



AI-Assisted digital learning and its role in enhancing communication skills and creativity in elementary language education: a data-driven perspective

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Article Information	Abstract
Submitted: Jan 20, 2026 Revised: March 29, 2026 Accepted: May 15, 2026 Keywords Learning Management System; System Development Life Cycle; Decision Making; E-Learning Implementation.	Purpose: This study aims to investigate the role of AI-assisted digital learning in improving elementary students' communication skills and creativity within Indonesian language education. Method: A quantitative research design with a survey approach was applied in this study. The sample consisted of 52 fifth-grade students from an elementary school in Yogyakarta, Indonesia. Data were collected using structured questionnaires that assessed the extent of AI-assisted learning tool usage, students' communication skills, and creativity levels. Statistical analysis was conducted using Pearson product-moment correlation, supported by prerequisite tests including normality and linearity assessments to ensure data validity. Findings: The results reveal a positive and statistically significant relationship between AI-assisted digital learning and students' communication skills ($r = 0.647$), as well as creativity ($r = 0.597$). Additionally, the combined relationship between AI-assisted learning and both dependent variables is categorized as strong ($r = 0.607$). These findings indicate that the integration of AI-supported digital tools contributes to students' ability to express ideas more effectively and to develop creative outputs in language learning contexts. Significance: This study offers empirical evidence on the effectiveness of AI-assisted learning in primary education, particularly in supporting communication and creativity development. The findings provide a data-driven foundation for educators and policymakers to design more innovative and technology-enhanced learning environments.

INTRODUCTION

The rapid development of digital technology has significantly transformed educational practices across various levels of schooling. In particular, the integration of artificial intelligence (AI) into learning environments has introduced new opportunities for enhancing student engagement and learning outcomes (A. Y. Q. Huang et al., 2023; Nguyen et al., 2024; Radif, 2024; Vistorte et al., 2024). In elementary education, the development of communication skills is considered a fundamental component for supporting students' academic and social interactions (Silveira-Zaldivar et al., 2021). Communication skills enable students to express ideas clearly, participate actively in discussions, and construct meaningful understanding through interaction (Hsbollah & Hassan, 2022; Owens & Hite, 2022; Sormunen et al., 2020). In addition, creativity plays a crucial role in helping students generate innovative ideas and adapt to complex learning situations. However, traditional approaches to language learning often rely on teacher-centered instruction and written-based activities that limit student participation. These conventional methods are frequently insufficient to foster both communication skills and creativity simultaneously. As a result, students may struggle to articulate their ideas effectively and demonstrate creative thinking in learning tasks. This condition highlights

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the need for more interactive and student-centered learning approaches that align with current educational demands. Therefore, integrating advanced technologies such as AI-assisted learning tools is increasingly viewed as a strategic solution to address these challenges.

AI-assisted digital learning environments have emerged as an innovative approach to support more engaging and adaptive learning processes. These environments incorporate various digital tools that facilitate interaction, collaboration, and content creation among students. For instance, AI-supported platforms allow learners to design visual content, develop multimedia projects, and present ideas in more creative formats (Hui, 2026; Mykytiuk et al., 2025; Sripan & Lertpongrujikorn, 2025). Such features not only enhance students' motivation but also provide opportunities for active learning and self-expression. In language education, particularly at the elementary level, these tools can support students in organizing ideas, improving language structure, and expressing messages effectively (Hossain, 2024; Marzuki et al., 2023; Selfa-Sastre et al., 2022; Shadiev & Yang, 2020). Moreover, AI-assisted learning enables personalized learning experiences by adapting to students' abilities and learning preferences. This flexibility encourages students to explore learning materials more independently and creatively (Hsia et al., 2021; Yesil & Aras, 2024). The use of digital media also supports multimodal communication, combining text, images, and audio to strengthen understanding (Al-Muttairi & Al-Alusi, 2025; Dahlström, 2022; Hafner, 2020). Consequently, students are able to develop communication skills that are more dynamic and contextually relevant. Therefore, AI-assisted digital learning is considered a promising approach for improving both communication skills and creativity in language education.

