

Development of *Wayground* Media Based on *Problem-Based Learning* To Improve Social Studies Learning Outcomes

Yuni Harti^{1*}, Imam Sukwatus Suja'i², Ajar Dirgantoro³, Rahyu Setiani⁴

^{1,2,3} Universitas Bhinneka PGRI Tulungagung, Indonesia.

*Corresponding author: yunindrian77@gmail.com

ARTICLE INFO

Article history

Received Januari 30, 2026

Revised February 12, 2026

Accepted March 02, 2026

Keywords: *Wayground* Media, Problem Based Learning, Learning Outcomes, Social Studies.

ABSTRACT

Education aims to develop students' potential optimally; however, learning outcomes in Indonesia still face several challenges, particularly low student engagement caused by teacher-centered instruction. This condition makes students less active in the learning process and affects their understanding of Social Studies material. In addition, the demands of 21st-century learning and rapid technological development require innovative and interactive digital learning media that are oriented toward problem solving to improve student learning outcomes. This study aimed to develop *Wayground* media based on *Problem-Based Learning* to enhance the Social Studies learning outcomes of Grade VII students at SMP Negeri 1 Bandung in the first semester of the 2025/2026 academic year. The research employed a Research and Development (R&D) method by adapting and streamlining the Borg and Gall model, including needs analysis, design, product development, expert validation, field testing, revision, and dissemination. The results indicated that the developed media was highly valid based on evaluations by media, material, and language experts. The practicality level exceeded 90.2% across individual, small-group, and large-group trials. The media proved effective, as the mean score increased from 61.27 to 89.71, with an *N-Gain* of 0.74 (high category) and a statistically significant *t-test* result (Sig. 0.000 < 0.05). Strengthening the research design and including control groups are recommended for future studies.

1. INTRODUCTION

Education, as stated in Law Number 20 of 2003 on the National Education System of Indonesia, is a conscious and planned effort to create learning environments that enable students to actively develop their potential, including spiritual strength, self-control, intelligence, noble character, and necessary skills for themselves and society. Education is therefore a fundamental pillar of national development. However, despite continuous reforms, the quality of learning outcomes in Indonesia remains a significant concern, particularly regarding students' cognitive, affective, and psychomotor achievements (Masril, 2014). Various strategic efforts, such as curriculum reform, teacher professional development, infrastructure improvement, and school management strengthening, have been implemented. Nevertheless, these policies have not fully addressed classroom-level challenges, especially in promoting meaningful and sustainable learning outcomes (Cakrawala Pendidikan, SINTA 2). One persistent issue is the dominance of teacher-centered learning, where lectures and one-way communication prevail, limiting students' active engagement and higher-order thinking skills (Savery, 2015). The 21st-century learning paradigm emphasizes shifts from isolated learning to networked, technology-integrated environments. Students are no longer dependent solely on teachers as knowledge sources but can access information anytime and anywhere through digital technology (Kemendikbud, 2013). Learning

processes extend beyond classrooms into school and community contexts, and teachers act as facilitators rather than sole knowledge providers (Farihah & Soeprajitno, 2015). In line with this transformation, electronic learning (e-learning) is defined as learning utilizing information and communication technology accessible anytime and anywhere (Ministry of Education and Culture Regulation No. 109 of 2013).

