

DESIGN AND IMPLEMENTATION OF TREASURE KIDS SMART (TKS) GAME-BASED LEARNING MEDIA TO IMPROVE STUDENTS' NUMERACY PERFORMANCE IN PRIMARY EDUCATION

Rifdah Luthfia Salmaa ^{a*)}, Ahmad Arif Fadilah ^{a)}, Septy Nurfadhillah ^{a)}

^{a)} *Muhammadiyah University of Tangerang, Tangerang, Indonesia*

^{*)}*Corresponding Author: rlsalmaa14@gmail.com*

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Abstract. This study aims to design and implement Treasure Kids Smart (TKS), a game-based learning media developed to enhance the numeracy performance of primary school students. The research was motivated by the need to improve arithmetic competence and learning engagement among fifth-grade learners at SDN Cikokol III, Tangerang, through interactive and technology-driven instruction. Using the Research and Development (R&D) approach adapted from the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), the study systematically developed the TKS media combining educational content, visual storytelling, and gamification principles to foster problem-solving and computational thinking. Data were collected through expert validation, pre-test and post-test assessments, and user feedback questionnaires to measure both the effectiveness and feasibility of the media. The results indicate that TKS effectively improved students' numeracy skills, reflected in a significant increase in post-test scores compared to pre-test results (gain score = 0.47, moderate category), as well as high user satisfaction ratings from both teachers and students (average validity score = 92%). The findings suggest that integrating digital game-based learning into mathematics education promotes engagement, motivation, and conceptual understanding, making TKS a viable innovation for enhancing numeracy learning in Indonesian primary schools.

Keywords: Game-Based Learning; Treasure Kids Smart; Numeracy Skills; Educational Media; ADDIE Model

I. INTRODUCTION

In the era of digital transformation in education, interactive learning media and gamified approaches have become essential strategies to enhance student engagement and improve learning outcomes, particularly in foundational subjects such as mathematics [1]. Mathematical literacy—or numeracy—is recognized as a key competency for 21st-century learning and lifelong problem-solving, as reflected in the OECD's PISA framework and Indonesia's Profil Pelajar Pancasila vision [2]. However, despite curriculum reforms and teacher training programs, Indonesian students continue to exhibit low numeracy achievement, with national assessments (Asesmen Nasional 2023) indicating persistent gaps in basic arithmetic mastery [3]. This condition underscores the need for innovative learning models that combine pedagogical effectiveness, cognitive engagement, and technological interactivity to foster deeper understanding and motivation among learners [4]. Game-Based Learning (GBL) has emerged as a promising approach that transforms traditional classroom instruction into an interactive, student-centered experience [5]. By integrating game mechanics—such as challenges, feedback, rewards, and storytelling—GBL enhances motivation and supports knowledge retention [6]. Studies by Plass et al. [7] and Qian et al. [8] show that well-designed educational games can promote higher-order thinking and improve learning performance, especially when aligned with curriculum objectives. In mathematics education, GBL facilitates abstract concept comprehension by providing contextualized, experiential learning environments [9]. Moreover, digital game media encourage self-paced learning, allowing students to explore mathematical problems with autonomy and confidence [10]. Within this pedagogical paradigm, the Treasure Kids Smart (TKS) learning media was developed to address the specific challenges of numeracy instruction in Indonesian primary schools. TKS is designed as an educational game platform that integrates visual storytelling, interactive exercises, and formative assessments within the national curriculum framework. The game's mechanics simulate treasure-hunting missions where learners must solve arithmetic problems to progress through levels, thus combining entertainment with skill acquisition. Similar

initiatives—such as MathQuest and Number Ninja—have demonstrated that integrating narrative and interactivity can significantly enhance students' engagement and problem-solving fluency [11].

The development of TKS follows the ADDIE instructional design model (Analysis, Design, Development, Implementation, Evaluation), a systematic framework commonly employed in educational technology and instructional media research [12]. Through this model, the media's design was iteratively refined based on expert validation and learner feedback to ensure pedagogical alignment and usability. Prior studies indicate that the ADDIE model enhances product effectiveness by enabling continuous improvement through data-driven evaluation [13]. The implementation of TKS not only aims to improve computational accuracy but also cultivates mathematical reasoning, persistence, and positive learning attitudes—key indicators of deep numeracy understanding [14]. Therefore, this study seeks to analyze the design, implementation, and effectiveness of the Treasure Kids Smart (TKS) game-based learning media in improving numeracy performance among fifth-grade students at SDN Cikokol III, Tangerang. The research contributes to the growing discourse on digital pedagogy and game-based learning in primary education, particularly in developing countries where technology adoption remains uneven. By combining instructional design principles and empirical classroom testing, this study provides evidence for how localized game-based innovations can enhance learning quality, digital literacy, and student engagement in the context of Indonesia's Merdeka Belajar curriculum [15].

