

Wordwall Labeled Diagram Gamification as a STEM-Based Social Sciences Learning Medium on Students' Critical Thinking Skills

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ABSTRACT

One of the skills that must be mastered by students in the 21st century to deal with problems and challenges in their personal and social life is critical thinking. Critical thinking skills can be improved through STEM (Science, Technology, Engineering, And Math) based wordwall labeled diagram gamification learning media. This study aims to determine the effect of wordwall labeled diagram gamification as a STEM-based IPS (Science, Technology, Engineering, And Math) learning medium on students' critical thinking skills. This study uses a quantitative approach to the type of preexperimental research with a one group pretest-posttest design. The research was conducted on VA class students at State Elementary School 4 Kalibagor, Kalibagor District. The sample used was 21 students, namely 7 boys and 14 girls by purposive sampling. The instruments used are description questions based on indicators of critical thinking skills according to Ennis including elementary clarification, basic support, inference, advance clarification, and strategy and tactics. The critical thinking skills test was carried out in two stages, namely pretest and posttest. Based on the results, the average score for critical thinking skills in the pretest was 58.7% in the sufficient category, while in the posttest it was 81.2% in the very good category. The hypothesis test used was the paired sample t test, the results obtained through the IBM SPSS version 25 software with (0.05%) obtained a significance value (2-tailed) 0.000 < 0.05. Based on this study, it can be concluded that H0 is rejected and H1 is accepted, so that there is an influence of wordwall labeled diagram gamification as STEMbased IPS (Science, Technology, Engineering, And Math) learning media on students' critical thinking skills.

Keywords: Wordwall labelled diagram media, STEM, Critical thinking skills, Learning social sciences

INTRODUCTION

Human resources must possess adaptive, creative, critical, and innovative skills to face 21st-century challenges. Critical thinking is essential for individuals to address both personal and social issues in their lives. Critical thinking skills can be developed as individuals have the opportunity to become critical intellectuals. Critical thinking is a process of honing systematic thinking when dealing with problems, carefully distinguishing and analyzing problems, and devising a series of problem-solving plans [1]. Critical thinking influences a person's attitude, behavior, and character. Individuals who think critically have high self-esteem, objectively appreciate opinions, control themselves in complex situations, and solve problems calmly [2].

Critical thinking skills can be developed through education. Therefore, education in schools should impart knowledge and teach students critical thinking. A new challenge for teachers is to prepare a classroom learning system by integrating students' knowledge and skills, especially critical thinking skills, to make them adaptive, creative, critical, and innovative individuals. An appropriate learning system is based on Science, Technology,

© 2025 by the authors; licensee PGSD UMP. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/). Srivanto1907@gmail.com (Correspondence) Engineering, and Mathematics (STEM) approaches. Currently, the STEM approach is a choice in education to produce a generation ready for the 21st century [3]. Thus, education becomes of high quality when supported by a learning medium as an effort to enhance students' critical thinking skills. Learning media must be designed to adapt to the conditions, interests, and learning styles of 21st-century students. Current-generation students are highly mobile, app-dependent, and always connected. They prefer interactive gaming (gamification) for learning rather than doing homework through [3]. Gamification becomes an appropriate alternative learning medium to be applied through the principles of STEM-based learning systems. STEM strongly supports using digital technology in the learning process to develop students' critical thinking skills [4].

Critical thinking skills are something that must be instilled in students from the elementary school level. However, due to ineffective and inefficient learning processes, students' critical thinking skills still need to improve. Students are accustomed to working on problems classified as moderate to low level and rarely are they presented with high-level issues. As a result, it is evident that when teachers instruct students to proceed with something, only one or two students participate in following the teacher's instructions. The results of a 2014 survey by the Global Index of Cognitive Skills and Educational Attainment showed that Indonesia ranked 40th out of 40 countries [5]. Trends in International Mathematics and Science Study (TIMSS) survey results in 2011 also indicated that >95% of students could not answer high-level questions. The 2018 Programme for International Student Assessment (PISA) survey ranked Indonesia 74th out of 79 countries. Therefore, based on the results of TIMSS and PISA, it is evident that Indonesia is in a critical state regarding critical thinking.