Despite technological advancements, Social Studies (IPS) learning at SMP Negeri 1 Bandung is often perceived as monotonous and challenging. Students frequently experience boredom, resulting in low engagement and unsatisfactory learning outcomes. Although platforms such as Zoom and Google Meet facilitate online instruction, they do not necessarily ensure students' conceptual understanding. Therefore, innovative digital learning media that are interactive and problem-oriented are needed. Recent studies over the past decade highlight the effectiveness of digital game-based learning and *Problem-Based Learning* (PBL) in fostering motivation, collaboration, and higher-order thinking skills (Savery, 2015; Sumarni, 2022). Game-based learning environments incorporating fantasy, challenge, and curiosity can enhance student engagement and conceptual mastery (Salsabila et al., n.d.). However, most prior studies focus on general digital platforms or separate applications of PBL and game-based media. Limited research specifically integrates a narrative educational game application such as *Wayground* with a structured PBL framework in Social Studies at the junior secondary level. This gap indicates the need for empirical development research that examines the validity, practicality, and effectiveness of such integration. The novelty of this research lies in the integration of a narrative-based digital learning application, *Wayground*, with a structured Problem-Based Learning (PBL) framework specifically designed for Social Studies learning at the junior secondary level. Unlike previous studies that tend to examine digital game-based learning or PBL separately, this study systematically combines interactive storytelling features, problem-solving activities, and curriculum-aligned Social Studies content into a single instructional medium. In addition, this research applies a comprehensive Research and Development (R&D) approach that evaluates the product not only in terms of effectiveness but also validity and practicality through expert validation and multi-stage field trials.

This integrated approach provides a more holistic evaluation and produces a structured digital learning model that can be directly implemented in classroom practice. Therefore, this study contributes a new instructional design model that bridges digital game-based learning and Problem-Based Learning within the context of Social Studies education in Indonesian junior secondary schools. Based on this gap, the present study addresses the following problem: how can *Wayground*-based *Problem-Based Learning* media be developed to produce valid, practical, and effective instructional tools for improving Social Studies learning outcomes? The study adopts a Research and Development (R&D) approach adapted from the Borg and Gall model, involving needs analysis, design, product development, expert validation, field testing, revision, and dissemination. The objectives of this study are (1) to develop *Wayground*-based PBL media for Grade VII Social Studies, (2) to examine its validity through expert judgment (media, material, and language), (3) to analyze its practicality through field trials, and (4) to evaluate its effectiveness in improving students' learning outcomes. The expected result is an innovative digital learning medium that enhances student engagement, promotes higher-order thinking, and significantly improves Social Studies achievement.

2. METHODS

This study employed a Research and Development (R&D) design, which serves as a systematic procedure for developing and validating educational products (Siregar, 2017). According to Sugiyono (2013), R&D is a research method used to produce specific products and to test their effectiveness. The primary objective of this research was to develop a *Wayground*-based *Problem-Based Learning* (PBL) media product and examine its validity, practicality, and effectiveness in improving Social Studies learning outcomes. The development procedure adapted the ten-step model of Borg and Gall (as cited in Sukmadinata, 2021), which includes: (1) research and information gathering, (2) planning, (3) developing the preliminary product draft, (4) expert validation, (5) initial revision, (6) field testing, (7) product revision, (8) operational field testing, (9) final product revision, and (10) dissemination and implementation. The model was modified to enhance efficiency while considering limitations of time, cost, and resources.

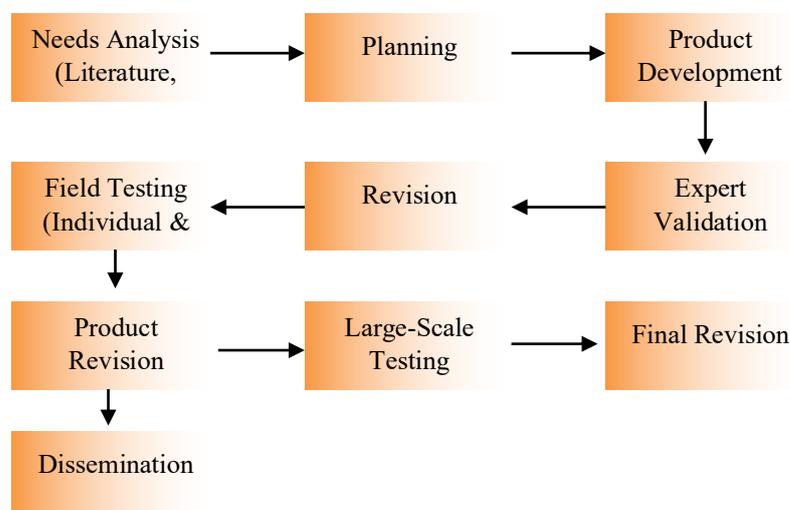


Figure 1. The steps of research and development of *Wayground* media based on *Problem-Based Learning* adapted from the Borg & Gall model.