The increasing exposure of students to digital technologies in their daily lives has further influenced their learning behaviors and expectations. Students in the current digital era are more accustomed to interactive, visual, and technology-driven learning environments (Emma, 2026). This shift has made traditional teaching methods less effective in maintaining student interest and engagement [need citation]. As a result, educators are encouraged to adopt innovative instructional strategies that integrate technology into classroom practices. AI-assisted learning tools provide a platform for students to collaborate, communicate, and create content in meaningful ways (Kim et al., 2022; Lai, 2021; Purba et al., 2025). These tools also support the development of higher-order thinking skills, including critical thinking and creativity. In addition, the integration of technology aligns with the concept of 21st-century learning, which emphasizes digital literacy and innovation (Martínez et al., 2021; Nurhidayat et al., 2024; Usfandi Haryaka, 2025; Zou et al., 2025). However, the implementation of AI in elementary education still faces several challenges, including limited research evidence and practical application. Many educational institutions are still exploring effective ways to integrate AI into their teaching practices. Therefore, further investigation is needed to understand how AI-assisted learning can support key student competencies in primary education contexts.

Recent studies have demonstrated the effectiveness of technology-enhanced learning in improving communication skills and student creativity; however, these findings are often situated within higher education or professional contexts, such as nursing and medical education, where digital and extended reality tools are predominantly applied (Al-

Sheikhly et al., 2020; Gutiérrez-Puertas et al., 2020; Li et al., 2025). In parallel, research on student creativity has highlighted the positive impact of digital technologies, STEM/STEAM education, and creativity training programs in fostering creative thinking skills, yet these studies largely focus on general educational settings or higher education, with limited emphasis on elementary-level learners (Aguilera & Ortiz-Revilla, 2021; Ritter et al., 2020; Tang et al., 2022). Furthermore, emerging studies on artificial intelligence in education indicate its potential to enhance both learning performance and creative outputs, particularly through AI-assisted learning environments and generative AI tools, but the majority of these investigations are concentrated in higher education contexts or specific domains such as academic writing and language acquisition (Chen, 2025; Habib et al., 2024; Pham et al., 2023). Although research on technology-enhanced language learning and chatbot-supported instruction has expanded significantly, it primarily addresses learner engagement, language acquisition, or general learning outcomes rather than focusing on the integrated development of communication skills and creativity (Y.-M. Huang et al., 2022; Shadiev & Yang, 2020; Zhang et al., 2022). Therefore, there remains a clear gap in empirical, data-driven studies that examine the role of AI-assisted digital learning in simultaneously enhancing communication skills and creativity within elementary language education contexts, particularly in developing countries, where such integrative approaches are still underexplored.

Although numerous studies have examined the role of digital technology in education, most of the existing literature focuses on higher education or professional training contexts rather than elementary-level learning. Previous research has demonstrated that technology-enhanced learning can improve communication skills and creativity, yet these studies often investigate these variables separately rather than as integrated learning outcomes. Furthermore, studies on AI-assisted learning primarily emphasize academic performance, student engagement, or general learning effectiveness without specifically addressing communication skills and creativity simultaneously. In the context of language learning, existing research tends to focus on language acquisition or learner engagement rather than the development of communication competence and creative expression. Additionally, many studies are conducted in developed countries, leaving a gap in understanding the role of AI-assisted learning in developing country contexts. Empirical, data-driven research that examines the combined influence of AI-assisted digital learning on communication skills and creativity in elementary education remains limited. This gap indicates the need for a more comprehensive and context-specific investigation. Therefore, this study aims to examine the role of AI-assisted digital learning in enhancing communication skills and creativity among elementary students in Indonesian language education. This research employs a quantitative approach to provide empirical evidence on the relationship between AI-supported learning tools and key student competencies. The findings are expected to contribute to the development of technology-enhanced learning strategies and support more effective educational practices in primary education.

LITERATURE REVIEW

Artificial intelligence (AI) has increasingly become a transformative force in modern education, particularly in shaping technology-enhanced learning environments. AI-assisted digital learning refers to the use of intelligent systems and digital platforms that support teaching and learning processes through automation, personalization, and adaptive feedback (Gligorea et al., 2023; Juyal et al., 2025; Rakhmetov et al., 2025; Yuensook et al., 2025). These systems enable educators to design more flexible and responsive learning experiences that cater to individual student needs. In recent years, AI-assisted tools have been widely integrated into educational practices, ranging from intelligent tutoring systems to content creation platforms (Lin et al., 2023). Such technologies are known to facilitate active learning by encouraging students to interact with digital content in more meaningful ways. In addition, AI-assisted learning environments promote self-directed learning by allowing students to explore materials independently (Wang et al., 2024; Wu et al., 2024; Yang, 2026). The integration of AI also supports real-time feedback, which helps learners identify errors and improve their understanding. Furthermore, AI technologies enhance the accessibility of educational resources, enabling students to access learning materials anytime and anywhere (Alam & Mohanty, 2023; Masrek et al., 2024; Stelea et al., 2025). Despite these advantages, the application of AI in elementary education remains relatively limited compared to higher education contexts. Therefore, understanding the role of AI-assisted learning in primary education is essential for maximizing its potential benefits.

