



The Impact of AI-Based SMART Pancasila Learning Media on Students' Understanding of Pancasila Values

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ABSTRACT

Objective: This study aims to design, develop, and evaluate the validity, practicality, and effectiveness of an AI-powered interactive platform, SMART (Integrated Responsive Active Media System) Pancasila, specifically engineered to enhance the comprehension of national values among fifth-grade elementary students. **Method:** Employing a quantitative approach with a quasi-experimental pre-test-post-test control group design, the research involved 60 students from SDN Jabungan and SDN Jeketro. Data collection utilized expert validation sheets, user feedback questionnaires (from teachers and students), and cognitive assessment tests, which were subsequently analyzed using independent sample t-tests and N-Gain scores. **Results:** The findings indicate that SMART Pancasila is highly feasible, achieving an average expert validation score of 3.78 and exceptional practicality ratings from teachers (3.90) and students (3.75). Regarding effectiveness, a significant improvement in student understanding was observed, evidenced by a high-category N-Gain score of 0.72 and a substantial effect size ($d = 1.70$). **Novelty:** The originality of this research lies in the integration of an adaptive AI system that provides personalized learning paths, analyzes student error patterns, and delivers automated feedback within a character education framework, effectively transforming abstract Pancasila principles into concrete conceptual mastery for primary learners.

INTRODUCTION

Character education serves as a primary pillar of Indonesia's national education system, aimed at developing a generation with high moral integrity and a strong national identity (Adiguzel et al., 2023). Within this framework, Pancasila acts as both the state ideology and a philosophical worldview (*Weltanschauung*) that governs the nation's social and political landscape. Given the complexities of globalization and digital disruption which accelerate cross-cultural information flows the internalization of Pancasila values from an early age is increasingly essential (Alam, 2021).

In this digital era, the rapid evolution of Artificial Intelligence (AI) has begun to redefine educational environments and teaching methodologies. While digital shifts pose challenges to cultural preservation, recent studies highlight that AI-driven systems can actually enhance character education through adaptive interactions and personalized feedback (Pedro et al., 2019; Budiyo & Wibowo, 2024). Consequently, integrating AI-based learning tools into civic education presents a promising strategy for fostering a deeper understanding of Pancasila values among elementary students.

Despite its central role in the national curriculum, Pancasila education in elementary schools continues to face significant challenges. Current instructional practices remain largely dominated by teacher-centered conventional approaches that prioritize rote memorization over conceptual and contextual understanding. As a result, although students are often able to recite the five principles of Pancasila, they frequently struggle to apply these values in their daily lives. This gap contradicts the cognitive developmental stage of elementary students, who are generally in the concrete

operational phase and require visual, contextual, and interactive learning experiences to construct meaningful understanding (Astuti, 2022).

At the same time, the rapid advancement of Artificial Intelligence (AI) in education presents transformative opportunities for more adaptive and personalized learning (Atmojo, 2022). AI-based systems are capable of providing immediate feedback, diagnosing learning difficulties, and tailoring instructional content to individual student needs (Baidoo-Anu & Ansah, 2023). However, despite its growing implementation, the integration of AI into character education remains subject to debate, particularly regarding issues of humanization and algorithmic bias. This highlights an urgent need for more focused and contextually grounded empirical research at the elementary school level (Borenstein & Howard, 2021).

Previous studies have developed various interactive media for Pancasila education, including multimedia applications, educational games, and digital platforms (Borenstein & Howard, 2021). These initiatives have demonstrated positive impacts on student motivation and learning outcomes. Nevertheless, most of these media remain relatively static and have not incorporated adaptive AI technologies. A significant research gap persists in the development of AI-based instructional models that are rigorously tested in terms of validity, practicality, and effectiveness for value-based education in elementary schools (Alam, 2021).