The initial stage involved needs analysis through literature review, classroom observation, and interviews with a Grade VII Social Studies teacher at SMP Negeri 1 Bandung. The selected material focused on “Economic Activities” (production, distribution, and consumption), aligned with Basic Competency 3.3 of the national curriculum. The product development stage included designing interactive multimedia elements integrated with PBL scenarios. The draft product was validated by media experts (focusing on visual communication and technical design), subject-matter experts (content relevance and instructional quality), and language experts (clarity, appropriateness, and readability). Revisions were made based on expert feedback before field testing. The product trials consisted of three stages: individual testing (10 students with varied academic abilities), small-group testing (one class of 30 students), and large-group testing (two Grade VII classes). Data were collected through observation, questionnaires, interviews, and pre-test and post-test assessments. Both qualitative and quantitative data were collected (Hardani et al., 2020). Qualitative data were obtained from expert suggestions, classroom observations, and interviews. Quantitative data were derived from validation questionnaires, student response questionnaires, and learning achievement tests. The achievement test consisted of 25 multiple-choice and short-answer items administered as pre-test and post-test. Descriptive analysis with Likert scales was used to assess product validity and feasibility (Arikunto, 2013). Student responses were analyzed using percentage calculations based on the Guttman scale (“Yes” = 1; “No” = 0), categorized into five criteria ranging from “Very Poor” to “Very Good.” To measure

effectiveness, learning improvement was calculated using the N-Gain score and analyzed with SPSS 22.0. This analysis determined the extent to which the *Wayground*-based PBL media significantly improved students' Social Studies learning outcomes.

3. RESULTS AND DISCUSSION

This section summarizes the findings of the development and implementation of *Wayground*-based *Problem-Based Learning* (PBL) media for Grade VII Social Studies. The results include needs analysis, expert validation, practicality testing, and effectiveness testing through pre-test and post-test comparisons.

3.1 Needs Analysis

Classroom observations and interviews revealed that Social Studies learning was still predominantly teacher-centered. Students showed limited engagement, particularly in analyzing contextual economic problems. Daily assessment results indicated that many students did not meet the minimum mastery criteria. Students expressed a need for more interactive, problem-oriented digital learning media.

3.2 Expert Validation Results

The developed *Wayground*-based PBL media was validated by media, material, and language experts. The summary of validation results is presented below.

Table 1 Validation Results

Validator	Total Score	Category
Media Expert	30 (Avg. 4.29)	Very Valid
Material Expert	30	Very Valid
Language Expert	33/35	Very Valid

