THE EFFECT OF WORDWALL MEDIA INTEGRATION IN LINEAR PROGRAM LEARNING ON STUDENTS' CONCEPT UNDERSTANDING AND LEARNING INTEREST

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ABSTRACT
This research seeks to evaluate the impact of integrating Wordwall media on students' enthusiasm for learning and grasp of mathematical principles in linear programming topics. A lack of interest and challenges in comprehending abstract mathematical ideas serve as the foundation for this investigation. Wordwall was selected due to its provision of interactive learning experiences that enhance student participation. The research adopted a quasi-experimental approach using a non-equivalent control group design. The tools for research included a concept comprehension test (15 questions) and a learning interest survey (30 statements). Data analysis involved the Kolmogorov-Smirnov normality check, Levene's homogeneity examination, paired sample t-test, independent sample t-test, and N-Gain. The findings revealed that the incorporation of Wordwall media significantly and positively influenced students' enthusiasm for learning and their comprehension of mathematical concepts. The progress noted in the experimental group was classified as moderate, while the control group exhibited relatively minimal improvement. Consequently, Wordwall media can serve as a viable alternative learning tool to elevate the quality of mathematics education in vocational high schools. In conclusion, this study asserts that the incorporation of Wordwall media is effective in boosting students' enthusiasm for learning and their understanding of mathematical principles.

Keywords: Wordwall Media, Learning Interest, Mathematical Concept Understanding, Linear Program.

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PRELIMINARY

As a core subject, mathematics plays a crucial role in developing students' logical, analytical, and systematic thinking skills. However, mathematics is often considered a difficult and boring subject, especially when students study abstract material, such as linear programming (Maslinda, Nur Izzati, 2025) (Azzahra et al., 2023). As an optimization tool in mathematics, linear programming is used to achieve the maximum or minimum value of an objective function, by considering a series of constraints formulated as linear inequalities(Elfina, 2024).

Students' conceptual mathematical abilities are reflected in their capacity to understand meaning, interpret relationships, and apply mathematical principles to various

problem contexts. In the context of linear programming, this requires a strong mastery of the concepts of linear inequality systems, determining the solution region, and the process of finding optimum values(Fajar et al., 2019)(Wahyuni & Prihatiningtyas, 2020) . The main difficulties students face in learning linear programming lie in ineffective representations and a weak understanding of basic concepts, such as linear inequalities, solution regions, and optimum values. Research indicates that these two factors are significant obstacles in solving problems related to this topic (Hidayatullah, Da, 2025) .

Students' low understanding of mathematical concepts can be traced to their lack of learning intensity in the subject. In this regard, learning interest plays a significant internal factor in determining the level of learning success (Aftriyati & Roza, 2020) . Students with a high learning interest generally demonstrate an active, motivated, and enthusiastic attitude during learning(Ndraha et al., 2022). On the other hand, students with low interest tend to feel bored, unmotivated, and passive. Recent data reveals that additional barriers arise due to the persistent stigma of mathematics as a difficult subject, further hindering them from deepening their understanding of calculation materials (Anita et al., 2024) . The lack of variety and appeal in mathematics learning significantly contributes to students' low interest in the subject (Safira, 2024). In this digital era, the development of information and communication technology has opened up opportunities for education to adopt and integrate learning media that utilize technology (Puteri et al., 2025) . This research demonstrates that technology-based interactive media offers rich and contextual learning experiences, facilitates active student interaction with the material, and provides constructive feedback. Therefore, selecting the right learning media plays a crucial role in increasing student interest and motivation (Mubarrok et al., 2025) . As an alternative interactive learning media, Wordwall can be utilized to support a more engaging and effective learning process.