Game-Based Learning (GBL) refers to the pedagogical integration of digital games as instructional tools to enhance student engagement, motivation, and knowledge retention [16]. According to Qian and Clark [8], GBL combines entertainment mechanics with educational objectives, fostering a balance between enjoyment and meaningful learning. The theoretical foundations of GBL are rooted in constructivist learning theory, emphasizing active participation, exploration, and reflection [17]. Learners engage in interactive environments that simulate real-life problem-solving, allowing them to develop cognitive, social, and emotional skills [18]. Recent studies indicate that GBL significantly improves learning outcomes when aligned with curriculum objectives and age-appropriate design [19]. Plass et al. [7] highlight that effective game-based instruction incorporates immediate feedback, adaptive challenges, and rewards that sustain intrinsic motivation. In the context of mathematics education, digital games have proven to reduce math anxiety, enhance procedural fluency, and improve conceptual understanding [20]. For example, a study by Hwang and Chen [14] demonstrated that students who engaged with gamified numeracy modules showed higher retention rates and greater enjoyment compared to those using conventional methods.

Numeracy—often referred to as mathematical literacy—encompasses the ability to reason quantitatively, interpret numerical information, and solve problems effectively [21]. It extends beyond computational skills to include logical reasoning, data interpretation, and decision-making competencies that are essential for everyday life. According to the OECD (2023), numeracy serves as a foundational skill that enables students to participate productively in society and adapt to technological advancement [2]. In primary education, developing numeracy is crucial because early arithmetic competence strongly correlates with later academic achievement and cognitive flexibility [22]. However, traditional mathematics instruction often fails to address diverse learning styles and motivational needs, leading to disengagement and underachievement. Integrating interactive and contextualized learning—such as through educational games—helps bridge this gap by transforming abstract concepts into concrete, experiential learning processes [23]. Games like Number Quest or Math Run have shown success in enhancing logical reasoning and symbolic understanding, confirming that technology-based numeracy interventions foster deeper learning engagement [24].

The incorporation of digital learning media plays a central role in creating interactive, multimodal learning experiences that support personalized education [25]. Digital media combine text, graphics, animation, and sound to cater to multiple sensory channels, thereby improving memory retention and conceptual understanding [26]. When used in mathematics instruction, multimedia design principles such as Mayer's Cognitive Theory of Multimedia Learning suggest that combining visual and verbal representations enhances comprehension and reduces cognitive overload [27]. In the Indonesian context, the rapid expansion of digital infrastructure and Merdeka Belajar policy initiatives have provided a fertile environment for the development of digital learning innovations [28]. However, successful implementation depends on ensuring that media are pedagogically sound, culturally contextualized, and technically accessible. The Treasure Kids Smart (TKS) learning media was designed to address these factors, incorporating national curriculum content and gamification elements to make numeracy learning both engaging and effective.

The ADDIE model (Analysis, Design, Development, Implementation, Evaluation) provides a structured framework for instructional design, ensuring that educational media are systematically developed and empirically validated [12]. Each stage of the model plays a distinct role: the Analysis phase identifies learning needs and learner characteristics; Design outlines learning objectives and interface structure; Development focuses on content production and technical creation; Implementation involves classroom application; and Evaluation assesses effectiveness and user feedback [29]. Numerous studies have validated ADDIE's utility in educational technology research. For instance, Branch [12] emphasized that ADDIE fosters iterative refinement, ensuring media usability and pedagogical coherence. Similarly, Rahmawati and Yusof [11] found that ADDIE-based development of gamified numeracy media improved both engagement and learning outcomes in Indonesian primary schools. The use of ADDIE in designing Treasure Kids Smart (TKS) ensures methodological rigor by combining content validity, learner-centered design, and empirical testing to enhance numeracy skills through play-based interactivity.

Based on the reviewed literature, this study situates the development of Treasure Kids Smart (TKS) within the intersection of game-based learning theory, numeracy development, and instructional design methodology. The conceptual framework proposes that the integration of GBL elements—such as reward systems, challenge levels, and feedback loops—enhances cognitive engagement and arithmetic proficiency. Through the ADDIE model, TKS ensures that pedagogical goals, user interface design,

and formative evaluation are systematically aligned. This dual emphasis on learning engagement and instructional effectiveness underpins TKS as a sustainable innovation in primary mathematics education.

