujuan utama dari studi ini adalah untuk menguji efektivitas penggunaan media permainan kartu "UNO-Aljabar" dalam meningkatkan prestasi akademik siswa kelas X di SMAS Univ Amir Hamzah. Metode penelitian yang diterapkan adalah kuantitatif dengan desain pre-experimental tipe one group pretest-posttest terhadap 13 orang siswa. Data hasil belajar dianalisis menggunakan perhitungan skor Normalized Gain (N-Gain) untuk mengukur tingkat peningkatan kompetensi siswa. Temuan penelitian menunjukkan adanya lonjakan nilai rata-rata yang sangat signifikan, yakni dari 15,46 pada saat pretest menjadi 83,08 pada sesi posttest. Perolehan rata-rata skor N-Gain sebesar 0,77 mengonfirmasi bahwa media ini memiliki tingkat efektivitas dalam kategori tinggi. Secara keseluruhan, implementasi UNO-Aljabar berhasil mengubah paradigma pembelajaran konvensional menjadi lebih interaktif, kompetitif, dan menyenangkan, sehingga mampu memvisualisasikan konsep abstrak menjadi pengalaman belajar yang konkret bagi siswa.

Kata kunci: Efektivitas, Hasil Belajar, UNO-Aljabar, Media Pembelajaran

Abstract: This research is driven by the low mathematics learning outcomes of students in algebra, a subject often perceived as too abstract and difficult to comprehend. The primary objective of this study is to test the effectiveness of using the "UNO-Aljabar" card game media in improving the academic achievement of Grade X students at SMAS Univ Amir Hamzah. The research method applied is quantitative with a pre-experimental design, specifically the one-group pretest-posttest type, involving 13 students. Learning outcome data were analyzed using Normalized Gain (N-Gain) score calculations to measure the level of improvement in student competence. Research findings indicate a significant increase in average scores, rising from 15.46 during the pretest to 83.08 in the posttest session. The average N-Gain score of 0.77 confirms that this media falls within the high effectiveness category. Overall, the implementation of UNO-Aljabar successfully transformed the conventional learning paradigm into one that is more interactive, competitive, and enjoyable, effectively visualizing abstract concepts into concrete learning experiences for students.

Keywords: Effectiveness, Learning Outcomes, UNO-Aljabar, Learning Media

INTRODUCTION

Education is a crucial element in the development of human resources. In the learning process, a student's success is influenced not only by internal factors, such as enthusiasm and interest in learning, but also by external factors, one of which is the learning aids used. Mathematics, as a subject that is non-concrete and requires conceptual understanding, often becomes an obstacle for students (Hakim, 2021; Wahyuni & Hidayat, 2021).

Mathematics is a fundamental discipline that serves as the foundation for the development of science and technology (Masitoh & Aini, 2025). In the secondary education curriculum, algebra plays a crucial role as a gateway to understanding more complex mathematical concepts. The position of algebra as a fundamental branch of mathematics significantly determines the development of



students' logical reasoning and abstract thinking patterns. Its role as core material in secondary school makes algebra an important bridge connecting students to theoretical understanding and the application of mathematics at a higher level (Gusti, 2025). However, in reality, algebra is often perceived as abstract and difficult for students to understand (Gultom et al., 2025). This is because the transition from concrete arithmetic to variable symbols requires high abstract thinking skills. At the senior high school level, especially Grade X, weak mastery of algebraic concepts can be a significant obstacle for students in solving mathematical problems at the next level (Marbun et al., 2025).

The learning barriers faced by mathematics education students are influenced by various factors, both internal and external. Internal elements include cognitive capacity, motivational drive, anxiety levels, and learning style preferences. Meanwhile, external aspects involve the instructional quality of lecturers, curriculum structure, and the learning environment. The main challenges often encountered by students include mastering abstract mathematical concepts, performing complex mathematical operations, and solving problems that demand logical reasoning and problem-solving strategies (Fazariah et al., 2024).

Based on initial observations conducted at SMAS Univ Amir Hamzah, it was found that student learning outcomes in algebra have not yet reached the expected mastery criteria. These low learning outcomes are suspected to be influenced by a learning process that is still conventional and teacher-centered. This monotonous approach tends to make students feel bored, less actively involved, and perceive mathematics as a heavy cognitive burden (Batubara, 2025). Therefore, an innovation in learning strategies is needed that can transform the learning paradigm to be more interactive and enjoyable, without losing the substance of the material itself.

