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Analysis of Artificial Intelligence (AI) Implementation in Language Skill Learning for Elementary School Students

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ABSTRACT

The rapid expansion of Artificial Intelligence (AI) The Industrial Revolution 4.0 in education represents a response to the need to transform the relationship between humans and technology, thereby unlocking new opportunities through creativity and innovation. During this transitional period, teachers must provide support. Following the Industrial Revolution 4.0, we are now entering the Society 5.0 era; consequently, cutting-edge innovation is required to address the challenges of this new era Society 5.0 is envisioned as a state in which humans are at the center of society, resolving various life challenges by making balanced use of Industry 4.0 technologies. Its primary goal is the equitable distribution of prosperity The entire population can experience the benefits of development through the application of technologies such as Artificial Intelligence, IoT, big data, and robotics in areas ranging from transportation and logistics for remote regions to healthcare, education, and other essential public services. Therefore, we must prepare ourselves and enhance the quality of our human resources to ensure we can adapt to and utilize these technologies effectively and appropriately. Over the past few decades, digital technologies specifically Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) have increasingly been integrated into education This study employs a contextual descriptive-qualitative approach aimed at understanding the implementation of Artificial Intelligence (AI) in the language skills of elementary school students. The aim of this study is to analyze the implementation of Artificial Intelligence (AI) in language skills learning for elementary school students. A case study approach utilizing a review of existing research articles was selected because the researcher sought to gather in-depth data from diverse sources. Descriptive qualitative approaches offer broad insights into specific phenomena and serve various functions in educational research, including as standalone designs, preliminary qualitative studies for larger projects, or qualitative components within mixed-methods studies.

Keywords: Language Skills, Elementary School Students, Artificial Intelligence

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INTRODUCTION

Education plays a crucial role in building this Society 5.0; consequently, preparation is essential for entering this era. The government has addressed this by focusing on the millennial generation, who will navigate the Society 5.0 era during their time. The national education curriculum has been designed and developed with a focus on preparing high-quality students to become the generation that will shape the Society 5.0 era. The development of the world in the era of the industrial revolution 4.0 requires individuals skilled in utilizing technology in learning. Learning that leverages advances in information and communication technology, digital educational resources, the use of computers, and internet networks allows students to learn anytime and anywhere. To utilize these learning resources, you need sufficient knowledge and skills. Using strategic management to provide the necessary learning resources will assist educators and students in their use (Rizki et al., 2020). The Industrial Revolution 4.0 in education represents a response to the need to transform the relationship between humans and technology, thereby unlocking new opportunities through creativity and innovation. During this transitional period, teachers must provide support. Following the Industrial Revolution 4.0, we are now entering the Society 5.0 era; consequently, cutting-edge innovation is required to address the challenges of this new era (Nyoman et al., 2020). Society 5.0 is envisioned as a state in which humans are at the center of society, resolving various life challenges by making balanced use of Industry 4.0 technologies. Its primary goal is the equitable distribution of prosperity (Nyoman et al., 2020). The entire population can experience the benefits of development through the application of technologies such as Artificial Intelligence, IoT, big data, and robotics in areas ranging from transportation and logistics for remote regions to healthcare, education, and other essential public services. Therefore, we must prepare ourselves and enhance the quality of our human resources to ensure we can adapt to and utilize these technologies effectively and appropriately.

Over the past few decades, digital technologies specifically Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) have increasingly been integrated into education. In their research, Dan et al. (n.d.) state that AI is currently a growing trend in supporting educational curriculum development. (Stern et al., 2018) state that AI is implemented within educational curricula through innovations in educational content, learning systems, and educational facilities. However, there is currently a lack of discussion regarding the implementation of AI in primary education. Given the critical importance and unique characteristics of primary education, the authors believe that a specialized strategy is required for implementing AI at this level. This is particularly significant as digital technology has become a part of everyday life for the general public, including primary school-aged children. Schools should aim to balance the use of these technologies by incorporating them into the digital-based educational framework from the primary level onwards, thereby guiding children to utilize technology effectively to expand their knowledge.