Communication skills are widely recognized as a fundamental component of language learning, particularly in elementary education. These skills encompass the ability to express ideas clearly, interpret messages effectively, and engage in meaningful interactions. In language education, communication skills are developed through both verbal and written activities that encourage students to articulate their thoughts (Costigan & Brink, 2020; Delgado-Crespo et al., 2020; Mart, 2020; Robert & Meenakshi, 2022). Effective communication not only supports academic achievement but also enhances social interaction and collaboration among students (Dahmani et al., 2024; Ningsih et al., 2025). However, traditional language teaching methods often emphasize grammatical accuracy over communicative competence. As a result, students may demonstrate limited ability to express ideas in authentic contexts. Recent pedagogical approaches emphasize the importance of interactive learning environments that promote active participation (Muir et al., 2022; Prykhodkina et al., 2025). Digital learning tools have been shown to provide opportunities for students to practice communication in more dynamic and engaging ways (Alenezi et al., 2023; Kumi-Yeboah et al., 2020; Pokrovskaja et al., 2021). In particular, multimedia platforms allow learners to combine text, visuals, and audio in expressing their ideas. This multimodal approach strengthens students' ability to communicate across different contexts. Therefore, integrating technology into language learning is considered an effective strategy for improving communication skills.

Creativity is an essential aspect of student development, particularly in fostering innovation and problem-solving abilities. In educational settings, creativity refers to the ability to generate original ideas, produce meaningful work, and think beyond conventional boundaries. The development of creativity is closely linked to students'

ability to explore, experiment, and express their ideas freely (Ozkan & Umdü Topsakal, 2021; Rahayuningsih et al., 2021; Wei et al., 2025). However, traditional learning environments often limit opportunities for creative expression due to rigid instructional structures (Cheung et al., 2021; French et al., 2020; Sasson et al., 2022; Sigurðardóttir et al., 2021). Consequently, students may struggle to develop creative thinking skills that are necessary for adapting to complex challenges. Contemporary educational approaches emphasize the importance of creating learning environments that encourage exploration and imagination (Campbell, 2020; Henriksen et al., 2021). Digital technologies have been identified as powerful tools for supporting creativity by providing diverse platforms for content creation (Ceh et al., 2024; Selfa-Sastre et al., 2022; Tang et al., 2022). Through digital tools, students can design visual projects, produce multimedia content, and present innovative ideas. These activities enable learners to engage in creative processes that combine knowledge and imagination. Furthermore, the use of technology fosters a more student-centered learning approach, where learners actively construct their own understanding. Therefore, integrating digital tools into education is essential for enhancing student creativity.

The integration of AI-assisted learning tools has shown significant potential in enhancing both communication skills and creativity in educational contexts. AI technologies provide interactive and adaptive learning environments that support student engagement and participation (Radif, 2024; Yaseen et al., 2025). In communication development, AI tools can assist students in organizing ideas, refining language use, and improving clarity of expression (Marzuki et al., 2023; Ou et al., 2024). These tools often include features such as automated feedback, language suggestions, and interactive simulations. In terms of creativity, AI-assisted platforms enable students to generate new ideas and explore various forms of expression. For example, content creation tools allow learners to design visual and multimedia outputs that reflect their creative thinking. Moreover, AI technologies encourage collaborative learning by enabling students to work together on digital projects (Hu et al., 2022). This collaborative process enhances both communication and creativity simultaneously. However, most existing studies tend to examine these outcomes separately rather than in an integrated manner. In addition, research on AI-assisted learning often focuses on higher education contexts, leaving elementary education relatively underexplored. Therefore, further investigation is needed to understand how AI can simultaneously support communication skills and creativity in younger learners.