Based on a comprehensive evaluation, Wordwall is not only valid and suitable for use in learning contexts but also significantly contributes to improving student learning outcomes(Prastika, 2021). This digital platform provides various interactive educational game templates such as quizzes, matching pairs, random wheels, and crosswords. With its ease of use, diverse template variety, and accessibility via computer, tablet, or smartphone, Wordwall enables teachers to create engaging, interactive, and enjoyable learning content (Akmal, 2020). Several studies have documented the positive impact of Wordwalls on mathematics learning. For example, a study by (Rahmadanti et al., 2024) examined their implementation in elementary schools. Findings from (Utami & Harahap, 2025)) showed a

significant increase in mathematical concept understanding through the Wordwall-assisted RADEC model, with a jump in average scores from 49.29 to 82.86. Meanwhile, from a different perspective, a study by (Nadia, 2022) revealed a significant influence of Wordwalls on mathematical understanding when analyzed through the lens of student motivation and learning interest.

Several empirical studies support the effectiveness of Wordwall in learning. (Tamrin & Masykuri, 2024) demonstrated that combining a contextual approach with this platform increases student motivation and understanding. (Titi Tri Kurniawati, 2025) added that its implementation significantly encourages active engagement, strengthens motivation, and facilitates conceptual understanding. In mathematics, (Ferlina et al., 2024) confirmed its positive impact on learning interest, while (Nadia, 2022) highlighted its ability to create an interactive and enjoyable learning atmosphere. The use of word walls in the classroom is often associated with the expectation of improving the quality of learning, such as a more lively atmosphere, active student participation, and better understanding of the material, especially on procedural topics like linear programming. However, these claims have not been widely substantiated through research in vocational high school settings. Based on this limited evidence, the primary objective of this study is to measure and analyze the actual impact of this media integration on conceptual understanding and student learning engagement at the vocational level .

METHODS

This study employed a quasi-experimental design with a Nonequivalent Control Group Design, chosen because the subjects came from naturally formed classes, making full randomization impossible. The sample selection technique in this study uses purposive sampling, namely a sample determination technique with certain considerations. The study population included all 238 tenth-grade students at SMKS PEMDA Rantauprapat in the 2025/2026 academic year . academic homogeneity, similarity of teachers, scheduling alignment, and the absence of linear programming material, two classes were selected as samples: Class X TKJ (the experimental group) and Class X TKR (the control group), each consisting of 30 students. Thus, the total sample size for this study was 60 students.

The research instruments consisted of a descriptive test to measure understanding of mathematical concepts and a questionnaire assessing learning interest using a four-choice Likert scale. The indicators of understanding mathematical concepts in this study refer to the Regulation of the Minister of National Education/Directorate General of

Elementary and Secondary Education No. 506/Kep/PP/2004, which includes students' abilities in restating a concept, classifying objects based on certain properties, providing examples and non-examples of a concept, presenting concepts in various forms of representation such as tables, graphs, and mathematical models, using and selecting procedures or operations appropriately, and applying concepts or algorithms in solving linear programming problems. Meanwhile, the learning interest indicator was developed based on Safari (2003), which includes students' feelings of enjoyment towards learning, attention during the learning process, interest in learning materials and activities, and students' active involvement in mathematics learning activities. Data analysis in this study was conducted through descriptive and inferential analysis. Descriptive analysis was used to describe the trend of students' learning interest and understanding of mathematical concepts, which included calculating the average value, standard deviation, minimum and maximum values, and N-Gain to determine the level of improvement in learning outcomes in the experimental and control classes. Inferential analysis was used to test the research hypothesis, which began with prerequisite tests in the form of the Kolmogorov–Smirnov normality test and the Levene variance homogeneity test, then continued with a paired sample t-test to determine the differences in pretest and posttest in each group and an independent sample t-test to compare the posttest results between the experimental and control classes at a significance level of 0.05.