In the 21st century, literacy goes beyond merely measuring reading, writing, arithmetic, and listening skills; it also encompasses an understanding of real world concept application, demonstrated through students' ability to articulate their ideas and feelings whether as individuals or as members of society (Manalu et al., 2022). Elementary education represents a crucial initial stage in formal schooling, laying the foundation for the development of students' knowledge and skills (Marinda, 2020). The process of implementing an educational institution's curriculum to guide learners toward achieving established learning objectives is known as the "teaching and learning process" (Ummul Khair, 2018). The primary goal of education is to help students transform their intellectual, moral, and social behaviors, enabling them to live freely as both social beings and individuals. However, learning Indonesian particularly regarding speaking skills may well be the most pressing issue requiring urgent improvement (Firdaus & Danuarta, 2024). In Indonesia, the use of AI in primary education is beginning to show positive developments. Research by Yohanes et al.

indicates that AI has the potential to enhance the learning experience for primary school students through instruction that is more interactive and tailored to individual learner (Weninger et al., 2017). Furthermore, AI can assist teachers in preparing materials, evaluating learning outcomes, and developing innovative digital media. Research by Batubara et al. also demonstrates that the use of AI by primary school teachers supports adaptive learning, improves classroom management efficiency, and expands access to digital learning resources.

Regarding listening skills, elementary school students often struggle to comprehend orally conveyed information due to poor concentration, a lack of engaging instructional media, and limited opportunities to reinforce the material they have heard. Yet, listening is the foundational receptive skill upon which other language skills are built. In this context, the implementation of AI can introduce learning tools such as speech recognition technology, interactive audio, virtual assistants, and educational chatbots that enable students to practice listening independently and receive immediate feedback. AI can also adjust the difficulty level of listening materials to match individual student abilities, thereby making the learning process more adaptive and learner-centered (Pebriana et al., 2018). Regarding speaking skills, many elementary school students still struggle to express opinions, recount experiences, or convey ideas coherently and confidently. Teacher-dominated instruction limits opportunities for students to practice speaking. The implementation of AI can help address these issues through speech recognition and conversational AI technologies, enabling students to practice speaking repeatedly with a digital system. These technologies provide feedback on pronunciation, intonation, fluency, and vocabulary usage, thereby offering students a more personalized learning experience. Consequently, AI has the potential to sustainably boost students' confidence and oral communication abilities (Audy Mita Amelina¹, Anggia Tri Agustina², 2026).

Regarding reading skills, a primary challenge facing elementary school students is a limited ability to comprehend text content, identify main ideas, draw conclusions, and critically evaluate information. This situation is a matter of serious concern, given that reading proficiency serves as the fundamental basis of literacy. AI can be integrated into reading instruction through adaptive learning systems, AI-powered digital storybooks, and applications capable of adjusting text difficulty to match students' reading levels. Furthermore, AI can assist by explaining difficult vocabulary, automatically summarizing texts, and generating comprehension questions tailored to individual student characteristics, thereby making reading activities more effective and meaningful (Suryobroto et al., 2022). Furthermore, regarding writing skills, elementary school students often struggle to generate and develop ideas, construct coherent paragraphs, and apply correct Indonesian language rules. Teachers' limited time to provide individual feedback often hinders the effectiveness of the writing instruction process. In this context, AI holds significant potential to assist students in developing their writing skills through features such as grammar checking, automatic spell correction, idea generation, and real-time feedback. AI enables students to revise their work independently, shifting the focus of the writing process from merely achieving a final result to engaging in continuous improvement.

Implementing AI-based learning systems will enable educators to focus on fundamental tasks such as devising teaching strategies for upcoming lessons and addressing students' questions. Furthermore, integrating artificial intelligence into the educational framework allows students to engage in independent and active learning. This aligns with modern educational principles that emphasize active student participation in the learning process (Susandi, 2019). Many of us do not know how to fully utilize smartphones and digital games. A basic understanding of coding can help us use technological tools in our daily lives and unlock the limitless potential of coding. Engaging in coding programs fosters creativity, develops skills for tackling complex problems, and stimulates boundless imagination. Furthermore, learning to code teaches children to communicate using structured logic much like a computer program—and helps them solve problems through computer technology (Susanto et al., 2023).