Based on the existing literature, it is evident that AI-assisted digital learning, communication skills, and creativity are interconnected elements in modern education. Previous studies have established that digital technologies can enhance communication and creativity, yet these relationships are often examined independently. Moreover, the majority of research has been conducted in higher education or specialized learning environments. This creates a gap in understanding how these variables interact within elementary education contexts, particularly in language learning. In addition, while AI technologies have shown promising results, their practical implementation in primary education remains limited. There is also a lack of empirical studies that adopt a data-driven approach to analyze the combined effects of AI-assisted learning on multiple student

competencies. Addressing this gap is essential for developing more effective and holistic educational strategies. Therefore, this study focuses on examining the role of AI-assisted digital learning in enhancing both communication skills and creativity among elementary students. By integrating these variables into a single analytical framework, this research aims to provide a more comprehensive understanding of technology-enhanced learning. The findings are expected to contribute to the advancement of educational practices that support 21st-century skills development.

METHOD

Research Design

This study employed a quantitative research design using a survey approach to examine the relationship between AI-assisted digital learning and students' communication skills and creativity in elementary language education. The quantitative design was selected to provide objective and measurable evidence regarding the relationships among variables. A correlational framework was applied to determine the strength and direction of associations between the independent and dependent variables. The independent variable in this study was the use of AI-assisted digital learning, while the dependent variables were communication skills and student creativity. The survey method allowed for the collection of data from participants in a structured and systematic manner. This approach was considered appropriate for identifying patterns and relationships within a relatively small sample size. In addition, the design enabled the use of statistical analysis to support data interpretation. The study also incorporated prerequisite tests to ensure the validity and reliability of the data. Therefore, the chosen research design provided a suitable framework for addressing the research objectives.

Participants

The participants of this study consisted of 52 fifth-grade students from an elementary school located in Yogyakarta, Indonesia. The selection of participants was based on purposive sampling, considering that the students had prior experience using AI-assisted digital learning tools in classroom activities. All participants were actively involved in Indonesian language learning and had been exposed to technology-supported instructional practices. The sample included students with relatively similar academic backgrounds and learning environments to ensure consistency in data collection. The age range of participants was approximately 10 to 11 years old, representing a typical elementary education level. The participants were selected to reflect the characteristics of learners in primary education who are increasingly exposed to digital technology. Prior to data collection, consent was obtained from the school and relevant authorities. Ethical considerations were carefully addressed to ensure the confidentiality and anonymity of participants. Therefore, the selected participants were deemed appropriate for investigating the research variables.

Instruments

Data were collected using structured questionnaires designed to measure three main variables: the use of AI-assisted digital learning, communication skills, and student creativity. The questionnaire items were developed based on relevant theoretical frameworks and previous studies in educational technology and language learning. Each

variable was measured using a Likert-scale format ranging from strongly disagree to strongly agree. The instrument for AI-assisted learning assessed students' frequency of use, engagement, and perceived benefits of digital learning tools. Communication skills were measured through indicators such as clarity of expression, ability to convey ideas, and participation in learning activities. Meanwhile, student creativity was assessed through indicators including originality, flexibility of ideas, and ability to produce creative outputs. Before data collection, the instrument was tested for validity and reliability to ensure accuracy. Data collection was conducted during classroom sessions with the assistance of the teacher. Students were guided to complete the questionnaire independently to ensure authentic responses. Therefore, the instruments and data collection process were designed to obtain reliable and valid data.

Data Analysis

The collected data were analyzed using statistical methods to examine the relationships among variables. Descriptive statistics were first used to summarize the data and provide an overview of participants' responses. Subsequently, prerequisite tests, including normality and linearity tests, were conducted to ensure that the data met the assumptions required for further analysis. The main analysis employed Pearson product-moment correlation to determine the strength and direction of relationships between AI-assisted digital learning, communication skills, and creativity. The correlation coefficients were interpreted based on established statistical criteria to classify the strength of relationships. In addition, significance testing was conducted to determine whether the relationships were statistically meaningful. The analysis was carried out using statistical software to ensure accuracy and efficiency. The results of the analysis were then interpreted in relation to the research objectives. Therefore, the data analysis procedures provided a comprehensive understanding of the relationships among the studied variables.