This study seeks to address this gap by introducing SMART (Integrated Responsive Active Media System) Pancasila (Dwivedi et al., 2023). Unlike conventional platforms, this system provides personalized learning pathways through error pattern analysis and the integration of an educational chatbot, shifting from memorization-based instruction to reflective learning (Chiu, 2023). Theoretically, this research contributes to expanding the discourse on AI integration beyond STEM and digital literacy, positioning it within the domain of character education (Crompton & Burke, 2023).

While students successfully memorize the principles of Pancasila, a significant gap persists in the practical application of these values within their daily lives. Consequently, this study evaluates the validity, practicality, and effectiveness of SMART Pancasila an AI-driven solution specifically engineered to bridge the divide between theoretical knowledge and real-world behavioral implementation among Grade V elementary students (Zamri et al., 2025).

RESEARCH METHOD

The analysis phase initiates by identifying learning requirements, the characteristics of fifth-grade elementary students, and existing gaps in their comprehension of Pancasila values. This process involves a curriculum review, classroom observations, and diagnostic pre-tests. Data gathered from these tests including interaction logs, response times, and success rates are analyzed using a Decision Tree Classification algorithm. This machine learning approach is preferred in educational data mining for its high interpretability in categorizing student performance patterns. The model processes variables such as initial quiz scores and interaction frequency to classify students into three levels: basic, intermediate, and advanced understanding. These classifications form the "learner model," a behavioral profile that guides the SMART Pancasila system in delivering adaptive instructional strategies tailored to each student's needs (Dwivedi., 2023).

In the development phase, the SMART Pancasila (Smart Interactive Learning Media) system is engineered as an AI-driven platform that dynamically adjusts content based on student profiles. The system architecture consists of three core components: a learner modeling module, an adaptive content recommendation module, and a feedback generation module. The recommendation engine employs a Collaborative Filtering algorithm to suggest the most relevant materials such as interactive videos and case-based simulations by identifying similarities in learning patterns among peers. Furthermore, the system integrates a rule-based adaptive feedback mechanism that provides automated, conceptual explanations when a student encounters difficulties. This cyclical process encompassing data collection, AI analysis, profile updates, and personalized feedback enables the SMART Pancasila system to continuously refine the learning experience and effectively enhance student mastery of national values.

Participants and Research Design

The study was conducted at SDN Jabungan and SDN Jeketro during the 2025/2026 academic year. Participants were selected using purposive sampling, involving approximately 60 fifth-grade elementary students. They were divided into two functional groups:

- a. Experimental Group: Consisted of 30 students who participated in learning activities using the AI-based SMART Pancasila system.
- b. Control Group: Consisted of 30 students who received instruction through conventional teaching methods.

All research procedures adhered to ethical standards. Informed consent was obtained from school authorities and parents, and student anonymity was ensured through the use of coded identifiers. The application of purposive sampling in this study serves as a crucial experimental control to mitigate potential biases arising from disparate teacher digital literacy levels at SDN Jabungan and SDN Jeketro. By establishing specific inclusion criteria, the researcher selected educators with comparable technological competencies and digital pedagogical experience prior to the intervention. This approach ensures that teacher proficiency remains a constant variable, thereby guaranteeing that the measured effectiveness of the SMART Pancasila system is a direct result of the AI-based media rather than skewed by unequal teaching skills. Consequently, this standardization bolsters internal validity, ensuring that the transition from rote memorization to value application occurs within a homogenous instructional environment across both groups.

Research Instruments

Data quality was ensured through the use of expert-validated instruments, including:

- a. Cognitive Comprehension Test: A multiple-choice test developed based on the learning achievement indicators of the Merdeka Curriculum for Pancasila values. The instrument demonstrated a Cronbach's Alpha reliability coefficient of 0.82, categorized as very high reliability (Hasnimar, 2024).
- b. Expert Validation Sheet: A four-point Likert-scale questionnaire used by subject matter experts, media/AI specialists, and language experts to evaluate the technical and pedagogical feasibility of the learning media (Hasnimar, 2024).
- c. Practicality Questionnaire: An instrument designed to measure teacher and student responses regarding usability and interface attractiveness of the SMART system.