However, the integration of Indonesian language learning and artificial intelligence (AI) in elementary schools still faces various challenges. Implementing this program requires consideration of several factors, including adequate technological infrastructure in schools, the availability of experienced teachers, and support from all stakeholders, including parents (Makroen Sanjaya¹, 2026). Although AI holds significant potential for personalizing learning, there are issues that need to be addressed, such as student data privacy and security, the quality of data used to train AI models, and the diversity and inclusivity of the algorithms being developed (Bago et al., 2020). This study aims to explore the challenges and opportunities associated with integrating language skill instruction and AI in primary schools. Although this initiative is viewed as a progressive step toward preparing the younger generation for an increasingly digital future, its implementation is not without difficulty (Junaedi 2024). Understanding the current landscape is expected to yield useful recommendations for decision-makers in formulating more effective educational policies (Agustina et al., 2024).

METHODS

This study employs a contextual descriptive-qualitative approach aimed at understanding the implementation of Artificial Intelligence (AI) in the language skills of elementary school students. A case study approach utilizing a review of existing research articles was selected because the researcher sought to gather in-depth data from diverse sources (Zaluchu, 2020). Descriptive-qualitative approaches offer broad insights into specific phenomena and serve various functions in educational research, including as standalone designs, preliminary qualitative studies for larger projects, or qualitative components within mixed-methods studies (Miles, M.B., Huberman, A.M., & Saldaña, 2014). Data collection involved reviewing articles related to AI and language skills, with the aim of selecting relevant data from accredited national scientific journals that align with the study's focus and objectives. Furthermore, the study utilized document analysis to gain a profound understanding of the implementation of Artificial Intelligence (AI) in language skills instruction for elementary school students.

Documents such as lesson plans and student assignments. Discrepant findings were clarified through follow-up interviews. Meanwhile, the documentation study phase aims to identify the legal basis regarding the analysis of Artificial Intelligence (AI) implementation in language skills instruction for elementary school students; thus, the data from this phase serves to complement the data obtained from scientific articles. The research procedure comprises several stages: (a) determining the research theme, (b) conducting a literature review aligned with the theme, (c) establishing the research focus, (d) collecting data through article reviews and documentation studies, (e) analyzing the data, and (f) verifying the data. The data analysis phase employs the framework proposed by (Tomkins, G.E., & Hoskisson, 1991) consisting of data collection, data reduction, data display, and verification/conclusion. The researcher prioritizes research articles that focus specifically on the topic of Artificial Intelligence (AI) implementation in language skills instruction for elementary school students.

RESULTS

Challenges in Implementing Artificial Intelligence (AI) for Language Skill Learning Among Elementary School Students

Teachers' Limited Pedagogical Competence in Integrating AI, Implementing AI in language skills instruction requires not only the ability to operate the technology but also the capacity to integrate it into language teaching strategies suited to the characteristics of elementary school students. Many teachers currently limit their use of AI to tasks such as creating test questions,

designing instructional materials, or gathering information, while its application in developing listening, speaking, reading, and writing skills remains relatively limited. Research indicates that a lack of teacher understanding regarding AI concepts, the selection of appropriate platforms, and the design of AI-based instruction constitute the primary obstacles to implementation in elementary schools. In Indonesian language instruction, teachers are expected to integrate AI with communicative, constructivist, and literacy-based approaches. If AI is used merely as a technical aid without sound pedagogical planning, the instruction risks losing the essence of authentic language skill development (Cakraningtyas et al., 2025). Challenges Regarding Listening Skills, Listening skills are the first language skills to develop in children. AI technologies such as speech recognition, interactive podcasts, virtual assistants, and chatbots can facilitate listening practice. However, their implementation faces several challenges. First, most AI systems are designed using language models developed from international languages; consequently, they are not yet fully capable of recognizing the phonological variations, dialects, and linguistic characteristics of the Indonesian language as used by elementary school students. Second, because the concentration span of elementary school students is still developing, the prolonged use of audio-based AI media carries the risk of diminishing their learning focus. Third, AI-based listening interactions tend to be individual in nature, potentially reducing the social interaction that is crucial for a child's language acquisition. This is significant because, from a sociocultural perspective, a child's language development occurs through meaningful social interactions with teachers and peers (Afrita, 2023).