Procedure

The research procedure was conducted in several systematic stages to ensure the accuracy and reliability of the study. First, preliminary observations were carried out to identify the learning context and the use of AI-assisted digital tools in the classroom. Second, the research instruments were developed and validated to ensure their suitability for data collection. Third, permission was obtained from the school and relevant authorities to conduct the study. Fourth, the questionnaires were administered to the selected participants during scheduled learning sessions. During the data collection process, clear instructions were provided to ensure that students understood how to complete the questionnaire. Fifth, the collected data were checked and organized for analysis. Sixth, statistical analysis was conducted to examine the relationships among variables. Finally, the results were interpreted and discussed in relation to the research objectives and existing literature. Therefore, the research procedure ensured that the study was conducted in a systematic and reliable manner.

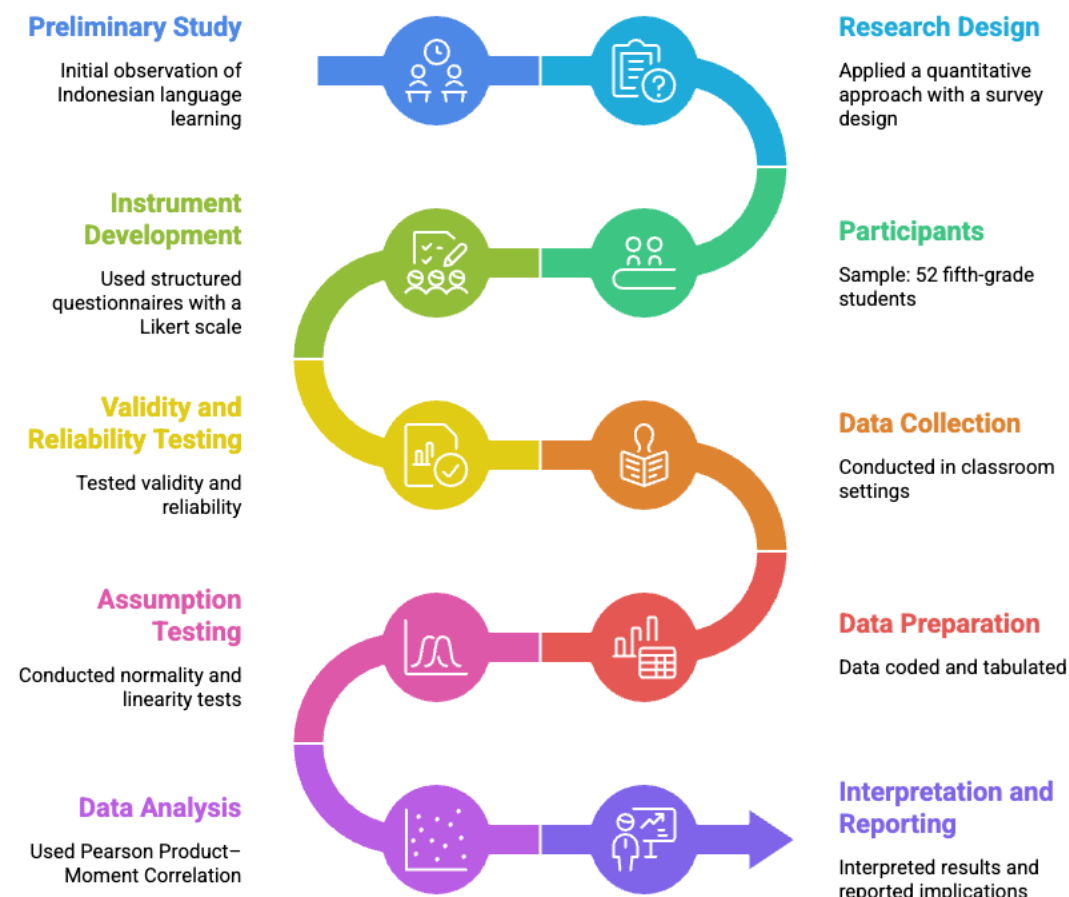


Figure 1. Research Procedure Flowchart

RESULTS AND DISCUSSION

Result

This section presents a comprehensive analysis of the relationship between AI-assisted digital learning, communication skills, and student creativity. The findings are organized into descriptive statistics, prerequisite testing, and inferential statistical analysis using Pearson correlation.