Considering the challenges above, teachers must design innovative learning media to develop students' critical thinking skills. Learning media suitable for 21st-century students takes the form of visual (visually literate) content using digital technology such as gamification. Gamification involves applying game elements in video form to be applicable across various fields. Various digital technologies developed based on gamification principles include Wordwall. Wordwall is a digital platform or application designed as a learning medium, providing multiple game features, including 18 (eighteen) features available for free [6]. One of the features provided by Wordwall is the Labelled Diagram feature. Labeled Diagram is a game where players draw lines from a point containing a statement label to the corresponding object point on the image. STEM principles design the Wordwall Labelled Diagram learning medium. The benefits of STEM-based learning through technology application include shaping students' socialization, organization, and social spirit, thereby honing their critical thinking skills [7]. Pradani [8] highlighted the characteristics of Wordwall Labelled Diagram, including 1) enhancing students' knowledge through learning while playing, 2) sharpening students' thinking abilities, attitudes, language, and skills, 3) creating a fun learning atmosphere, 4) facilitating teachers in creating questions and students in answering questions without the need for handwritten responses, 5) the game is easy to use and suitable for currentgeneration students, 6) there are many free game options for teachers, preventing student boredom with just one game, 7) the Wordwall Labelled Diagram learning media is student-oriented, creating active participation in discussions, expressing ideas or thoughts, and making decisions.

Several researchers have conducted research on the implementation of the Wordwall Labelled Diagram learning media. For instance, Wordwall has increased student learning motivation in social studies subjects [9]. The application of Wordwall has proven effective, Wordwall Labeled Diagram Gamification as a STEM-Based Social Sciences Learning Medium on Students' Critical Thinking Skills

with a success rate of 91.90% in social studies [10]. Developing the learning media "Kerinda: Hindu-Buddhist Kingdom" and Wordwall games in social studies achieved excellent results with an average percentage score of 88% [11]. Additionally, there are many significant benefits of the Wordwall-based TPACK (Technological Pedagogical Content Knowledge) media [12].

The above research indicates that Wordwall learning media has an impact on improving motivation and critical thinking skills, enhancing learning outcomes. However, these studies have limitations, as they solely focus on learning media without integrating Wordwall learning media with a STEM approach. This research applies the Wordwall Labelled Diagram learning media based on STEM, which other researchers still need to do. In other words, this study introduces innovation by implementing Wordwall Labelled Diagram learning media based on STEM to enhance the critical thinking skills of elementary school students in social studies, specifically focusing on the geographical location of Indonesia for fifth-grade students. Based on the above description, this research aims to determine the effect of wordwall labeled diagram gamification as a STEM-based IPS (Science, Technology, Engineering, And Math) learning medium on primary school students' critical thinking skills

MATERIAL AND METHODS

This research employed a quantitative approach, specifically a pre-experimental design with a one-group pretest-posttest design—the research design aimed to gather data on student's critical thinking skills before and after the intervention. The intervention in this study utilized the Wordwall Labelled Diagram learning media based on STEM. Before the intervention, students completed a pretest, then received the treatment with the STEM-based Wordwall Labelled Diagram learning media, and finally, they completed a posttest. The research design is illustrated in Table 1

Table 1.	One	Group	Pretest-Posttest	Research	Design
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Pretest	Treatment	Posttest
O ₁	Х	O ₂

Explanation:

 $O_1 = pretest$ before the treatment

 $O_2 = posttest$ after the treatment

X = using *wordwall labeled diagram* as a STEM-based IPS (Science, Technology, Engineering, and Math) learning medium

This research was conducted at SDN 4 Kalibagor, Kalibagor District, in the first semester of the academic year 2022/2023, with the research subjects being the VA class, consisting of 21 students, including 7 male students and 14 female students, selected using a purposive sampling technique. The data collection method used open-ended questions with an instrument based on critical thinking skills indicators. The critical thinking skills test questions were administered before and after the learning implementation. Scores for critical thinking skills were obtained from students' answers to each questions. Scoring criteria were based on a scoring rubric, with each sub-indicator in the questions receiving a score from 0 to 4. The data analysis techniques employed included descriptive statistical analysis and parametric analysis, consisting of tests for normality and hypothesis testing (t-test).