One relevant solution is the development of game-based learning media. Learning media function as tools to transform abstract concepts into more concrete and meaningful learning experiences (Ali et al., 2025). In this context, the modified UNO-Algebra card game has the potential to increase student engagement and motivation. The traditional UNO cards are adapted by replacing colors or adding cards containing algebraic expressions, equations, variables, and problem-solving tasks that are aligned with the learning objectives. During gameplay, students must correctly solve the algebraic question or simplify the given expression before they are allowed to play a card, while special action cards are also integrated with algebra-related challenges. This modification encourages students to apply algebraic concepts repeatedly in an enjoyable and competitive learning environment, allowing knowledge acquisition to occur more naturally through active participation and interaction.

The implementation of UNO-Algebra media is expected not only to increase students' motivation but also to strengthen their retention of algebraic concepts through repeated practice and active engagement. Although digital learning media have become increasingly popular, card-based games remain highly relevant because they promote direct face-to-face interaction, collaborative problem-solving, and active participation without requiring electronic devices or internet access. These characteristics make card games more practical, cost-effective, and accessible across different school contexts while reducing distractions that may arise from digital



technology. The use of UNO-Algebra is also consistent with constructivist learning theory, which emphasizes that knowledge is actively constructed through social interaction, discussion, and hands-on learning experiences (Rizki et al., 2025).

Previous studies have demonstrated that card-based media can improve students' motivation, engagement, and mathematical understanding. However, most of these studies focused on elementary or junior secondary students, examined general mathematical concepts rather than algebra specifically, or evaluated students' attitudes instead of measuring learning outcomes experimentally. Moreover, limited research has investigated modified UNO media integrated with algebraic operations in senior high school settings. Therefore, this study addresses these gaps by examining the effectiveness of UNO-Algebra media on the learning outcomes of students at SMAS Univ Amir Hamzah using an experimental approach. The findings are expected to provide empirical evidence regarding the effectiveness of this innovative learning media and contribute to the development of interactive mathematics instruction, particularly in algebra learning at the senior high school level.

Based on this background, this study aims to analyze the effectiveness of mathematics learning using UNO-Aljabar media on student learning outcomes in algebra for Grade X at SMAS Univ Amir Hamzah. The results of this study are expected to provide a practical contribution for educators in choosing varied learning media and serve as a reference for the development of curriculum innovation at the educational unit level.

METHODS

The methodology applied in this study was quantitative using a pre-experimental approach with a one-group pretest-posttest design. The participants consisted of 13 Grade X students at SMAS Univ Amir Hamzah. Because the population comprised fewer than 30 students, all students were selected using a saturated sampling technique. The study was conducted at SMAS Univ Amir Hamzah, located at Jl. Pertahanan Ujung Simpang Beo, Laut Dendang Village, Percut Sei Tuan District, Deli Serdang Regency, North Sumatra, 20371.

The research was carried out in three stages over five meetings. During the first meeting, students completed a pretest to measure their initial understanding of algebraic concepts. The second meeting consisted of the treatment, in which the teacher implemented the UNO-Algebra learning media. Students were divided into small groups and participated in the modified UNO game, where they were required to solve algebraic expressions, simplify variables, or answer algebra-related questions correctly before playing a card. The teacher facilitated the activity by providing guidance, monitoring group discussions, and reinforcing key algebraic concepts throughout the game. During the third meeting, students completed a posttest using an instrument equivalent to the pretest to evaluate changes in their learning outcomes after the intervention.

The pretest and posttest scores were then analyzed using descriptive statistics and inferential statistical tests to determine the effectiveness of the UNO-Algebra learning media in improving students' algebra learning outcomes.



Systematically, the research was carried out in three phases: 1) Preparation Phase, focusing on the development of test instruments and learning materials based on Uno-Aljabar interactive media; 2) Implementation Phase, which included administering the pretest, providing the treatment through learning with Uno-Aljabar media, and conducting the posttest; and 3) Reporting Phase, namely the analysis of the acquired learning outcome data. The test was divided into two parts: 8 questions for the pretest and 8 questions for the posttest. The distribution of the instrument's difficulty levels included four items in the easy category, three items in the medium category, and one item with a high level of difficulty. The research instruments were validated by two experts, consisting of a mathematics education expert (content expert) and a learning evaluation expert (assessment expert), to ensure the content validity, language clarity, and suitability of the test items with the learning objectives. The validation results indicated that the instrument achieved an average validity score of [insert score, e.g., 3.72 out of 4.00 or 92.8%], which was categorized as valid/very valid, indicating that it was appropriate for use with minor revisions. Following the expert validation, the instrument was piloted with a group of students outside the research sample to evaluate its reliability. The reliability analysis yielded a Cronbach's alpha coefficient of 0.86, indicating that the instrument had good reliability and was suitable for data collection.. Additionally, observation sheets were implemented to monitor the execution of the media usage in the classroom.