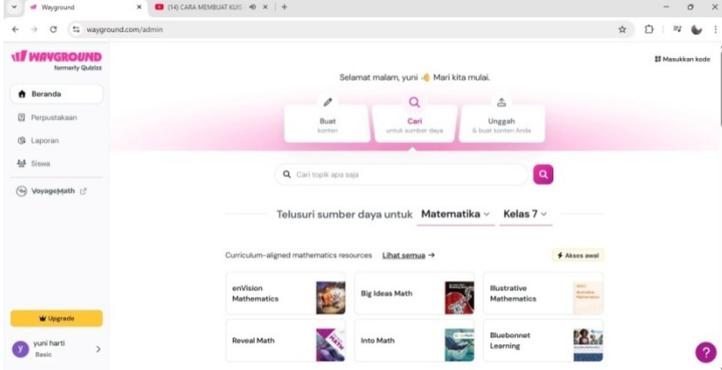
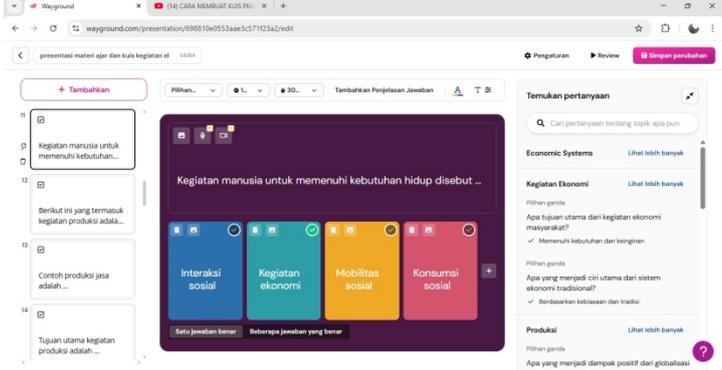
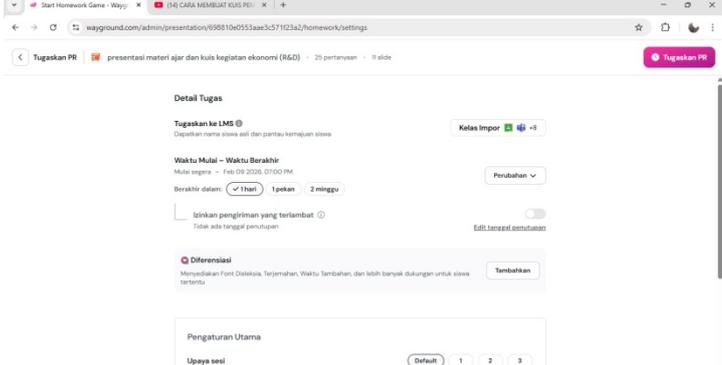
The results indicate that the media meets academic, visual, and linguistic standards and is appropriate for classroom implementation.

The product revision was carried out in accordance with the validators' suggestions to improve the visual aspects, the *Problem-Based Learning* flow, the clarity of instructions, and the completeness of the evaluation components in the *Wayground* media. These revisions indicate that the developed media became more systematic, communicative, and aligned with the learning needs of Grade VII Social Studies students.

The results of the product development are as follows:

Table 2 Product Development Results

No.	Product Image	Description
1		<i>Wayground</i> login page

No.	Product Image	Description
2		<p>Wayground library menu page</p>
3		<p>Product home page after logging into wayground</p>
4		<p>Creating quiz questions</p>
5		<p>Assignment</p>

No.	Product Image	Description
6		Example of quiz question display

3.3 Practicality Test Results

Practicality was tested through individual, small-group, and large-group trials. Students evaluated ease of use, clarity, attractiveness, and usefulness.

Table 3 Practicality Test Results

Trial Stage	Percentage	Category
Individual Trial (10 students)	90.2%	Very Practical
Small Group (30 students)	91.4%	Very Practical
Large Group (63 students)	91.78%	Very Practical

These findings demonstrate high usability and positive student acceptance across all implementation stages.

3.4 Effectiveness Test Results

Effectiveness was measured using pre-test and post-test scores analyzed with N-Gain.

Table 4 N-Gain Score

Average Pre-test	Average Post-test	N-Gain
61.27	89.71	0.74 (High)

The significant increase indicates substantial improvement in students' understanding after using the *Wayground*-based PBL media.

Table 5 Paired Sample t-Test Analysis

t-value	Sig. (2-tailed)
17.131	0.000 (<0.05)

The statistical test confirms a significant difference between pre-test and post-test scores, indicating that the intervention was effective.

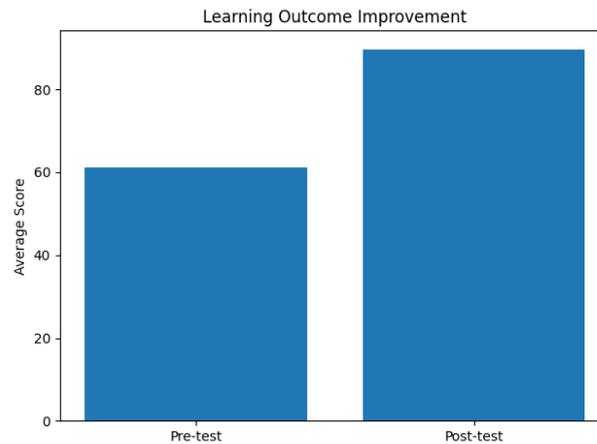


Figure 2. Comparison of Pre-test and Post-test Scores

Figure 1 illustrates the substantial increase in average scores after implementation of the *Wayground*-based PBL media.