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RESULTS AND DISCUSSION

The indicators of critical thinking skills in this study are based on Ennis's theory as cited in H. Lestari et al. [11], including 1) providing elementary clarification, 2) building basic support, 3) making inferences, 4) providing advanced clarification, 5) strategizing and tactics. Based on the research results, the average percentage scores for each critical thinking skills indicator in the pretest questions are presented in Figure 1.





Based on the bar chart above, the average percentage scores for each critical thinking skills indicator in the pretest questions are as follows: Indicator 1 obtained 65.5%, Indicator 2 obtained 50.6%, Indicator 3 obtained 57.7%, Indicator 3 obtained 58.3%, and Indicator 4 obtained 57.1%.



Figure 2. Bar Chart of Percentage Scores for Critical Thinking Skills Indicators in Posttest Questions

Based on the bar chart above, it is evident that the average percentage scores for each critical thinking skills indicator in the posttest questions are higher than those in the pretest questions. Specifically, Indicator 1 obtained 82.5%, Indicator 2 obtained 79.2%, Indicator 3 obtained 83.3%, Indicator 3 obtained 83.9%, and Indicator 4 obtained 75%.

The data obtained from the critical thinking skills test comprise results from openended pretest and posttest questions. These questions were administered to the students and then analyzed. The pretest was given before the learning process to measure the extent of student's critical thinking skills in answering critical thinking skills questions related to the subject matter. After that, the students were treated using the wordwall labeled diagram as a STEM-based learning medium. Once the lesson on the geographical location of Indonesia in the social studies subject was completed, the students were given a different set of posttest questions. Based on the pretest and posttest results from the 21 students, the lowest and highest scores and average scores are presented in Table 2.

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Table 2. Description of Pretest and Posttest Scores						
Data	Pretest	Posttest				
Number of Students	21	21				
Highest Score	72.5	92.5				
Lowest Score	45	70				
Mean	58.7	81.2				

Based on the table above, there are 21 students. The average pretest score is 58.7, with the highest score of 72.5 and the lowest score of 45. Meanwhile, the average posttest score is 81.2, with the highest score of 92.5 and the lowest score of 70. The obtained differences can be interpreted to mean that the treatment using the wordwall labeled diagram as a STEM-based learning medium can enhance students' critical thinking skills. The difference between pretest and posttest scores for students' critical thinking skills is illustrated in Figure 3.



Figure 3. Bar Chart of the Difference Between Pretest and Posttest Scores of Critical Thinking Skills

Based on the bar chart above, it is evident that the posttest scores are higher than the pretest scores. This result indicates improved students' critical thinking skills after implementing the treatment using the wordwall labeled diagram as a STEM-based learning medium. Furthermore, to determine whether this medium significantly affects students' critical thinking skills, a paired sample t-test was conducted, and the results are presented in Table 3.

Explanation	Mean	Std. Deviation	Sig. (2-tailed)	Test Decision
Shapiro-Wilk				
Pretest	58.8095	7.48411	0.833	Normally
Posttest	81.1905	6.35507	0.747	Distributed Data
Paired sample t-test Pretest-Posttest	-22.38095	7.13601	0,000	Significant

Table 3. Results of the Normality Test and Paired Sample t-test

Based on the table above, before conducting the paired sample t-test, the data underwent a normality test using the Shapiro-Wilk analysis technique. The obtained probability scores for the pretest were 0.833, and for the posttest were 0.747. These values are more significant than the significance level of 0.05, indicating that the data is normally distributed. With the data having a normal distribution, a paired sample t-test was conducted, resulting in a probability score of 0.000, which is smaller than the significance level of 0.05.

Based on these calculations, it can be analyzed that there is a difference in critical thinking skills before and after the treatment using the wordwall labeled diagram as a STEM-based learning medium. This is attributed to the learning system integrating the Wordwall Labelled Diagram learning medium with the STEM approach. It is relevant to students' real-life situations, thus stimulating their critical thinking skills. Learning with the wordwall labeled diagram as a STEM-based learning medium has a positive impact, as it generally motivates students to design, develop, and apply science and technology. Introducing digital media into the classroom automatically changes teaching strategies, methods, and techniques. Teachers no longer need to lecture in an abstract manner thanks to the utilization of these learning media [13]. In line with the views of Jannah & Atmojo [14], using digital media in learning can make teaching time more effective, and students become more focused because of visualization compared to merely reading texts. Additionally, elements present in digital media can enhance student motivation and engagement in the learning process [15].