RESULTS AND DISCUSSION

This research was conducted at SMKS PEMD Rantauprapat in the odd semester of 2025/2026 with a quasi-experimental pretest-posttest control group design. Class X TKJ (30) as the experimental class received linear programming learning based on wordwall media, while class X TKR (30) as the control class used a conventional approach. Data were collected through a concept understanding test (15 items α=0.84-0.90) and a learning interest questionnaire (30 items, α=0.90-0.99)

Descriptive Statistics

Table 1. Average Learning Interest and Conceptual Understanding

Variables	Class	Pretest (Mean ± SD)	Posttest (Mean ± SD)	N-Gain
Interest in Learning	Control	72.9 ± 29.20	73.2 ± 29.09	1.35 (Low)
	Experiment	74.2 ± 28.56	89.9 ± 25.17	51.51 (Currently)

Variables	Class	Pretest (Mean ± SD)	Posttest (Mean ± SD)	N-Gain
Concept Understanding	Control	7.63 ± 4.07	7.77 ± 3.96	1.35 (Low)
	Experiment	7.87 ± 4.12	9.97 ± 3.92	44.84 (Currently)

Based on the descriptive statistics in Table 1, it can be seen that the experimental class showed better improvement than the control class in both the learning interest and conceptual understanding variables. In the control class, the average learning interest and conceptual understanding from pretest to posttest only experienced a very small increase with an N-Gain value of 1.35 which is included in the low category. In contrast, the experimental class experienced a significant increase, indicated by an increase in the average learning interest from 74.2 to 89.9 with an N-Gain of 51.51 (moderate category), as well as an increase in conceptual understanding from 7.87 to 9.97 with an N-Gain of 44.84 (moderate category). These results indicate that the treatment given to the experimental class was more effective in increasing students' learning interest .s

Assumption test

Based on the results of the analysis prerequisite test, the data in this study have met the assumptions of normality and homogeneity. The Kolmogorov–Smirnov normality test shows that all data groups have a significance value greater than 0.05, so the data are normally distributed. In addition, the results of the homogeneity of variance test using Levene show a significance value of 0.297 for the learning interest variable and 0.863 for the conceptual understanding variable, both of which are greater than 0.05. Thus, it can be concluded that the data variance between groups is homogeneous, so the data is suitable for analysis using parametric statistical tests.

Hypothesis Testing

Table 2. Results of Paired and Independent T-Tests

Test	Variables	Control Class (Sig.)	Experimental Class (Sig.)	Posttest Comparison (Sig.)
Paired t-test	Interest in Learning	0.083	0.000*	0.021*
	Concept Understanding	0.053	0.000*	0.035*

*Sig. < 0.05 (significantly different)

Based on the results of the hypothesis test using a paired t-test, it was found that in the control class, there was no significant difference between the pretest and posttest scores for either learning interest or conceptual understanding, as indicated by significance values of 0.083 and 0.053, respectively (Sig. > 0.05). This indicates that learning in the controlled class was unable to provide a meaningful increase in students' learning interest and conceptual understanding. In contrast, in the experimental class, a significance value of 0.000 was obtained for both variables (Sig. < 0.05), indicating a significant difference between the pretest and posttest after the treatment. Furthermore, the results of the independent t-test comparing posttest scores between the control and experimental classes showed a significant value of 0.021 for learning interest and 0.035 for conceptual understanding (Sig. < 0.05). These findings indicate a significant difference between the two classes at the final stage of learning, with the experimental class performing better than the control class. Thus, it can be concluded that the treatment applied to the experimental class had a significant effect on increasing students' interest in learning and understanding of concepts.

The integration of wordwall media resulted in a moderate N-Gain (51.51% interest, 44.84% conceptual understanding) in the experimental class, significantly higher than the control class (both 1.35%). The increased learning interest was due to the wordwall's gamification elements, such as interactive quizzes and linear programming graphic visualizations, which shifted students' perception of mathematics from "boring" to "challenging but fun". For conceptual understanding, wordwalls facilitate visual representations of linear equations and iterative practice, allowing students to concretely internalize the relationships between variables. This aligns with cognitive load theory (Mubarrok et al., 2025)S. Practical implications: Vocational high school mathematics teachers are recommended to train the use of word walls for abstract materials such as linear programs.