DISCUSSION

Validity of the Development of *Wayground* Media Based on *Problem-Based Learning* to Improve Social Studies Learning Outcomes

Based on the results of the problem and needs analysis conducted in the previous stage, the development of *Wayground* media based on *Problem-Based Learning* (PBL) for Grade VII Social Studies on the topic of economic activities was carried out systematically. The development process carefully considered the substance of the material, visual and interface design, linguistic clarity, and alignment with the syntax of the PBL model. The validation results from the media expert, as presented in Table indicate that the aspects of media engineering and visual communication obtained a total score of 30 with an average of 4.29, categorized as “very valid.” This finding suggests that the developed media meets validity standards in terms of design structure, layout organization, navigation clarity, and visual quality. The interface was designed to support interactive and student-centered learning. This result is consistent with Mayer’s Cognitive Theory of Multimedia Learning (2021), which emphasizes that well-organized visual design and appropriate integration of text and images enhance students’ attention, comprehension, and retention. Clear navigation and structured digital environments also strengthen students’ cognitive engagement (Smaldino, Lowther, & Mims, 2019). Therefore, the media validation confirms that *Wayground* is technically and pedagogically feasible to support problem-based instruction.

Validation by the material expert produced a total score of 30, categorized as “very valid” in terms of content relevance, conceptual accuracy, and instructional objectives. This indicates that the economic activities material aligns with the Basic Competencies in the curriculum, is conceptually accurate, and corresponds to the cognitive development level of Grade VII students. The material was presented contextually and integrated with real-life problems close to students’ daily experiences, thereby supporting the fundamental principles of PBL. According to Savery (2015), authentic problems serve as triggers for learning in PBL environments, enabling students to construct knowledge through inquiry and reflection. Arends (2012) further emphasizes that contextual problem presentation is central to stimulating critical thinking and problem-solving skills. Thus, the material validation confirms that *Wayground* is not only valid in substance but also aligned with the core characteristics of PBL, which aim to improve higher-order thinking and

Social Studies learning outcomes. Language validation obtained a total score of 33 out of 35, also categorized as “very valid.” The evaluated aspects included language appropriateness for students’ characteristics, sentence clarity, terminology accuracy, grammatical rules, typography, politeness, and clarity of usage instructions. The results demonstrate that the language used in *Wayground* is communicative, structured, and easily understood by junior high school students.

Clear and structured language plays a critical role in problem-based learning, as students must comprehend problems, discuss possible solutions, and present findings systematically. Vygotsky (1978) emphasized that language functions as a mediational tool in cognitive development and concept formation. Additionally, Branch (2010) noted that clarity and readability significantly influence the effectiveness of instructional materials. Therefore, the linguistic aspect of *Wayground* effectively supports PBL implementation. Revisions based on validator feedback further improved the product. These revisions included adding identity information and learning objectives, inserting a preface slide, clarifying instructions for use, strengthening the explicit PBL stages, refining guiding questions, reorganizing evaluation components, and simplifying language. These improvements align with the ADDIE development model, which highlights evaluation and revision as crucial steps in enhancing instructional product quality (Branch, 2010). Overall, the validation results from media, material, and language experts demonstrate that *Wayground*-based PBL media meets theoretical and empirical validity standards and is appropriate for implementation in Grade VII Social Studies at SMP Negeri 1 Bandung.