Descriptive Analysis

The descriptive statistics were conducted to provide an overview of students' responses regarding the use of AI-assisted digital learning tools, communication skills, and creativity. The results indicate that students generally demonstrated a high level of engagement with AI-assisted learning platforms. Most participants reported frequent use of digital tools in completing learning tasks, particularly in activities involving content creation and presentation. In terms of communication skills, students showed a moderate to high level of ability in expressing ideas, participating in discussions, and conveying messages clearly. This suggests that the integration of digital tools may facilitate more active communication during the learning process. Similarly, student creativity was observed to be in the moderate category, with students demonstrating the ability to produce original ideas and creative outputs, particularly in multimedia-based assignments. Overall, the descriptive findings suggest that AI-assisted digital learning is positively perceived by students and is associated with improved engagement in both communication and creative activities.

Prerequisite Test Results

Before performing the correlation analysis, prerequisite tests were conducted to ensure that the data met the assumptions of parametric statistical analysis.

Table 1. Normality Test Results

Variable	Sig. Value	Interpretation
AI-Assisted Learning	> 0.05	Normal
Communication Skills	> 0.05	Normal
Creativity	> 0.05	Normal

The results of the normality test indicate that all variables have significance values greater than 0.05, suggesting that the data are normally distributed. Therefore, the data meet the assumptions required for parametric testing.

Table 2. Linearity test results

Relationship	Sig. Value	Interpretation
AI → Communication	> 0.05	Linear
AI → Creativity	> 0.05	Linear

The linearity test confirms that the relationships between AI-assisted learning and both dependent variables are linear. These results validate the use of Pearson correlation analysis in this study.

Correlation Analysis

The main objective of this study was to examine the relationships between AI-assisted digital learning and students' communication skills and creativity. The results of the Pearson Product–Moment Correlation analysis are presented in Table 3.

Table 3. Correlation analysis results

Variables	r-value	Sig. Value	Interpretation
AI → Communication Skills	0.647	< 0.05	Strong, Significant
AI → Creativity	0.597	< 0.05	Moderately Strong
AI → Communication & Creativity	0.607	< 0.05	Strong, Significant

The results indicate a strong and statistically significant positive relationship between AI-assisted digital learning and communication skills ($r = 0.647$, $p < 0.05$). This finding suggests that students who are more engaged in AI-supported learning environments tend to exhibit better communication abilities, particularly in expressing ideas and participating in interactive learning activities. Similarly, the relationship between AI-assisted learning and creativity was found to be moderately strong ($r = 0.597$, $p < 0.05$). This indicates that the use of digital tools contributes to the enhancement of students' creative thinking and their ability to generate innovative outputs. Although the correlation is slightly lower compared to communication skills, it still demonstrates a meaningful relationship. Furthermore, the combined correlation between AI-assisted learning and both communication skills and creativity yielded a value of 0.607, which falls into the strong category. This result indicates that AI-assisted digital learning plays a significant role in simultaneously improving multiple student competencies. The positive direction of all correlations implies that increased utilization of AI-assisted tools corresponds with higher levels of communication skills and creativity.

The findings of this study demonstrate that AI-assisted digital learning is significantly associated with improvements in both communication skills and creativity among elementary students. The stronger relationship observed in communication skills suggests

that digital tools may be more directly linked to interactive and expressive aspects of learning. Meanwhile, creativity, although slightly lower in correlation, still benefits from the use of digital platforms that encourage idea generation and content creation. These results highlight the importance of integrating AI-assisted technologies into language learning, as they provide opportunities for students to engage in meaningful communication and creative processes. The findings also reinforce the role of technology-enhanced learning environments in supporting the development of essential 21st-century skills.

Discussion

The findings of this study demonstrate that AI-assisted digital learning has a significant positive relationship with students' communication skills, as indicated by a strong correlation coefficient. This result suggests that the integration of AI-supported tools can enhance students' ability to express ideas, engage in discussions, and participate actively in learning processes (Cai et al., 2025). These findings are consistent with previous studies that highlight the role of technology-enhanced learning in improving communication competencies through interactive and collaborative environments. Research in AI-mediated education indicates that digital platforms can support meaningful interaction by providing real-time feedback and facilitating student engagement. In addition, prior studies in language learning have shown that digital tools encourage students to practice communication in more authentic and dynamic contexts (Choi & Chung, 2021; Selfa-Sastre et al., 2022). The present findings reinforce the idea that communication skills are not only developed through direct instruction but also through technology-supported interaction. Compared to traditional learning environments, AI-assisted learning offers more opportunities for students to articulate ideas in multimodal formats. This aligns with the constructivist perspective, which emphasizes active participation in knowledge construction. However, it is important to note that the effectiveness of AI in enhancing communication skills depends on how it is integrated into pedagogical practices. Therefore, the results confirm that AI-assisted learning can serve as an effective medium for strengthening communication skills in elementary education.