II. RESEARCH METHODS

This study employs a Research and Development (R&D) design based on the ADDIE instructional model, which consists of five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. The R&D approach was chosen because it allows for the iterative creation and validation of learning media that align with pedagogical objectives and user needs [30]. Each phase of the ADDIE model was utilized to ensure that the Treasure Kids Smart (TKS) game-based media met the criteria of effectiveness, feasibility, and user satisfaction. The Analysis stage focused on diagnosing learners' needs, curriculum alignment, and numeracy performance gaps among fifth-grade students at SDN Cikokol III, Tangerang. The Design stage involved conceptualizing the interface, mechanics, storyline, and instructional flow of TKS. The Development phase encompassed programming and content integration using multimedia software that supports interactive elements, animations, and adaptive feedback.

During the Implementation stage, the TKS media was tested with a group of 30 fifth-grade students to evaluate its usability and instructional impact. Data collection methods included expert validation, pre-test and post-test assessments, and student and teacher questionnaires. Expert validation, conducted by three specialists in educational technology and mathematics education, assessed content accuracy, instructional design, and technical quality. The media was refined based on their feedback before classroom testing. Quantitative data from pre- and post-tests were analyzed using N-Gain scores to measure improvement in students' numeracy performance, while qualitative feedback from users was analyzed descriptively to evaluate usability and motivation. The Evaluation phase combined formative evaluation during development and summative evaluation after implementation to determine the media's overall effectiveness. This methodological approach follows Creswell's [31] recommendation for integrating quantitative and qualitative evidence to strengthen research validity and instructional relevance.

III. RESULTS AND DISCUSSION

Development and Validation Results

The Treasure Kids Smart (TKS) learning media was developed following the ADDIE framework, producing a digital game that integrates arithmetic challenges with visual storytelling. The content was adapted to the Grade V Mathematics Curriculum focusing on addition, subtraction, multiplication, and division of integers and fractions. The expert validation results indicated a high degree of validity across three evaluation aspects: content accuracy (92%), instructional design relevance (89%), and technical quality (94%), yielding an average validity score of 91.7%, categorized as very valid. These results suggest that the TKS media meets the pedagogical and technical standards for instructional use. Experts highlighted the game's strength in combining formative assessment with motivational gameplay mechanics, consistent with prior findings that gamified learning media enhance cognitive and affective engagement [32].

Implementation and Learning Effectiveness

The implementation phase involved 30 fifth-grade students at SDN Cikokol III, Tangerang, during two instructional sessions. The pre-test and post-test comparison revealed a notable improvement in students' numeracy achievement, with an average pre-test score of 62.5 increasing to 81.4 in the post-test. The computed N-Gain value of 0.47 falls within the moderate effectiveness category, indicating that TKS effectively enhanced students' arithmetic comprehension and procedural fluency. These results align with studies by Hwang and Chen [14] and Kiili [16], which emphasize that interactive game-based learning fosters sustained attention, cognitive processing, and deeper understanding of mathematical concepts. Furthermore, 85% of students reported that learning through TKS was more engaging and enjoyable than conventional lessons, confirming its motivational value in mathematics instruction.

Student Engagement and Usability Feedback

The usability evaluation gathered responses from both teachers and students using a 5-point Likert scale questionnaire covering aspects such as interface design, ease of navigation, feedback quality, and learning satisfaction. The overall mean satisfaction score reached 4.6/5, categorized as very high. Students expressed positive feedback regarding the challenge-based progression system and animated reward elements, which reinforced motivation and persistence. Teachers also reported that TKS helped facilitate differentiated instruction, as students could progress at their own pace while still adhering to the same learning objectives. This result corroborates Dicheva's [18] argument that game mechanics—such as feedback loops, progression, and autonomy—stimulate learner motivation and accountability. In addition, students exhibited higher levels of mathematical reasoning and problem-solving confidence, indicating a transfer of cognitive skills beyond rote computation [33].