Practicality of *Wayground* Media Based on *Problem-Based Learning* to Improve Social Studies Learning Outcomes

Practicality is a key indicator in Research and Development studies, reflecting the extent to which an instructional product can be used easily, attractively, and effectively in real classroom contexts. According to Nieveen (2013), practicality is characterized by ease of use, clarity of instructions, time efficiency, and positive user acceptance. In this study, practicality was evaluated through three stages: individual trials, small-group trials, and large-group trials. The individual trial involving Grade VII students yielded a practicality percentage of 90%, categorized as “very practical.” This stage aimed to identify technical and substantive issues before broader implementation. Students reported positive perceptions regarding visual appearance, ease of navigation, clarity of instructions, content suitability, and interactive problem-based features. This aligns with Plomp and Nieveen’s (2013) assertion that early trials function diagnostically to ensure readiness for wider implementation. The small-group trial conducted in Class VII A (31 students) produced a practicality score of 91.4%, also categorized as “very practical.” The average indicator scores ranged from 4.33 to 4.83, indicating strong student approval across almost all aspects. Since classroom settings reflect heterogeneous academic abilities, this stage provided empirical insight into how the media performs under realistic instructional conditions. Borg and Gall (2007) recommend such limited trials to ensure comprehensive product evaluation across varied learner abilities. However, methodologically, early-stage trials remain exploratory and limited in generalizability (Creswell & Poth, 2018). Therefore, the research proceeded to large-group testing.

The large-group trial involving 63 students (Classes VII B and VII C) resulted in an average practicality percentage of 91.78%, categorized as “very practical.” The consistency of scores across all trial stages indicates that *Wayground* is widely accepted and user-friendly. High ratings in interface clarity and ease of use support Sweller’s (2019) Cognitive Load Theory, which states that structured and simple digital designs reduce extraneous cognitive load and allow students to focus on essential learning content. High motivation scores were also observed. Dicheva et al. (2015)

argue that interactive digital environments containing challenge elements enhance intrinsic motivation. In Social Studies, which is often perceived as theoretical, *Wayground* appears to transform learning into a contextual and engaging experience. Nevertheless, some critical considerations must be acknowledged. First, practicality data were collected through self-report questionnaires, which may be subject to social desirability bias (Podsakoff et al., 2003). Second, analysis relied primarily on descriptive statistics. Incorporating reliability testing such as Cronbach's Alpha would strengthen methodological rigor (Fraenkel, Wallen, & Hyun, 2019). Third, high practicality does not automatically guarantee effectiveness. Clark (2012) emphasized that technology impacts learning only when supported by strong pedagogical design. In summary, *Wayground*-based PBL media demonstrates very high practicality across all testing stages, consistent with digital learning and PBL literature. However, practicality should be interpreted as a prerequisite for implementation rather than the sole indicator of instructional success.

Effectiveness of *Wayground* Media Based on *Problem-Based Learning* to Improve Social Studies Learning Outcomes

Effectiveness is the primary indicator of success in instructional product development. It demonstrates whether a product not only functions properly but also significantly improves learning outcomes (Plomp & Nieveen, 2013). In this study, effectiveness was evaluated through pre-test and post-test comparisons, N-Gain analysis, and paired samples t-test in a large-group trial involving 63 Grade VII students. The average pre-test score was 61.27, below the minimum mastery criterion (70). This indicates insufficient prior understanding of economic activities. Such findings are consistent with Barron and Darling-Hammond (2008), who argue that traditional lecture-based approaches often fail to foster deep conceptual understanding. After implementing *Wayground*-based PBL, the average post-test score increased significantly to 89.71. This substantial improvement suggests that most students exceeded the mastery criterion. Hmelo-Silver (2004) explains that PBL promotes meaningful learning through exploration, collaboration, and reflection. *Wayground* facilitated these processes by presenting contextual problems, interactive quizzes, and guided inquiry tasks. The average N-Gain score was 0.74, categorized as high (Hake, 1999). This indicates strong relative improvement compared to initial performance. Moreover, N-Gain distribution suggests that the media benefits students across varying academic abilities, reducing potential digital learning gaps (OECD, 2020). However, Meltzer (2002) warns that high N-Gain scores may partly result from low initial pre-test scores. Therefore, interpretation should consider baseline conditions.