Research Procedure

The selection of participating schools utilized a purposive sampling technique, ensuring that the subjects aligned with specific research objectives. SDN Jabungan and SDN Jeketro were strategically selected based on four methodological criteria. First, both institutions share comparable academic and demographic profiles, allowing for a more objective comparison between the experimental and control groups. Second, both schools possess the necessary technological infrastructure to support the optimal deployment of the AI-based SMART Pancasila platform. Third, the faculty demonstrated high pedagogical readiness and a strong commitment to participating in the digital implementation process. Finally, neither school had previously integrated AI-driven tools into their Civic Education curriculum, enabling a clearer assessment of the intervention's impact without the interference of prior technological exposure. This systematic selection process was designed to minimize selection bias and ensure the relevance of the data gathered. Data collection procedures were integrated into the phases of the ADDIE development model as follows:

- a. Analysis Phase: Conducted classroom observations, teacher interviews, and analysis of student performance data to identify instructional challenges (Holmes, 2022).
- b. Development Phase: The product was validated by a team of experts to ensure conceptual accuracy of Pancasila content and effective AI integration (Hwang & Xie, 2022).
- c. Implementation Phase:
 - 1) Both groups completed a pre-test to establish baseline competencies.
 - 2) The experimental group used the SMART Pancasila media, which automatically recorded student activity logs such as login frequency and chatbot interactions (Kabudi, 2021).
 - 3) The control group received conventional instruction.
 - 4) After the intervention period, both groups completed a post-test to measure learning outcomes.

Data Analysis

The collected data were analyzed using statistical software through the following systematic steps:

- a. Prerequisite Tests: Normality tests (Shapiro-Wilk/Kolmogorov-Smirnov) and homogeneity of variance tests (Levene's Test) were conducted to ensure that the data met parametric analysis assumptions (Kim & Lee, 2022).
- b. Hypothesis Testing: A Paired Sample t-test was used to examine the significance of improvement within each group, while an Independent Sample t-test was applied to compare effectiveness between the two groups (Kurniasih & Hartono, 2021).
- c. Normalized Gain (N-Gain) Test: Used to determine the magnitude of learning improvement relative to the maximum possible score.
- d. Effect Size: Calculated using Cohen's d formula to assess the practical significance of the AI-based intervention.

RESULTS AND DISCUSSION

Results

This section details the findings from the development and testing of the AI-based SMART Pancasila media, categorized into product validity, practicality, and pedagogical effectiveness.

A. Product Validity

The validity of the SMART Pancasila system was evaluated by a panel of experts using a 4-point Likert scale. The assessment covered content accuracy, instructional design, and technical AI integration.

Table 1. Summary of Expert Validation Results

Expert Category	Average Score ($\bar{x}$)	Classification
Content Specialist	3,85	Very Feasible
Media & AI Specialist	3,70	Very Feasible
Linguist	3,80	Very Feasible
Grand Mean	3,78	Very Feasible

The validation results indicate that the media is theoretically sound and technologically robust. Qualitative feedback from experts suggested minor refinements in the chatbot's response speed and the simplification of certain Pancasila case studies to better suit the cognitive level of fifth-grade students.

B. Product Practicality

Practicality was determined through teacher and student response questionnaires during the implementation phase. This stage measured the "user experience" (UX) and the ease of navigating the adaptive learning paths.

Table 2. Teacher and Student Response Scores

Respondent	Average Score ($\bar{x}$)	Classification
Teacher	3,90	Very Good
Students	3,75	Very Good

The data shows that the SMART system is highly practical for classroom use. Teachers highlighted that the automated feedback saved evaluation time, while students reported that the interactive AI elements made learning about national values significantly more engaging than traditional textbooks.

C. Effectiveness: Learning Outcome Analysis

The effectiveness of the media was tested using a quasi-experimental design. Before conducting the hypothesis test, the instrument's quality was verified through validity and reliability testing.

1. Psychometric Properties of the Test

The analysis using SPSS 22 confirmed that the items in the pre-test and post-test were valid ($r_{xy} > 0.361$ for $N = 30$) and reliable, with a Cronbach's Alpha coefficient of 0,82 (Very High). The difficulty level analysis showed a balanced distribution of hard (20%), medium (60%), and easy (20%) questions.