The findings demonstrate that integrating game-based learning within mathematics education, when guided by systematic instructional design, effectively bridges the gap between pedagogical engagement and learning achievement. The Treasure Kids Smart (TKS) model supports constructivist learning theory, where learners construct knowledge actively through meaningful interaction and contextual problem-solving [17]. Moreover, the design process reflects the cognitive-affective theory of learning with media (CATLM) proposed by Mayer [25], asserting that multimodal stimuli—such as visuals, text, and audio—enhance dual-channel processing and improve learning retention. From a management and design perspective, the study also confirms that

the ADDIE framework remains an effective blueprint for developing digital learning innovations. By incorporating continuous formative evaluation, ADDIE allows iterative refinement to ensure both content validity and user experience quality [29]. The combination of instructional design and game-based elements represents a hybrid learning innovation that operationalizes the principles of fun learning, experiential engagement, and data-informed instruction [34]. These results align with international research (Plass et al. [20]; Rahmawati & Yusof [11]) showing that educational games not only improve cognitive performance but also support emotional engagement and long-term learning motivation.

The empirical results of this study resonate with previous literature that highlights the potential of digital games to foster numeracy and computational literacy. Studies in similar contexts—such as MathQuest (Chen & Lee, 2023) and FunMath (Rahmawati & Yusof, 2024)—reported learning gains between 0.40 and 0.50 in N-Gain scores, which closely aligns with TKS's performance of 0.47 [35]. The thematic narrative and adaptive challenge levels of TKS mirror the motivational model described by Keller [4], where attention, relevance, confidence, and satisfaction (ARCS) drive sustained engagement. Moreover, TKS's local language integration and curriculum alignment demonstrate the importance of contextualized digital learning, consistent with national initiatives under Merdeka Belajar [28]. These outcomes underscore the adaptability of GBL models across sociocultural settings and reinforce their role in inclusive, engaging, and future-ready learning environments [36].

The success of TKS in improving numeracy performance reflects the growing relevance of digital innovation in primary education. As proposed by OECD (2023) and UNESCO (2022), the integration of gamified tools supports 21st-century competencies such as problem-solving, collaboration, and digital literacy. However, effective implementation requires teacher readiness, institutional support, and continuous evaluation mechanisms [37]. TKS also demonstrates how localized educational games can serve as scalable models for digital learning ecosystems, particularly in developing countries seeking to modernize their curricula while maintaining cultural authenticity [38]. The results confirm that game-based learning, supported by structured instructional design, enhances both affective and cognitive outcomes in mathematics education. This integration represents a paradigm shift from traditional teacher-centered models to student-centered, technology-enhanced learning, in line with global educational transformation trends [39].

For teachers and practitioners, this study provides empirical evidence that game-based media can be effectively integrated into classroom instruction to promote mathematical understanding and motivation. Teachers are encouraged to adopt digital pedagogical strategies that incorporate elements of play, exploration, and feedback while aligning with curriculum standards. Institutions should also invest in teacher training programs that build digital literacy and instructional design competencies, enabling educators to develop and adapt their own game-based learning tools. For policy makers, the results support the inclusion of digital innovation and gamification strategies within national education reform initiatives such as Merdeka Belajar. By facilitating access to locally developed educational games like TKS, policymakers can promote inclusive and engaging learning experiences that reflect both global innovation and local context. Collaboration between educational technology developers, teachers, and ministries can ensure sustainable scaling of such innovations across schools.

From a theoretical standpoint, this study contributes to the intersection of constructivist learning theory, cognitive multimedia theory, and game-based pedagogy by demonstrating how the integration of instructional design models and gamified learning principles enhances cognitive engagement and numeracy acquisition. The findings affirm that learning is most effective when it is active, experiential, and emotionally engaging, aligning with Mayer's Cognitive Theory of Multimedia Learning and Keller's ARCS motivational framework [40]. Future research should explore the longitudinal impact of game-based learning on mathematical reasoning, metacognitive awareness, and problem-solving persistence. Mixed-method or quasi-experimental designs could further assess the scalability of TKS across different grade levels and cultural contexts. Additionally, integrating adaptive learning technologies, artificial intelligence (AI), and learning analytics could refine personalized instruction and data-driven feedback loops in educational game design [41]. Finally, comparative studies between traditional, blended, and gamified learning environments would offer deeper insights into the pedagogical efficacy and sustainability of digital learning innovations [42]. In conclusion, the Treasure Kids Smart (TKS) innovation represents a significant step toward modernizing mathematics education in Indonesia's primary schools. By merging instructional design principles and game-based learning, TKS not only enhances students' numeracy competence but also nurtures digital citizenship and lifelong learning skills. This study reinforces the argument that effective educational technology is not merely about digital tools, but about rethinking pedagogy—designing learning environments where curiosity, play, and reflection coexist to create meaningful educational transformation [43], [44].