The paired samples t-test produced a significance value of 0.000 (< 0.05), indicating a statistically significant difference between pre-test and post-test scores. This confirms that the intervention had a measurable impact (Fraenkel, Wallen, & Hyun, 2019). Nevertheless, limitations exist. The one-group pretest-posttest design is vulnerable to internal validity threats such as testing effects and maturation (Campbell & Stanley, 1963). The absence of a control group also limits causal inference. Future studies should employ quasi-experimental designs. Additionally, reporting effect size measures (Field, 2018) and detailed validity and reliability analyses (Messick, 1995) would strengthen academic rigor. Despite these limitations, findings align with constructivist theory (Jonassen, 2011), multimedia learning theory (Mayer, 2020), and empirical research demonstrating the effectiveness of digital-supported PBL (Walker et al., 2015; Schmid et al., 2021). In conclusion, the large-group trial demonstrates that *Wayground*-based *Problem-Based Learning* media is effective in improving Social Studies learning outcomes, as evidenced by significant score improvement (61.27 to 89.71), high N-Gain (0.74), and statistically significant t-test results. While further methodological strengthening is recommended, *Wayground* shows strong

potential as an innovative, valid, practical, and effective instructional media for Grade VII Social Studies.

4. CONCLUSION

The Problem Based Learning (PBL)-based *Wayground* media was found to be highly valid, practical, and effective. Its validity was confirmed through expert evaluations, with a total score of 30 and an average of 4.29 (very valid category) from the media expert, a total score of 30 (very valid category) from the material expert, and a total score of 33 out of a maximum 35 (very valid category) from the language expert. This validity encompasses visual design quality, alignment of content with basic competencies, and the use of communicative language appropriate for seventh-grade students. Revisions based on validators' suggestions, including the addition of learning objectives, clarification of PBL stages, and simplification of language, further enhanced the media's quality. Practically, product trials at individual, small-group, and large-group levels demonstrated very high practicality, with percentages above 90.2% at each stage. The media was considered easy to use, engaging, clearly instructed, and capable of increasing students' motivation in social studies learning. Its simple and structured interface design also helped reduce cognitive load and strengthen student engagement in problem-solving activities, although the high practicality results should be interpreted cautiously due to reliance on self-report data without in-depth instrument reliability analysis. Furthermore, the PBL-based *Wayground* media proved effective in improving social studies learning outcomes, as indicated by an increase in the average score from 61.27 to 89.71 and an N-Gain value of 0.74 (high category). The paired samples t-test result (Sig. (2-tailed) $0.000 < 0.05$) confirmed a statistically significant difference between pre- and post-treatment scores. These findings align with constructivist theory and the characteristics of PBL, which emphasize active student engagement in contextual problem-solving; however, future research should employ stronger experimental designs, include control groups, and report effect sizes and instrument validity more comprehensively to reinforce the effectiveness claim.

5. REFERENCES

- Arends, R. I. (2012). *Learning to teach* (9th ed.). McGraw-Hill.
- Arikunto, S. (2013). *Prosedur penelitian: Suatu pendekatan praktik*. Rineka Cipta.
- Barron, B., & Darling-Hammond, L. (2008). Teaching for meaningful learning: A review of research on inquiry-based and cooperative learning. *Edutopia*. <https://www.edutopia.org>
- _____, H. S. (2012). *Principles and practice of a PBL*. Southern Illinois University School of Medicine.
- Branch, R. M. (2010). *Instructional design: The ADDIE approach*. Springer.
- Borg, W. R., & Gall, M. D. (2007). *Educational research: An introduction* (8th ed.). Pearson.
- Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Houghton Mifflin.
- Clark, R. E. (2012). Learning from media: Arguments, analysis, and evidence. *Information Age Publishing*.
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage Publications.
- Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). Gamification in education: A systematic mapping study. *Educational Technology & Society*, 18(3), 75–88.