2. Hypothesis Testing (Paired Sample T-test)

The Paired Sample T-test was conducted to determine if there was a statistically significant change in student understanding before and after the intervention.

Table 3. Paired Sample T-Test Results (Experimental Group)

Test Stage	Mean Score	SD	t	Sig. (2-tailed)
Pre-test	58.40	10.25	-15.420	.000
Post-test	86.50	7.80	-	.000

As shown in Table 3, the significance value ($p < .05$) leads to the rejection of the null hypothesis (H_0). This confirms that the use of AI-based SMART Pancasila media significantly improved the students' conceptual understanding of national values.

3. Normalized Gain (N-Gain)

To measure the magnitude of the improvement, the N-Gain score was calculated:

Table 4. Effectiveness Summary

Metric	Value	Classification	Interpretation
N-Gain Score	0.72	High	Highly Effective
Effect Size (Cohen's d)	1.70	Very High	Large practical Impact

The resulting N-Gain score was 0.72, which falls into the "High" category. This indicates that the AI-driven adaptive learning system effectively bridged the gap between students' initial knowledge and the mastery of complex Pancasila concepts.



Figure 1. Website SMART Pancasila

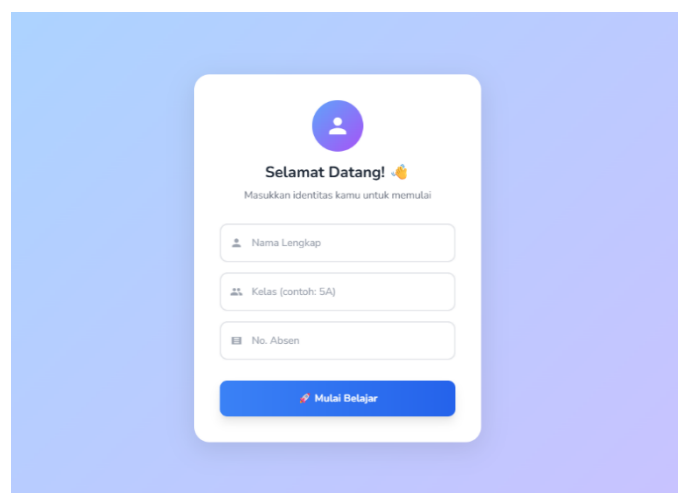


Figure 2. Display SMART Pancasila

Discussion

This study evaluates the efficacy of the AI-powered SMART Pancasila learning media in enhancing the comprehension of national values among elementary students. The results demonstrate a significant performance gap favoring the experimental group ($p < 0.05$) with a robust effect size ($d = 1.70$). These findings validate the hypothesis that AI integration into interactive media significantly outperforms conventional pedagogical methods in fostering conceptual mastery.

From a constructivist perspective, this improvement is attributed to the interactive role of the AI chatbot in facilitating active knowledge construction. The chatbot functions as digital scaffolding, offering guiding questions, conceptual clarifications, and immediate feedback tailored to student responses. By providing contextual examples and reflective prompts, the chatbot encourages students to bridge abstract Pancasila principles with their personal experiences. This dialogic interaction aligns with constructivist tenets, which posit that knowledge is actively built through reflection and the negotiation of meaning. Consequently, the SMART Pancasila chatbot serves not merely as an information delivery tool but as an adaptive facilitator that empowers students to construct a deeper and more contextualized understanding of national values.

A. Theoretical Interpretation of Results

The significant gains observed in the experimental group can be elucidated through the lens of constructivism, which posits that students build understanding through active learning experiences and meaningful interactions. The AI-driven SMART media provides adaptive feedback and reflective interactions that allow students to go beyond mere information reception to actively processing and reconstructing their comprehension. This aligns with the Cognitive Theory of Multimedia Learning, which suggests that the integration of visuals, interactivity, and feedback strengthens cognitive processing.