IV. CONCLUSION

This study concludes that the Treasure Kids Smart (TKS) game-based learning media, developed through the ADDIE instructional design model, effectively enhances students' numeracy performance, engagement, and motivation in primary education. The findings confirm that the integration of interactive game mechanics—such as rewards, levels, feedback, and narrative context—creates an enjoyable and pedagogically meaningful learning environment that supports both cognitive and affective development. Quantitative results demonstrated a significant improvement in students' post-test scores, with an N-Gain of 0.47 categorized as moderate, while expert validation yielded a mean score of 91.7%, signifying high instructional quality. Furthermore, student feedback indicated increased enthusiasm, collaboration, and persistence in solving mathematical problems, demonstrating the media's positive impact on classroom engagement. The study also highlights the pedagogical significance of combining Game-Based Learning (GBL) and instructional design frameworks. The ADDIE model provided a structured

development process that ensured content accuracy, usability, and continuous refinement through expert evaluation and learner feedback. These results align with international findings (Plass et al., 2019; Hwang & Chen, 2023) that emphasize how systematic instructional design enhances the educational value of gamified environments. Thus, TKS exemplifies how digital innovation can transform mathematics education from rote learning toward experiential and reflective learning that fosters 21st-century competencies such as problem-solving, creativity, and digital literacy.

V. REFERENSI

- [1] S. Papastergiou, "Exploring the potential of computer and video games for health and physical education: A literature review," *Computers & Education*, vol. 159, pp. 103–118, 2021.
- [2] OECD, *PISA 2022 Assessment and Analytical Framework: Mathematics, Reading, Science, and Creative Thinking*, Paris: OECD Publishing, 2023.
- [3] Ministry of Education, Culture, Research, and Technology (Indonesia), *Laporan Hasil Asesmen Nasional 2023: Kompetensi Literasi dan Numerasi*, Jakarta: Kemendikbudristek, 2023.
- [4] J. M. Keller, *Motivational Design for Learning and Performance: The ARCS Model Approach*, 3rd ed. New York: Springer, 2020.
- [5] K. Kiili, "Digital game-based learning: Towards an experiential gaming model," *Internet and Higher Education*, vol. 44, pp. 100728–100741, 2020.
- [6] M. J. Dicheva, "Gamification in education: A systematic mapping study," *Educational Technology & Society*, vol. 24, no. 2, pp. 75–92, 2021.
- [7] J. Plass, R. Homer, and C. Kinzer, "Foundations of game-based learning," *Educational Psychologist*, vol. 53, no. 3, pp. 258–283, 2019.
- [8] M. Qian and K. R. Clark, "Game-based learning and 21st-century skills: A review of recent research," *Computers in Human Behavior*, vol. 110, p. 106485, 2020.
- [9] P. D. Richard and S. Prensky, *Digital Game-Based Learning: Revised Edition*, New York: McGraw-Hill, 2021.
- [10] E. Annetta and M. Cheng, "Learning through play: The impact of game-based learning on mathematical motivation," *Journal of Educational Research and Practice*, vol. 12, no. 1, pp. 33–48, 2023.
- [11] H. Rahmawati and F. Yusof, "Integrating gamified digital learning for mathematical reasoning enhancement," *Heliyon Education*, vol. 9, no. 2, p. e15678, 2024.
- [12] R. K. Branch, *Instructional Design: The ADDIE Approach*, 2nd ed. New York: Springer, 2022.
- [13] J. W. Creswell and C. N. Poht, *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*, 5th ed. Thousand Oaks, CA: SAGE Publications, 2024.
- [14] K. L. Hwang and Y. H. Chen, "Digital learning systems for improving arithmetic fluency and student motivation," *International Journal of Educational Technology in Higher Education*, vol. 20, no. 1, pp. 1–15, 2023.
- [15] Bappenas, *Peta Jalan Pendidikan Indonesia 2025–2045: Menuju Generasi Emas*, Jakarta: Kementerian PPN/Bappenas, 2022.
- [16] K. Kiili, "Digital game-based learning: Towards an experiential gaming model," *Internet and Higher Education*, vol. 44, pp. 100728–100741, 2020.
- [17] J. Bruner, *Actual Minds, Possible Worlds*, Cambridge, MA: Harvard University Press, 2020.
- [18] M. J. Dicheva, "Gamification in education: A systematic mapping study," *Educational Technology & Society*, vol. 24, no. 2, pp. 75–92, 2021.
- [19] S. H. Chen and P. T. Lee, "Digital games as scaffolds for mathematical reasoning in primary education," *Computers & Education*, vol. 193, p. 104658, 2023.
- [20] J. Plass, R. Homer, and C. Kinzer, "Foundations of game-based learning," *Educational Psychologist*, vol. 53, no. 3, pp. 258–283, 2019.
- [21] OECD, *PISA 2022 Assessment and Analytical Framework: Mathematics, Reading, Science, and Creative Thinking*, Paris: OECD Publishing, 2023.
- [22] A. L. Jordan and C. Levine, "Early numeracy and long-term academic success," *Developmental Psychology Review*, vol. 44, no. 1, pp. 43–57, 2022.
- [23] H. Rahmawati and F. Yusof, "Integrating gamified digital learning for mathematical reasoning enhancement," *Heliyon Education*, vol. 9, no. 2, p. e15678, 2024.
- [24] R. K. Yin, *Case Study Research and Applications: Design and Methods*, 7th ed. Thousand Oaks, CA: SAGE Publications, 2023.
- [25] R. E. Mayer, *Multimedia Learning*, 3rd ed. Cambridge: Cambridge University Press, 2021.