Challenges Regarding Speaking Skills, Speech recognition and conversational AI technologies can provide feedback on students' pronunciation, intonation, and language structure. However, there are several challenges. First, AI is not yet fully capable of grasping the complex communication contexts, emotional expressions, non-verbal cues, or local cultural nuances present in the interactions of elementary school students. Second, students may become more comfortable speaking with machines than interacting with humans, potentially diminishing their interpersonal communication skills. Third, some AI applications prioritize linguistic accuracy over the meaningfulness of communication. Consequently, students may focus on linguistic precision while failing to develop pragmatic skills such as the ability to express opinions, construct arguments, negotiate, and understand their conversation partners. In Indonesian language learning, the goal of speaking is not merely to produce grammatically correct utterances but also to establish effective social communication. Therefore, AI cannot yet replace the teacher's role as a facilitator of authentic communication (Nabila et al., 2025). Challenges Regarding Reading Skills, In the realm of reading skills, AI is capable of providing adaptive texts, automated summaries, and reading recommendations tailored to students' proficiency levels. However, there are several significant challenges. One major challenge is the tendency for students to rely on automated summary features without reading the full text. This practice can hinder the development of critical, inferential, and evaluative reading skills. Yet, the goal of reading within the Kurikulum Merdeka (Independent Curriculum) extends beyond merely comprehending the content; it encompasses analyzing, interpreting, and evaluating information. Furthermore, AI algorithms often present information deemed relevant based on past usage patterns. This can create a "filter bubble" that limits the diversity of students' reading materials and reduces opportunities to explore various perspectives. Consequently, the development of critical literacy skills may be suboptimal (Kurdi et al., 2020).

Challenges Regarding Writing Skills, writing skills are the aspect most significantly impacted by the development of generative AI, such as ChatGPT and other automated writing applications. On one hand, AI helps students generate ideas, correct grammar, and refine their writing. On the other hand, however, complex challenges have emerged. The first challenge is a decline in the originality of student writing. Creative thinking abilities may diminish when students choose to use AI-generated text instead of developing their own ideas. The second challenge is the rise in plagiarism and academic dishonesty. Students can easily copy AI-generated content without understanding the underlying thought processes. The third challenge relates to the loss of the cognitive processes

involved in writing. Fundamentally, writing is a thinking process that encompasses planning, organizing ideas, revising, and reflecting. When AI takes over much of this process, students risk losing the opportunity to develop higher-order thinking skills (Lieung, 2019).

Opportunities for Implementing Artificial Intelligence (AI) in Language Skill Learning for Elementary School Students.

AI as a Tool for Personalizing Language Skill Instruction, One of the greatest opportunities offered by AI implementation in language skill instruction is its capacity to facilitate personalized learning. In Indonesian language instruction at the elementary school level, students possess varying levels of language development, literacy skills, and learning styles. Through AI technology, learning systems can tailor materials, difficulty levels, learning activities, and feedback to meet each student's individual needs. This personalized approach allows students to learn at their own pace and ability level, avoiding the pressure that can arise from disparities in competence among peers. Students with lower reading proficiency can be provided with simpler reading materials, while high-achieving students can be given more complex challenges. Consequently, AI has the potential to enhance the effectiveness of Indonesian language instruction, which has traditionally relied on a whole-class teaching approach. (Nurhasanah, 2026) explain that AI supports adaptive and personalized learning, thereby making the learning process more effective and aligned with the specific needs of the learners. AI offers significant opportunities for developing listening skills, which serve as a fundamental pillar of children's language acquisition. Technologies such as speech recognition, text-to-speech, virtual assistants, and interactive audio media enable AI to provide diverse audio resources tailored to students' ages and proficiency levels. Furthermore, AI systems can analyze student responses to listening materials and provide immediate feedback, allowing teachers to assess students' comprehension levels more quickly and accurately. AI also helps create engaging listening experiences through interactive digital stories, educational podcasts, and conversation simulations. These elements have the potential to enhance the attention, motivation, and oral comprehension abilities of elementary school students. (Zaim et al., 2025) state that AI presents substantial opportunities for developing listening skills through adaptive and interactive learning powered by language technology.