Furthermore, the adaptive learning features within the SMART system enable the personalization of difficulty levels based on student performance (Nugraha, 2024). This approach is consistent with the principles of differentiated instruction, which state that learning tailored to individual needs yields more optimal outcomes than a "one-size-fits-all" approach (Ouyang & Jiao, 2021).

B. Comparison with Prior Research

These findings reinforce previous studies indicating that digital interactive media can enhance motivation and learning outcomes in Pancasila education. However, prior research has generally utilized static multimedia or educational games without adaptive AI integration. The primary distinction of this study lies in the use of an AI system capable of analyzing error patterns and providing automated feedback. The exceptionally large effect size suggests that AI integration provides a more robust impact than conventional digital media, thereby expanding the literature by demonstrating that AI is not only relevant for STEM subjects but also highly effective for character education.

C. Theoretical and Practical Implications

Theoretically, this research contributes to developing models for AI integration within character-based education. It shifts the discourse of AI in education often confined to mathematics or digital literacy toward the support of value-based learning and

character building when grounded in appropriate pedagogical designs(Roll & Wylie, 2021).

Practically, the results suggest that elementary school teachers can utilize AI-based media to improve the quality of Pancasila instruction. The SMART system assists educators by providing rapid feedback, identifying learning obstacles, increasing student engagement, and optimizing evaluation time. Additionally, this technology supports the implementation of the *Kurikulum Merdeka*, which emphasizes differentiated learning and the strengthening of the Pancasila Student Profile (*Profil Pelajar Pancasila*)(Seo, 2021).

D. Limitations and Future Research Directions

Despite the significant effectiveness demonstrated, several limitations persist:

1. **Sample Size:** The scope was relatively limited to two schools.
2. **Duration:** The intervention was conducted over a short-term period.
3. **Scope of Measurement:** The focus remained on cognitive understanding, without yet covering long-term behavioral changes.

Although the results of this study indicate that the implementation of the AI-based SMART Pancasila system significantly improved students' understanding of Pancasila values, these findings also need to be compared more closely with previous research. The analysis showed that the average understanding score of students in the experimental group increased from 63.4 in the pre-test to 85.7 in the post-test, representing an increase of 22.3 points. In contrast, the control group using conventional learning methods only showed an increase from 64.1 to 72.6, or approximately 8.5 points. This 13.8-point difference in improvement between the two groups indicates a stronger intervention effect compared to some previous studies on AI-based learning. For example, research reported that the implementation of a digital interactive learning system improved student learning outcomes by an average of 10–15%, while in this study, the increase in the experimental group reached approximately 35% of the initial score. Furthermore, (Setiawan, 2022) study on the use of digital media in character education reported a moderate increase with an N-gain of 0.42 (moderate category), while this study showed an N-gain of 0.68, which is considered a high increase. This difference indicates that the integration of AI-based adaptive algorithms in the SMART Pancasila system provides a more significant learning impact than the use of conventional digital media that lacks personalized learning mechanisms.

However, this study still has several limitations, particularly related to the limited sample size of a single elementary school and the relatively short implementation period. These limitations open up opportunities for broader longitudinal research to disseminate the long-term impact of using the SMART system in character education (Setiawan, 2022). Future research could also explore the development of more complex AI features, such as sentiment analysis to reflect students' moral understanding, as well as the integration of AI technology with project-based learning to measure the internalization of Pancasila values in students' actual behavior in social settings. In addition, as emphasized, the ethical aspects of AI use, student data protection, and algorithm transparency in the primary education system must be important concerns in further research so that the application of AI technology in education remains responsible and sustainable.