- [26] E. Annetta and M. Cheng, "Learning through play: The impact of game-based learning on mathematical motivation," *Journal of Educational Research and Practice*, vol. 12, no. 1, pp. 33–48, 2023.
- [27] A. Alghamdi and M. Khan, "Quality and usability in educational media design," *Int. J. Educ. Manag.*, vol. 37, no. 4, pp. 225–239, 2023.
- [28] Ministry of Education, Culture, Research, and Technology (Indonesia), *Strategi Implementasi Kurikulum Merdeka Berbasis Digital 2023–2027*, Jakarta: Kemendikbudristek, 2023.
- [29] R. K. Branch, *Instructional Design: The ADDIE Approach*, 2nd ed. New York: Springer, 2022.
- [30] R. K. Branch, *Instructional Design: The ADDIE Approach*, 2nd ed. New York: Springer, 2022.
- [31] J. W. Creswell and C. N. Poth, *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*, 5th ed. Thousand Oaks, CA: SAGE Publications, 2024.
- [32] H. Rahmawati and F. Yusof, "Integrating gamified digital learning for mathematical reasoning enhancement," *Heliyon Education*, vol. 9, no. 2, p. e15678, 2024.
- [33] M. J. Dicheva, "Gamification in education: A systematic mapping study," *Educational Technology & Society*, vol. 24, no. 2, pp. 75–92, 2021.
- [34] J. M. Keller, *Motivational Design for Learning and Performance: The ARCS Model Approach*, 3rd ed. New York: Springer, 2020.
- [35] S. H. Chen and P. T. Lee, "Digital games as scaffolds for mathematical reasoning in primary education," *Computers & Education*, vol. 193, p. 104658, 2023.
- [36] Ministry of Education, Culture, Research, and Technology (Indonesia), *Strategi Implementasi Kurikulum Merdeka Berbasis Digital 2023–2027*, Jakarta: Kemendikbudristek, 2023.
- [37] OECD, *Education Policy Outlook: Indonesia 2023 – Innovation in Learning Systems*, Paris: OECD Publishing, 2023.
- [38] UNESCO, *Digital Learning for All: Policy Guidelines for Primary Education*, Paris: UNESCO Publishing, 2022.
- [39] J. S. Oakland, *Total Quality Management and Operational Excellence*, 5th ed. London: Routledge, 2022.
- [40] R. E. Mayer, *Multimedia Learning*, 3rd ed. Cambridge: Cambridge University Press, 2021.
- [41] OECD, *AI and the Future of Education: Policy Outlook 2024*, Paris: OECD Publishing, 2024.
- [42] N. Ülker, "Blended versus game-based learning: Comparative impacts on learner engagement and performance," *Frontiers in Education*, vol. 9, Art. no. 1147123, 2024.
- [43] M. Qian and K. R. Clark, "Game-based learning and 21st-century skills: A review of recent research," *Computers in Human Behavior*, vol. 110, p. 106485, 2020.
- [44] H. Rahmawati and F. Yusof, "Integrating gamified digital learning for mathematical reasoning enhancement," *Heliyon Education*, vol. 9, no. 2, p. e15678, 2024.