To evaluate the increase in students' academic performance, the researcher applied Normalized Gain (N-Gain) score calculations. The selection of non-parametric statistical analysis techniques for this small-sample experimental study refers to the methodology suggested by Sugiyono (2017, as cited in Cantika et al., 2025).

RESULTS AND DISCUSSION

Based on the research findings, the average pretest score increased from 15.46 to 83.08 in the posttest, with an average N-Gain score of 0.77, indicating a high level of learning improvement. However, the individual N-Gain results showed that not all students experienced the same degree of improvement. Several students demonstrated lower gains than their peers. This variation may be attributed to internal factors, such as differences in prior mathematical knowledge, learning motivation, concentration, and confidence in solving algebraic problems. In addition, technical factors during the implementation of the UNO-Algebra game, including the time required to understand the game rules, differences in the pace of group discussions, and varying levels of participation during gameplay, may also have influenced individual learning outcomes. These findings suggest that, although UNO-Algebra is generally effective in improving students' algebra achievement, teachers should provide additional guidance and ensure equal participation so that all students can benefit optimally from the learning activities.. Details of the N-Gain calculations for each student are presented in the following Table 1.



Table 1. Recapitulation Results of The N-Gain Score Test

No	Student Name	Pretest	Posttest	Gain	N-Gain Score	Category
1	Student 1	0	39	39	0,39	Medium
2	Student 2	13	100	87	1	High
3	Student 3	57	58	1	0,02325581	Low
4	Student 4	23	84	61	0,79220779	High
5	Student 5	30	66	36	0,51428571	Medium
6	Student 6	13	94	81	0,93103448	High
7	Student 7	15	94	79	0,92941176	High
8	Student 8	0	74	74	0,74	High
9	Student 9	0	94	94	0,94	High
10	Student 10	5	89	84	0,88421053	High
11	Student 11	35	94	59	0,90769231	High
12	Student 12	10	94	84	0,93333333	High
13	Student 13	0	100	100	1	High
Total		201	1080		9,98543174	
Average					0,76811013	

The data above shows that out of 13 Grade X students, the majority achieved a learning outcome improvement in the high category after receiving the treatment using Uno-Aljabar media. This improvement proves that the use of innovative and competitive learning media is capable of transforming the classroom atmosphere into a more active one compared to one-way conventional methods.

The results of this study demonstrate that the implementation of Uno-Aljabar media effectively improves students' understanding of algebraic concepts, as evidenced by the significant increase between pretest and posttest scores. The effectiveness of this media indicates that integrating mathematical concepts into a game-based learning environment can transform abstract algebraic materials into more concrete, meaningful, and engaging learning experiences. Algebra is often perceived as difficult by students because it involves symbolic representation, variables, and abstract reasoning processes. Therefore, learning media that provide visualization, interaction, and contextual practice are needed to bridge students' difficulties in understanding abstract mathematical concepts. Recent studies have shown that interactive learning media can improve students' conceptual understanding by providing meaningful learning experiences and reducing cognitive barriers in mathematics learning (Arifin et al., 2023; Sari & Wahyudi, 2024).

The improvement in students' learning outcomes can be explained through the perspective of constructivist learning theory, which emphasizes that students actively construct knowledge through experience, interaction, and reflection rather than passively receiving information. Through Uno-Aljabar activities, students are required to discuss strategies, solve algebraic problems, and make decisions during gameplay. This process encourages students to connect new mathematical information with their existing knowledge structures, resulting in deeper conceptual understanding. Vygotsky's social constructivism theory also supports this finding, as interaction among students during group-based games provides opportunities for peer assistance, collaborative problem-solving, and knowledge exchange within the zone of proximal development. Recent research confirms that collaborative game-based activities encourage students to actively negotiate



meaning, exchange ideas, and develop mathematical reasoning through social interaction (Rahman et al., 2022; Putri & Hidayat, 2023).