The increase in student learning interest in the experimental class indicates that the use of Wordwall media can create a more engaging and interactive learning environment than conventional learning. The gamification elements, visualizations, and immediate feedback provided by Wordwall encourage students to be more focused, enthusiastic, and actively involved in the learning process. This finding aligns with learning motivation theory, which states that a fun and challenging learning environment can increase student attention, interest, and engagement, which are key indicators of learning interest. The results of this study also support previous research findings that suggest that technology-

based interactive learning media has a positive effect on students' interest in learning mathematics. In addition to increasing learning interest, the use of Wordwall has also been shown to improve students' understanding of mathematical concepts in linear programming. This media helps students understand abstract concepts through visual representations, interactive exercises, and gradual repetition of concepts. This aligns with constructivism theory, which emphasizes that conceptual understanding is formed through students' active involvement in constructing their own knowledge. Furthermore, from a cognitive load theory perspective, Wordwall helps reduce students' cognitive load by presenting information in a structured and visual manner, making it easier for students to understand the relationships between concepts, such as inequality systems, solution regions, and optimum values. Thus, the integration of Wordwall media not only improves cognitive learning outcomes, but also strengthens students' affective aspects, so that mathematics learning becomes more effective and meaningful.

CONCLUSION

These results indicate that the integration of Wordwall media in linear programming learning effectively addresses the problem of students' low interest in learning and understanding of mathematical concepts. The use of Wordwall has been proven to have a significant influence on increasing students' interest in learning and understanding of concepts compared to conventional learning, both based on descriptive and inferential analysis results. This media is able to create more interactive, interesting, and meaningful learning so that students are more actively involved and more easily understand the abstract concepts of linear programming. Thus, Wordwall is worthy of being used as an alternative learning media to improve the quality of mathematics learning in vocational high schools.

REFERENCES

Aftriyati, L. W., & Roza, Y. (2020). *Analisis Kemampuan Pemecahan Masalah Berdasarkan Minat Belajar Matematika Siswa Smapekanbaru Pada Materi Sltv*. *16*(2), 226–240. Https://Doi.Org/10.20956/Jmsk.V

Akmal, A. (2020). *Upaya Meningkatkan Minat Belajar Anak. 3*.

Anita, M., Asma, N., Siregar, R., Astuti, P., Maritim, U., Ali, R., Maritim, U., Ali, R., Maritim, U., Ali, R., Matematis, K. R., & Linear, P. (2024). *Analisis Kemampuan Representasi Matematis Siswa Dalam Menyelesaikan Masalah Kontekstual Pada Materi Program Linear Ditinjau Dari Karakteristik Berpikir Menurut. 7*, 46–57.

Azzahra, D. M., Yusepa, B. P. G., & Rahman, T. (2023). Peningkatan Kemampuan

Pemahaman Matematis Siswa Sma Melalui Model Problem Based Learning Berbantuan Canva. *Symmetry | Pasundan Journal Of Research In Mathematics Learning And Education*, *8*(1), 146–158. Https://Doi.Org/10.23969/Symmetry.V8i1.9385

Devin Aguswilanda Hidayatullah, M. Z. (2025). Analisis Kesulitan Pemahaman Konsep Pecahan Dalam Pembelajaran Matematika Pada Siswa Di Sekolah Dasar Jurnal Teknologi Pendidikan Dan Pembelajaran (Jtpp). *Teknologi Pendidikan Dan Pembelajaran*, *02*(04), 967–973.

Elfina, H. (2024). Analisis Kesulitan Siswa Dalam Menyelesaikan Soal Program Linier Berbantuan Kalkulator Grafik Di Kelas Xi. *Seminar Nasional Jurusan Matematika*.