- Farihah, U., & Soeprajitno. (2015). Peran guru sebagai fasilitator dalam pembelajaran abad ke-21. *Jurnal Pendidikan*, 16(2), 123–131.
- Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). Sage Publications.
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). *How to design and evaluate research in education* (10th ed.). McGraw-Hill Education.
- Hake, R. R. (1999). Analyzing change/gain scores. *Indiana University*.
<https://www.physics.indiana.edu/~hake>
- Hardani, Auliya, N. H., Andriani, H., et al. (2020). *Metode penelitian kualitatif & kuantitatif*. Pustaka Ilmu.
- Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, 16(3), 235–266. <https://doi.org/10.1023/B:EDPR.0000034022.16470.f3>
- Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning. *Educational Psychologist*, 42(2), 99–107.
<https://doi.org/10.1080/00461520701263368>
- Hung, W. (2016). The problem of problem-based learning: Why PBL works in some cases but not in others. *Interdisciplinary Journal of Problem-Based Learning*, 10(2), Article 5.
<https://doi.org/10.7771/1541-5015.1603>
- Jonassen, D. H. (2011). *Learning to solve problems: A handbook for designing problem-solving learning environments*. Routledge.
- Kemendikbud. (2013). *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 109 Tahun 2013 tentang Penyelenggaraan Pendidikan Jarak Jauh*. Kementerian Pendidikan dan Kebudayaan RI.
- Masril. (2014). Peningkatan kualitas pendidikan melalui pembelajaran bermakna. *Jurnal Pendidikan Nasional*, 8(1), 45–53.
- Mayer, R. E. (2020). *Multimedia learning* (3rd ed.). Cambridge University Press.
- _____, R. E. (2021). *E-learning and the science of instruction* (5th ed.). Wiley.
- Meltzer, D. E. (2002). The relationship between mathematics preparation and conceptual learning gains in physics. *American Journal of Physics*, 70(12), 1259–1268. <https://doi.org/10.1119/1.1514215>
- Messick, S. (1995). Validity of psychological assessment. *American Psychologist*, 50(9), 741–749.
<https://doi.org/10.1037/0003-066X.50.9.741>
- Nieveen, N. (2013). Formative evaluation in educational design research. In T. Plomp & N. Nieveen (Eds.), *Educational design research* (pp. 152–169). Netherlands Institute for Curriculum Development (SLO).
- OECD. (2020). *Education in the digital age: Healthy and happy children*. OECD Publishing.
<https://doi.org/10.1787/1209166a-en>
- Plomp, T., & Nieveen, N. (2013). *Educational design research*. Netherlands Institute for Curriculum Development (SLO).
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research. *Journal of Applied Psychology*, 88(5), 879–903.
<https://doi.org/10.1037/0021-9010.88.5.879>
- Salsabila, U. H., et al. (n.d.). Digital game-based learning and student engagement. *Journal of Educational Technology*, Advance online publication.

-
- Savery, J. R. (2015). Overview of problem-based learning: Definitions and distinctions. *Interdisciplinary Journal of Problem-Based Learning*, 1(1), 9–20. <https://doi.org/10.7771/1541-5015.1002>
- Schmid, M., Brianza, E., & Petko, D. (2021). Self-reported technology integration through the lens of TPACK. *Computers & Education*, 169, 104204. <https://doi.org/10.1016/j.compedu.2021.104204>
- Siregar, S. (2017). *Metode penelitian kuantitatif*. Kencana.
- Slavin, R. E. (2019). *Educational psychology: Theory and practice* (12th ed.). Pearson.
- Smaldino, S. E., Lowther, D. L., & Mims, C. (2019). *Instructional technology and media for learning* (12th ed.). Pearson.
- Sugiyono. (2013). *Metode penelitian pendidikan (pendekatan kuantitatif, kualitatif, dan R&D)*. Alfabeta.
- Sukmadinata, N. S. (2021). *Metode penelitian pendidikan*. Remaja Rosdakarya.
- Sumarni. (2022). *Problem-Based Learning* in social studies education. *Cakrawala Pendidikan*, 41(2), 456–469.
- Sweller, J. (2019). Cognitive load theory and educational technology. *Educational Technology & Society*, 22(1), 1–9.
- Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Walker, A., Leary, H., Hmelo-Silver, C. E., & Ertmer, P. A. (2015). *Essential readings in problem-based learning*. Purdue University Press.