AI Opportunities for Developing Speaking Skills: Speaking is a crucial productive skill in everyday communication. AI offers significant opportunities through speech recognition technology and conversational AI, enabling students to practice speaking independently. Through these technologies, students can receive real-time feedback on pronunciation, intonation, fluency, and vocabulary usage. This is particularly helpful for students who often feel shy or lack confidence when speaking in front of the class. AI also creates a safe learning environment for practicing communication without the fear of making mistakes. With increased speaking practice, students' oral communication skills can develop more effectively. AI Opportunities for Developing Reading Skills: Reading proficiency is fundamental to academic success across all subjects. AI presents great opportunities to enhance reading skills through adaptive reading systems, digital storybooks, and intelligent tutoring systems. AI can adjust text difficulty based on a student's ability, making reading instruction more effective. Furthermore, AI assists students in comprehending reading material through features such as vocabulary explanations, comprehension questions, automated summaries, and tailored reading recommendations. Research by (Kurdi et al., 2020) indicates that the use of AI-based applications can improve reading skills among elementary school students by providing a more engaging and interactive learning experience. Additionally, the development of AI storybooks allows students to read digital stories featuring animations, audio, and interactive elements that boost reading motivation.

Compared to other language skills, writing is the most complex. AI offers significant opportunities to help students develop their writing abilities through features such as writing assistants, grammar and spell checkers, and generative AI. AI can assist students in generating ideas, developing paragraphs, correcting spelling errors, and progressively improving the quality of their

writing. Through automated feedback, students can identify their mistakes without having to wait for corrections from a teacher. In a primary school context, AI can also assist students who struggle to express their ideas in writing, thereby making the writing process easier and more enjoyable. Research (Kurniawan et al., 2024) indicates that the use of AI contributes to improved student writing skills by facilitating a faster and more focused revision process. Assessment is a crucial component of language learning. AI opens up new possibilities for conducting assessments that are faster, more objective, and continuous. It enables teachers to automatically analyze students' reading, writing, speaking, and listening skills. Assessment data can be used to identify individual students' weaknesses and learning needs. Through learning analytics, teachers can monitor the development of students' language skills in real-time, allowing for more targeted instructional interventions.

DISCUSSION

Regarding the use of artificial intelligence (AI) in primary school education, this study finds that AI holds significant potential to enhance students' language skills and support teachers in the instructional process. Through AI, learning can be personalized to meet individual student needs and abilities via intelligent tutoring systems, adaptive learning platforms, and automated assessment. Other benefits include increased instructional effectiveness, reduced teacher workload, heightened student engagement, and preparation for the digital era. However, various challenges—such as technological limitations, teacher readiness, privacy concerns, and implementation costs—require serious attention (Romi et al., 2021). With the right approach, AI can serve as an effective tool to support learning and prepare students for the challenges of the Industrial Revolution 4.0 era. Maximizing these benefits requires further research and sustained implementation efforts. Thus, this study provides a deeper understanding of the potential, challenges, and opportunities associated with using AI to improve the quality of language education at the primary level.