The relationship between AI-assisted digital learning and student creativity was found to be moderately strong, indicating that AI tools contribute positively to creative development. This finding is in line with recent research suggesting that AI can stimulate idea generation and support creative thinking processes. Studies on generative AI have shown that AI-assisted environments can enhance creativity by providing prompts, suggestions, and alternative perspectives (Chandrasekera et al., 2025). Furthermore, empirical evidence suggests that AI can increase the novelty and usefulness of creative outputs, particularly for learners with lower baseline creativity. However, previous studies also highlight potential limitations, such as reduced diversity of ideas when AI-generated content becomes overly standardized. The present study supports the notion that AI can enhance creativity but does not fully replace human originality. In the context of elementary education, creativity appears to benefit from AI tools that facilitate exploration and experimentation. Compared to higher education studies, where AI is often used for complex problem-solving, this study demonstrates its relevance in early learning contexts. The moderate strength of the relationship indicates that creativity is influenced by

multiple factors beyond technology alone. Therefore, while AI-assisted learning contributes to creativity, it should be combined with appropriate pedagogical strategies to maximize its effectiveness.

The combined relationship between AI-assisted learning, communication skills, and creativity reveals a strong and integrated effect, suggesting that these competencies develop simultaneously within technology-enhanced environments. This finding supports the idea that communication and creativity are interconnected skills that can be fostered through the same learning processes. Previous studies have often examined these variables separately, focusing either on communication or creativity as isolated outcomes. However, emerging research indicates that AI-supported learning environments can promote multiple competencies at once by encouraging interaction, collaboration, and content creation. The results of this study extend this perspective by providing empirical evidence from an elementary education context. Compared to studies conducted in higher education, which often focus on cognitive performance, this study emphasizes holistic skill development. The integration of AI tools appears to create a learning environment where students can simultaneously express ideas and generate creative outputs (Bai, 2026; Filipov et al., 2025). This aligns with recent theoretical frameworks that view creativity as a process of active engagement rather than merely a final product. Furthermore, the findings highlight the importance of designing learning activities that integrate communication and creativity. Therefore, this study contributes to the literature by demonstrating the synergistic relationship between these competencies in AI-assisted learning environments.

Despite the positive findings, this study also highlights several considerations regarding the implementation of AI in education. While AI-assisted tools provide numerous benefits, there are concerns about their potential impact on students' independent thinking and creativity. Some studies have reported that excessive reliance on AI may reduce students' motivation to engage in deep learning processes [need citation]. In addition, there is a risk that students may depend too heavily on AI-generated content, which could limit the development of original ideas. The present findings suggest that AI should be used as a supportive tool rather than a substitute for active learning. Compared to previous studies, this research emphasizes the importance of balancing technological use with pedagogical guidance. Teachers play a crucial role in ensuring that AI is used effectively to enhance, rather than hinder, student learning. Furthermore, the effectiveness of AI-assisted learning may vary depending on students' developmental stages and learning contexts. Therefore, careful consideration is needed in designing AI-integrated learning environments. These findings highlight the need for responsible and guided use of AI in education.

Overall, the results of this study provide important implications for educational practice and future research. The findings suggest that AI-assisted digital learning can serve as an effective tool for enhancing both communication skills and creativity in elementary education. This supports the growing body of literature emphasizing the importance of integrating technology into learning environments to develop 21st-century skills. Compared to previous research, this study offers a more comprehensive perspective by examining multiple competencies simultaneously. The results also highlight the

importance of adopting a data-driven approach to evaluate the effectiveness of educational technologies. In addition, this study contributes to the limited body of research focusing on AI integration in primary education contexts. Future research is recommended to explore more advanced analytical methods, such as regression or structural equation modeling, to better understand causal relationships. It is also important to investigate the long-term impact of AI-assisted learning on student development. Furthermore, qualitative approaches could provide deeper insights into students' experiences with AI tools. Therefore, this study provides a foundation for further research and innovation in AI-assisted education.