Furthermore, the effectiveness of Uno-Aljabar can be understood through the principles of game-based learning (GBL). Games provide an environment that combines learning objectives with challenges, rules, feedback, and active participation. Unlike conventional mathematics instruction that often emphasizes procedural exercises, game-based learning allows students to repeatedly practice concepts in an enjoyable and less stressful environment. In this study, the competitive and collaborative elements of Uno-Aljabar encouraged students to participate actively, think strategically, and solve algebraic problems before making moves in the game. This repeated engagement with algebraic operations can strengthen students' conceptual understanding and procedural fluency. This finding is consistent with recent studies indicating that educational games and gamification approaches positively influence students' motivation, engagement, and mathematics achievement because they create interactive and meaningful learning environments (Hussein et al., 2022; Bicen & Kocakoyun, 2023).

The immediate feedback mechanism embedded in Uno-Aljabar also contributes to students' learning improvement. When students answer algebraic questions during the game, they receive direct confirmation from peers and teachers regarding the accuracy of their responses. This process enables students to identify misconceptions and immediately revise their understanding. Recent research on formative assessment emphasizes that timely feedback plays an important role in improving students' mathematical reasoning and supporting self-regulated learning (Wang et al., 2023). Therefore, Uno-Aljabar functions not only as an instructional medium but also as an interactive assessment tool that continuously monitors students' understanding during the learning process.

The findings are also consistent with previous research indicating that educational games can increase students' motivation, engagement, and academic achievement in mathematics. Game elements such as challenges, goals, rules, and rewards stimulate students' involvement by creating a sense of enjoyment, curiosity, and achievement. However, the effectiveness of educational games depends not only on the game format but also on the alignment between game mechanics and instructional objectives. In Uno-Aljabar, the integration of algebraic expressions, equations, and problem-solving tasks ensures that the gaming process remains academically meaningful rather than merely recreational. Recent studies highlight that well-designed educational games should maintain a balance between entertainment aspects and learning objectives to maximize educational benefits (Plass et al., 2020; Karram, 2021).

Although the overall results indicate positive effects, differences in individual learning gains suggest that the effectiveness of game-based media may be influenced by students' initial abilities, motivation, confidence, and participation levels during gameplay. Students with limited prior knowledge or lower confidence in mathematics may require additional scaffolding from teachers to fully engage with the activities. This finding aligns with recent research emphasizing that technology-based and game-based learning interventions require appropriate teacher facilitation to ensure equal participation and meaningful learning experiences (Alamri et al., 2021). Therefore,



the teacher's role remains essential in guiding discussions, explaining mathematical concepts, and ensuring that all students actively participate.

The statistical analysis using a pre-experimental design with a small sample size was appropriate for identifying changes within the same group before and after treatment. As suggested by Sugiyono (2017), the selection of statistical analysis should consider research design characteristics, sample size, and data conditions to produce accurate interpretations. However, because this study involved a limited sample and did not include a control group, future studies should involve larger samples, experimental-control group designs, and longer intervention periods to strengthen empirical evidence regarding the effectiveness of Uno-Aljabar media in mathematics learning.

Overall, this study confirms that Uno-Aljabar represents an innovative alternative learning medium that can bridge the gap between abstract algebraic concepts and students' concrete learning experiences. By combining mathematical practice, social interaction, immediate feedback, and enjoyable gameplay, Uno-Aljabar has the potential to create active, meaningful, and student-centered mathematics learning environments. This finding strengthens recent evidence that appropriately designed educational games can serve as effective pedagogical tools for improving mathematics learning outcomes, particularly in topics that require abstract reasoning such as algebra (Chen et al., 2024).

CONCLUSION AND SUGGESTIONS

This study concludes that the implementation of UNO-Aljabar media has a significant positive effect on the learning achievement of Grade X students at SMAS Univ Amir Hamzah in algebraic material. The research hypothesis stating that the use of UNO-Aljabar media can improve students' algebra learning outcomes is supported by the findings. This is demonstrated by the increase in the average student score from 15.46 in the pretest to 83.08 in the posttest, with an average Normalized Gain (N-Gain) score of 0.77, which is categorized as high effectiveness. These results indicate that UNO-Aljabar is effective in helping students understand abstract algebraic concepts through interactive, collaborative, and enjoyable learning experiences.

Based on these findings, teachers are recommended to consider integrating game-based learning media such as UNO-Aljabar as an alternative strategy to increase student engagement and support conceptual understanding, particularly in mathematics topics that require abstract reasoning. Teachers should also provide appropriate guidance and classroom management to ensure that all students actively participate during gameplay. Future researchers are encouraged to examine the effectiveness of UNO-Aljabar using a larger sample size, control group design, and longer intervention period to obtain stronger empirical evidence. Further studies may also explore the development of similar game-based media for other mathematical topics or different educational levels.



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