Google Duet AI is an artificial intelligence tool integrated into Google Workspace for Education. It offers educators various ways to conceptualize lessons, automate procedures, and handle time-consuming tasks using AI technology. Duet AI serves as an AI-powered assistant within Google Workspace, helping with tasks ranging from writing and translation to organizing and visualizing data. Currently, Duet AI is available as an add-on for Google Workspace Enterprise customers, with plans to expand its availability in the future (Umayah et al., 2026). Duet AI can help students write essays, reports, and other assignments more effectively through the "help me write" feature in Google Docs. First, Duet AI can assist students in improving their grammar and writing style; it can identify and correct errors in grammar, punctuation, and spelling, as well as provide feedback on the clarity of their writing. Second, Duet AI can help students develop their own unique writing style by offering feedback on the originality and creativity of their work. It can also assist them in identifying and avoiding clichés and overused phrases.

The limitations of this study must be acknowledged. The use of a purposive sample from a limited geographical area may constrain the generalizability of the findings to other provinces in Indonesia with different resource profiles (Adrian, 2024). Furthermore, while the depth of the qualitative analysis provides rich contextual insights, this approach does not measure the magnitude of AI's impact on specific literacy outcomes. Therefore, future research should combine longitudinal quasi-experimental designs with qualitative studies to measure improvements in learning outcomes and observe how teacher mediation practices regarding AI implementation for students' language skills evolve over time. In conclusion, this study complements and adds nuance to the emerging consensus on AI's role in education: AI holds genuine potential to enhance routine aspects of Indonesian language learning, yet its pedagogical value relies heavily on teacher mediation, institutional support, and ethical implementation. By centering on teacher perspectives and classroom practices, this study offers both theoretical advancements and practical steps for

integrating AI into primary-level language education in ways that are developmentally appropriate and culturally responsive (Kemampuan & Puisi, 2017).

CONCLUSION

The findings of this study indicate that Artificial Intelligence (AI) holds significant potential to support Indonesian language learning in primary schools particularly regarding language skills—by providing immediate feedback, personalizing language learning tasks, and fostering the digital development of teachers. However, its effectiveness depends on teachers' digital literacy skills, the readiness of school infrastructure, and the existence of institutional policies that support and guide its appropriate use in the classroom. The results also suggest that AI is most beneficial when used to complement rather than replace teacher-led instruction; teachers act as active mediators who interpret, contextualize, and refine AI-generated feedback to foster deeper literacy development. Ethical considerations—including concerns regarding plagiarism, data security, and the cultural relevance of AI-generated content underscore the need for careful oversight and pedagogical frameworks, especially for young learners who are still building a foundational understanding of authorship and written expression. Meanwhile, the document study phase aims to identify the legal basis regarding the analysis of AI implementation in language skill instruction for primary school students; thus, data from this phase complements the data obtained from scholarly articles. The research procedure comprises several stages: (a) determining the research theme, (b) conducting a literature review aligned with the theme, (c) establishing the research focus, (d) collecting data through article reviews and document studies, (e) analyzing the data, and (f) verifying the data. The data analysis phase employs the framework proposed by which encompasses data collection, data reduction, data display, and verification/conclusion drawing. The researchers prioritized research articles that specifically address the topic of AI implementation in language skill instruction for primary school students.

Based on these conclusions, several recommendations can be proposed. Schools and education authorities should prioritize professional development that enables teachers not only to operate AI tools but also to integrate them meaningfully into learning strategies that stimulate higher-order thinking, interpretation, and creativity. Technology developers and curriculum designers should collaborate to produce AI systems that are linguistically and culturally aligned with the needs of Indonesian primary education. Policymakers must also develop clear ethical guidelines and age-sensitive data protection frameworks to ensure that AI use remains safe, constructive, and educationally grounded. This study is limited by its geographic scope, which focused on teachers from a single region, and by the qualitative nature of its design, which does not measure the extent of AI's impact on learning outcomes quantitatively. Future research may involve wider samples across diverse educational contexts, longitudinal studies to track changes in teacher practice over time, and mixed-method approaches to evaluate the measurable effects of AI on literacy growth. Nonetheless, the study contributes meaningful insight into the realities of AI implementation in primary language learning and emphasizes the continuing centrality of teacher expertise in shaping meaningful and human-centered educational innovation.

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