Fajar, A. P., Kodirun, K., Suhar, S., & Arapu, L. (2019). Analisis Kemampuan Pemahaman Konsep Matematis Siswa Kelas Viii Smp Negeri 17 Kendari. *Pendidikan Matematika*, *9*(2), 229. Https://Doi.Org/10.36709/Jpm.V9i2.5872.

Ferlina, L., Fratiwi, N. J., Terbuka, U., Studi, P., & Fisika, P. (2024). *Edugame Wordwall : Sebuah Media Untuk Meningkatkan Minat Belajar Matematika Siswa*. *3*(2), 73–88.

Maslinda, Nur Izzati, L. R. (2025). Analisis Kesulitan Belajar Berdasarkan Gaya Berpikir Siswa Pada Materi Program Linear. *Pendidik Indonesia*, *6*(3), 236–243.

Mubarrok, A., Budi, S., & Rachmani, N. (2025). *Peran Media Pembelajaran Interaktif Terhadap Kemampuan Berpikir Kritis Siswa*. *8*, 51–63.

Nadia, D. O. (2022). Pengaruh Media Pembelajaran Wordwall Terhadap Hasil Belajar Siswa Sekolah Dasar. *Jurnal Ilmiah Pgsd Fkip Universitas Mandiri*, *08*, 1924–1933.

Ndraha, I. S., Mendrofa, R. N., & Lase, R. (2022). Analisis Hubungan Minat Belajar Dengan Hasil Belajar Matematika. *Educativo: Jurnal Pendidikan*, *1*(2), 672–681. Https://Doi.Org/10.56248/Educativo.V1i2.92

Prastika, Y. D. (2021). Hubungan Minat Belajar Dan Hasil Belajar Pada Mata Pelajaran Matematika Di Smk Yadika Bandar Lampung. *Jurnal Ilmiah Matematika Realistik*, *2*(1), 26–32. Https://Doi.Org/10.33365/Ji-Mr.V2i1.772

Puteri, A. R., Nasution, W. N., Irwan, M., Nasution, P., & Utara, U. I. N. S. (2025). Integrasi Teknologi Informasi Dan Komunikasi Dalam Pendidikan : Konsep , Perkembangan , Dan Inovasi Media Pembelajaran. *Pendidikan Indonesia: Teori, Penelitian Dan Inovasi*, *5*(4). Https://Doi.Org/10.59818/Jpi.V5i4.1760

Rahmadanti, A., Amril, L. O., & Efendi, I. (2024). *Efektivitas Media Pembelajaran Wordwall Terhadap Hasil Belajar Siswa Pada Pelajaran Matematika Di Sekolah Dasar*. *3*, 117–125.

Safira, S. (2024). Faktor Yang Memengaruhi Minat Dan Kesulitan Belajar Matematika Siswa Tingkat Sekolah Dasar. *Pendidikan, Bahasa Dan Budaya*, *3*, 220–230.

Tamrin, H., & Masykuri, A. (2024). Inovasi Metode Pembelajaran Berbasis Teknologi Dalam Meningkatkan Motivasi Belajar Siswa. *Journal Of Islamic Educational Development*, *1*(1), 63–72.

Titi Tri Kurniawati, N. T. (2025). Implementasi Aplikasi Wordwall Terhadap Motivasi Belajar Matematika Kelas 1 Sekolah Dasar Implementation Of Wordwall Application On Motivation To Learn Mathematics Grade 1 In Elementary. *Action Research Journal Indonesia*, *76*.

Utami, D., & Harahap, T. H. (2025). *Pengaruh Model Pembelajaran Radec (Read , Answer , Discuss , Explain , And Create) Berbantuan Media Wordwall Terhadap Pemahaman Konsep Matematika Siswa Sanggar Bimbingan Muhammadiyah Kepong Malaysia*. *09*(20), 564–575.

Wahyuni, R., & Prihatiningtyas, N. C. (2020). *Kemampuan Pemahaman Konsep Matematika Terhadap Kemampuan Koneksi Matematika Siswa Pada Materi Perbandingan*. *3*(2), 66–73.