Students' learning activities using the wordwall labeled diagram as a STEM-based learning medium went well during the learning process. Students actively participated in group activities and assisted each other in solving problems presented by the teacher. Through group discussions, students found it easier to understand when they faced difficulties and did not feel alone because their group members assisted them. Moreover, each member is a peer, so they do not feel awkward when asking questions or explaining to each other. As a facilitator, the teacher also had to control the students during the discussions to ensure that the learning process proceeded smoothly. This aligns with the learning theories proposed by Vygotsky and Piaget, suggesting that students can acquire knowledge through a learning process involving interaction within a heterogeneous group. Based on these assumptions, it is recommended that teachers collaborate with students to facilitate discussions, question-and-answer sessions, and even debates with peers to build knowledge [16].

The Wordwall Labelled Diagram learning media in group settings allows each member to have specific roles and responsibilities to achieve the learning goals successfully. As a result, each member becomes active and participates in completing the assigned tasks. This learning media enhances critical thinking skills, improving students' learning outcomes [17], [18].

CONCLUSION

Based on the analysis of the research results and discussions above, it can be concluded that the implementation of the wordwall labeled diagram as a STEM-based learning medium has a significant impact on the critical thinking skills of fifth-grade students in the social studies subject, specifically on the topic of the geographical location of Indonesia. The limitation of this research is that it only applies the wordwall labeled diagram as a STEM-based learning medium to one subject and measures only critical thinking skills. Future research should use the wordwall labeled diagram as a STEM-based learning medium for other issues to measure creative thinking skills.