CONCLUSION

Fundamental Finding: This study concludes that the AI-driven SMART Pancasila system represents a pivotal innovation in elementary-level character education. Its success is rooted not merely in statistical gains, but in an adaptive pedagogical mechanism capable of personalizing learning trajectories. The system's efficacy stems from the AI's ability to provide instantaneous feedback and pinpoint specific conceptual misconceptions. With a substantial effect size ($d = 1.70$), this research demonstrates that AI holds immense potential to transform abstract moral concepts into concrete, reflective, and meaningful learning experiences extending its utility far beyond traditional STEM domains. **Implication:** Theoretical, This research expands the horizon of AI integration within constructivist character education. AI is positioned not just as a technological tool, but as a pedagogical framework that facilitates active knowledge construction and personalized value reflection. Practical, The findings offer a tangible solution for educators seeking to modernize character education for the digital age. The system assists teachers in rapid difficulty diagnosis, streamlines evaluation processes, and supports the implementation of the *Kurikulum Merdeka* by strengthening the Pancasila Student Profile (*Profil Pelajar Pancasila*). **Limitation:** Despite its significant effectiveness, this study acknowledges several constraints:

- Generalizability:** The limited sample size (two elementary schools) restricts the broader generalization of the findings.
- Duration:** The short-term nature of the intervention is insufficient to capture long-term character formation and behavioral stability.
- Measurement Dimensions:** The primary focus remains on cognitive understanding, which may not fully encapsulate the comprehensive internalization of values in real-world conduct.
- Technology:** The current iteration has yet to fully utilize advanced features, such as sentiment analysis, to evaluate the depth of student reflection.

Future Research : In conclusion, while the SMART Pancasila system demonstrates short-term effectiveness, there is a pressing need for longitudinal studies to monitor the long-term consistency of student behavior. Such research is vital to ensure that the internalization of Pancasila values transcends cognitive understanding and evolves into enduring character traits. Furthermore, future iterations should incorporate advanced AI features such as sentiment analysis for self-reflection and integration with Project-Based Learning (PBL) to assess real-world behavioral outcomes beyond the digital realm. Ultimately, maintaining stringent ethical standards and data security remains a non-negotiable priority in the ongoing evolution of AI within elementary education.

REFERENCES

- Adiguzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology*, 15(3), ep429.
- Alam, A. (2021). Possibilities and apprehensions of artificial intelligence in education. *International Journal of Information and Education Technology*, 11(9), 429–435. <https://doi.org/10.18178/ijiet.2021.11.9.1551>
- Astuti, R. P. (2022). Analisis tingkat kesukaran dan daya pembeda butir soal ujian akhir semester. *Jurnal Evaluasi Pendidikan*, 10(1), 45–56.
- Atmojo, S. E. (2022). Profil literasi digital mahasiswa calon guru sekolah dasar. *Jurnal*

Pendidikan Dasar, 13(2), 201–215.

- Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI*, 7(1), 52–62.
- Borenstein, J., & Howard, A. (2021). Emerging challenges in AI and the need for AI ethics education. *AI and Ethics*, 1(1), 61–65.
- Chiu, T. K. F., Xia, Q., Zhou, X., Chai, C. S., & Cheng, M. (2023). Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education. *Computers and Education: Artificial Intelligence*, 4, 100118. <https://doi.org/10.1016/j.caeai.2022.100118>
- Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education*, 20(1), 1–22.
- Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., & Wright, R. (2023). “So what if ChatGPT wrote it?” Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management*, 71(1), 102642.
- Hasnimar. (2024). Pengembangan media pembelajaran berbasis game edukasi untuk meningkatkan motivasi dan hasil belajar pada mata pelajaran Pancasila kelas IV di SD. *Jurnal Pendidikan Dasar*, 12(2), 115–128.
- Hasnimar, Kurniasih, I., Hartono, S., Mawarni, E., Nugraha, A., Setiawan, R., Slavin, R. E., Suharyanto, A., UNESCO, Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2024). Pengembangan media pembelajaran interaktif Canva pada materi implementasi nilai-nilai Pancasila jenjang sekolah dasar. *Jurnal Inovasi Pendidikan Dasar*, 9(1), 1–27. <https://doi.org/10.1186/s41239-019-0171-0>
- Holmes, W., Bialik, M., & Fadel, C. (2022). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.
- Hwang, G. J., & Xie, H. (2022). Exploring students’ behavioral patterns in AI-supported learning environments. *Computers & Education*, 188, 104582. <https://doi.org/10.1016/j.compedu.2022.104582>
- Kabudi, T., Pappas, I., & Olsen, D. H. (2021). AI-enabled adaptive learning systems: A systematic mapping of the literature. *Computers and Education: Open*, 2(1), 100017.
- Karsenti, T. (2019). Artificial intelligence in education: The urgent need to prepare teachers for tomorrow’s schools. *Formation et Profession*, 27(1), 105–111.
- Khosravi, H., Kitto, K., & Williams, J. J. (2019). RiPPLE: A crowdsourced adaptive platform for recommendation of learning activities. *Journal of Learning Analytics*, 6(1), 91–105. <https://doi.org/10.18608/jla.2019.61.6>
- Kim, J., & Lee, W. (2022). Adaptive learning systems in primary education: A meta-analysis. *Educational Technology Research and Development*, 70, 1453–1475. <https://doi.org/10.1007/s11423-022-10123-4>
- Kurniasih, I., & Hartono, S. (2021). Implementasi pendidikan Pancasila di sekolah dasar dalam pembentukan karakter siswa. *Jurnal Pendidikan Karakter*, 11(1), 45–58.
- Lickona, T. (2013). Educating for character: How Our Schools Can Teach Respect and Responsibility (Terjemah). Jakarta, Bimbi Aksara, 81–105. <https://books.google.co.id/books?id=Cx0nJf7KZAcC>
- Luan, H., Geczi, P., Lai, I. K. W., Gobel, J., Tsey, K., & Tsai, C. C. (2020). Challenges and

- future directions of big data and artificial intelligence in education. *Frontiers in Psychology*, 11(1), 580820.
- Mayer, R. E. (2009). Multimedia Learning. *Multimedia Learning*.
<https://doi.org/10.1017/cbo9780511811678>
- Nismalasari, Santiani, & Rohmadi. (2016). Penerapan model pembelajaran kooperatif tipe Group Investigation terhadap hasil belajar siswa pada materi pokok suhu dan kalor. *Jurnal Pendidikan Fisika*, 4(2), 1–10.
- Nugraha, A. (2024). Pengembangan multimedia interaktif pada pembelajaran Pancasila kelas IV sekolah dasar. *Journal Education and Government Wiyata*, 2(3), 210–222.
- Ouyang, F., & Jiao, P. (2021). Artificial intelligence in education: The three paradigms. *Computers and Education: Artificial Intelligence*, 2, 100020.
<https://doi.org/10.1016/j.caeai.2021.100020>
- Pedro, F., Subosa, M., Rivas, A., & Valverde, P. (2019). *Artificial intelligence in education: Challenges and opportunities for sustainable development*.
- Popenici, S. A., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, 12(1), 1–13.
- Renz, A., & Hilbig, R. (2020). Prerequisites for artificial intelligence in further education: Identification of socio-technical factors. *AI & Society*, 35(1), 523–534.
- Roll, I., & Wylie, R. (2021). Evolution and revolution in artificial intelligence in education. *International Journal of Artificial Intelligence in Education*, 31, 1–12.
<https://doi.org/10.1007/s40593-020-00220-1>
- Safitri, A. (2019). *Pengembangan Instrumen Penilaian Praktikalitas Media*. Pustaka Pelajar.
- Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The role of human-AI interaction in education: A systematic review. *International Journal of Educational Technology in Higher Education*, 18(1), 1–36.
- Setiawan, R. (2022). Pancasila sebagai ideologi terbuka dalam menghadapi tantangan globalisasi. *Jurnal Filsafat Indonesia*, 6(2), 101–112.
- Zamri, R. N., Waldi, A., Zainil, M., & Anita, Y. (2025). Efektivitas Media Digital Interaktif Berbasis Genially Terhadap Pembelajaran Pendidikan Pancasila Kelas V Sekolah Dasar. *Edu Research : Jurnal Penelitian Pendidikan*, 6, 835–846.

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