Implication

The findings of this study provide important implications for both educational practice and policy in the context of elementary language learning. The positive relationship between AI-assisted digital learning and students' communication skills suggests that integrating technology into classroom instruction can enhance students' ability to express ideas effectively. This indicates that educators should incorporate AI-supported tools as part of interactive learning strategies to foster active participation. In addition, the moderate relationship between AI-assisted learning and creativity highlights the potential of digital platforms to support creative thinking and innovation among students. Therefore, teachers are encouraged to design learning activities that allow students to explore ideas, create digital content, and engage in collaborative projects. The results also imply that AI-assisted learning environments can support the development of multiple competencies simultaneously, including communication and creativity. From a pedagogical perspective, this supports the adoption of student-centered learning approaches that emphasize active engagement and experiential learning. Furthermore, the findings suggest that the effective use of AI requires appropriate guidance from teachers to ensure that technology enhances, rather than replaces, students' cognitive processes. From a policy standpoint, schools and educational institutions should invest in digital infrastructure and training programs to support the integration of AI in teaching practices. The study also highlights the need for curriculum development that incorporates technology-enhanced learning to prepare students for the demands of the digital era. In addition, stakeholders should consider ethical and responsible use of AI to maintain the balance between technological assistance and independent learning. Overall, these implications emphasize the importance of strategically integrating AI-assisted digital learning to improve the quality of education and support the development of essential 21st-century skills.

Limitation and Suggestion for Further Research

This study has several limitations that should be considered when interpreting the findings. First, the sample size was relatively small and limited to a single elementary school, which may restrict the generalizability of the results to broader educational contexts. Second, the study employed a correlational design, which only identifies relationships among variables and does not establish causal effects. Third, the measurement of variables relied on self-reported questionnaires, which may be subject to response bias and social desirability effects. Fourth, the study focused primarily on the use of AI-assisted digital tools in a specific learning environment, without comparing different

types of technologies or instructional approaches. Fifth, the research did not explore other potential factors that may influence communication skills and creativity, such as teacher competence, learning motivation, or socio-economic background. Additionally, the duration of the study was relatively short, limiting the ability to observe long-term impacts of AI-assisted learning. Therefore, future research is recommended to involve larger and more diverse samples across multiple schools and regions. Further studies should also consider using experimental or quasi-experimental designs to examine causal relationships more rigorously. In addition, incorporating mixed-method approaches could provide deeper insights into students' experiences and learning processes. Future research is also encouraged to compare different AI-based tools to identify the most effective strategies for enhancing communication and creativity. Longitudinal studies are needed to investigate the sustainability of AI-assisted learning outcomes over time. Finally, future investigations should explore the integration of additional variables to develop a more comprehensive understanding of technology-enhanced learning in elementary education.

CONCLUSION

This study concludes that AI-assisted digital learning plays a significant role in enhancing elementary students' communication skills and creativity in Indonesian language education. The findings indicate that the use of AI-supported tools is positively associated with students' ability to express ideas clearly and participate actively in learning activities. In addition, the results show that AI-assisted learning contributes to the development of student creativity, particularly in generating original ideas and producing creative outputs. Although the relationship with creativity is slightly lower than communication skills, it remains meaningful and relevant in educational contexts. The combined analysis further demonstrates that AI-assisted digital learning supports the simultaneous development of multiple competencies. These findings highlight the importance of integrating technology into language learning to create more interactive and engaging learning environments. From a pedagogical perspective, AI-assisted learning encourages student-centered approaches that promote active participation and creative exploration. The study also emphasizes that technology should be used as a supportive tool that complements, rather than replaces, traditional teaching methods. Furthermore, the results provide empirical evidence that supports the role of digital learning in developing essential 21st-century skills. In the context of elementary education, this study contributes to the limited body of research on AI integration at the primary level. The findings also offer practical insights for educators in designing more effective and innovative instructional strategies. Overall, this study underscores the potential of AI-assisted digital learning to improve the quality of education and support holistic student development.

AUHOR CONTRIBUTIONS STATEMENT

AM : Conceptualization of the study, research design, development of research instruments, data collection, and primary responsibility for writing the original draft of the manuscript. The author also conducted data analysis and interpretation of findings.

AP : Contributed to the development of the theoretical framework, supervision of the research process, and critical revision of the manuscript to ensure academic quality and coherence.

NH : Assisted in data analysis, validation of statistical results, and contributed to the interpretation of findings, particularly in aligning the results with relevant literature.

M : Provided overall supervision, contributed to the refinement of the research methodology, and was involved in reviewing and editing the final manuscript to ensure clarity, consistency, and scholarly rigor.

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