REFERENCES

- [1] Azizah, M., Sulianto, J., & Cintang, N. (2018). Analysis of Critical Thinking Skills of Elementary School Students in Learning Mathematics Curriculum 2013. Jurnal Penelitian Pendidikan, 35(1), 61–70. <u>https://doi.org/10.15294/jpp.v35i1.13529</u>
- [2] Anggraeni, N., Rustini, T., & Wahyuningsih, Y. (2022). Keterampilan Berpikir Kritis Siswa Sekolah Dasar Pada Mata Pelajaran IPS Di Kelas Tinggi. Jurnal Kajian Pendidikan Dan Hasil Penelitian, 8(1), 84–90. <u>https://doi.org/10.26740/jrpd.v8n1.p84-90</u>
- [3] Mulyani, T. (2019). Pendekatan Pembelajaran STEM untuk menghadapi Revolusi Industri 4.0. Seminar Nasional Pascasarjana 2019, 7(1), 455.
- [4] Maula, N. R., & Fatmawati, L. (2020). Pengembangan Media Pembelajaran Kayaku (Kayanya Alam Negeriku) Berbasis STEM Kelas IV Sekolah Dasar. *Jurnal Ilmiah Sekolah Dasar*, 4(1), 97. <u>https://doi.org/10.23887/jisd.v4i1.22351</u>
- [5] Symonds, Q. (2014). Britain and the Global Index of Cognitive Skills and Educational Attainment. https://www.qs.com/britain-and-the-global-index-of-cognitive-skills-and-educational-attainment/
- [6] Sun'iyah, S. L. (2020). Media Pembelajaran Daring Berorientasi Evaluasi Pembelajaran Pada Mata Pelajaran Pai Di Tingkat Pendidikan Dasar. Jurnal Studi Keagamaan, Pendidikan Dan Humaniora, 7(1), 1–18. https://doi.org/https://doi.org/10.52166/dar%20el-ilmi.v7i1.2024
- [7] Zuryanty, Hamimah, Ary Kiswanto Kenedi, Y. H. (2020). *Pembelajaran STEM Di Sekolah Dasar* (Deepublish (ed.)). Deepublish.https://books.google.co.id/books?hl=id&lr=&id=zaAaEAAAQBAJ&oi=fnd&pg=PP1&dq=Zuryanty,+ Hamimah,+Kenedi,+A.+K.,+%26+Helsa,+Y.+(2020).+Pembelajaran+Stem+Di+Sekolah+Dasar.+Yogyakarta+:++De epublish.+Https://Books.Google.Co.Id/Books%3FId%3DZaaaeaaaqbaj&ots=Z8Pj
- [8] Pradani, T. G. (2022). Penggunaan media pembelajaran wordwall untuk meningkatkan minat dan motivasi belajar siswa pada pembelajaran IPA di Sekolah Dasar. *Educenter*, 1(5), 452-457. <u>https://doi.org/10.55904/educenter.v1i5.162</u>
- [9] Permana, S. P., & Kasriman, K. (2022). Pengaruh Media Pembelajaran Wordwall terhadap Motivasi Belajar IPS Kelas IV. Jurnal Basicedu, 6(5), 7831–7839. <u>https://doi.org/10.31004/basicedu.v6i5.3616</u>
- [10] Kasa, B., Taneo, S. P., Lehan, A. A. D., Bol, A., Benu, N., Bulu, V., Loko, L. E., & Nota, M. C. G. (2021). Efektivitas Penggunaan Aplikasi Wordwall dalam Pembelajaran IPS Secara Daring (Online) di Kelas Tinggi Sekolah Dasar. *Haumeni Journal of Education*, 1(2), 154–159.
- [11] Lestari, Y. I., Amalia, R., & Nugraha, D. (2022). Edukatif: Jurnal Ilmu Pendidikan Pengembangan Video "Kerinda: Kerajaan Hindu - Buddha "serta Games Wordwall sebagai Media Belajar IPS di Sekolah Dasar. 4(5), 6606–6616. <u>https://doi.org/10.31004/edukatif.v4i5.2893</u>
- [12] Nur, N., & Jauhar, S. (2022). Analisis Penggunaan Media Pembelajaran Wordwall Berbasis TPACK pada Pembelajaran IPS Siswa Kelas V SDS IT Rabbani Kecamatan Tanete Riattang Kabupaten Bone. *Global Journal Teaching Professional*, 1(3), 371–378. <u>https://doi.org/DOI.10.35458</u>
- [13] Sriyanto, Purwanta, V. (2019). VARIABEL-VARIABEL ESENSIAL PENELITIAN PENDIDIKAN: PEMBELAJARAN. UNS Press.
- [14] Jannah, D. R. N., & Atmojo, I. R. W. (2022). Media Digital dalam Memberdayakan Kemampuan Berpikir Kritis Abad 21 pada Pembelajaran IPA di Sekolah Dasar. *Jurnal Basicedu*, 6(1), 1064–1074. https://doi.org/10.31004/basicedu.v6i1.2124
- [15] Dwi, M. (2020). Pemanfaatan Teknologi Pendidikan Di Masa Pandemi Covid-19: Penggunaan Fitur Gamifikasi Daring Di Universitas Muhammadiyah Pringsewu Lampung. *Al-Jahiz: Journal of Biology Education Research*, 1(1), 14. <u>https://doi.org/10.32332/al-jahiz.v1i1.2082</u>
- [16] Suci, Y. T. (2018). Examining Vygotsky's Theory and Social Interdependence as The Theory of the Theory in the Implementation of Cooperative Learning in Primary Schools. *NATURALISTIC: Journal of Education Research and Learning Studies*, 3(1), 231–239. <u>https://doi.org/10.35568/naturalistic.v3i1.269</u>
- [17] Ma'rifah, M. Z., & Mawardi, M. (2022). Peningkatan Kemampuan Berpikir Kritis Siswa Menggunakan Hyflex Learning Berbantuan Wordwall. Scholaria: Jurnal Pendidikan Dan Kebudayaan, 12(3), 225–235. <u>https://doi.org/10.24246/j.js.2022.v12.i3.p225-235</u>
- [18] Khan, A., et.al., (2020). Mediating Effect of Positive Psychological Strength and Study Skills on Examination Anxiety among Nigerian College Students, Sustainability 14 (4, 1479)., <u>https://doi.org/10.3390/su12041479</u>

http://jurnalnasional.ump.ac.id/index.php/Dinamika