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Computer Assisted Language Instruction: AI-based English Teaching to English For Sciences Students

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Abstract: *This study aims to explore the perceptions and experiences of science students in using artificial intelligence (AI) technology as an assistive medium in learning English. The research adopts a descriptive qualitative approach, conducted at STKIP Darud Da'wah Wal Irsyad (DDI) Pinrang. The study participants consist of eight students from various science study programs who have used AI applications such as Grammarly, ChatGPT, and Duolingo as part of their learning process. Data were collected through in-depth interviews, observation, and documentation, and then analyzed thematically using Braun & Clarke's approach. The findings indicate that AI serves as an adaptive learning facilitator, enhances learning autonomy, and promotes the development of writing and speaking skills in English. Students expressed positive responses towards AI due to its ability to provide instant feedback and personalization features. However, challenges were also identified, including AI's limitations in understanding specific scientific terms and technical obstacles related to interface and internet connectivity. This study concludes that AI is effective as a learning companion for English language acquisition among science students, but its use needs to be supported by curriculum integration and continuous lecturer guidance.*

Keywords: *Artificial Intelligence, Computer-Assisted Language Instruction, English Language Learning, Science Students*

INTRODUCTION

English has become a global language that plays a central role in international communication, knowledge development, and access to academic and technological resources. In higher education environments, particularly in the field of science, English proficiency is no longer merely an additional skill but a fundamental necessity (Bolton et al., 2023). This is because the majority of scientific literature, reputable journals, and contemporary reference sources are published in English. Science students are required not only to comprehend scientific texts but also to communicate ideas, write reports, present research findings, and participate in international academic forums. This challenge becomes increasingly evident in higher education institutions such as STKIP Darud Da'wah Wal Irsyad (DDI) Pinrang, which continues to strive to improve graduate quality to enable competition on both national and global scales.

However, in practice, many science students in Indonesia, including those at STKIP DDI Pinrang, still experience difficulties in mastering English language skills, both oral and written. These difficulties may be attributed to several factors, including conventional teaching methods that lack contextual relevance, limited time in the teaching-learning process, insufficient opportunities for active practice, and low learning motivation. Meanwhile, the development of information and communication technology has opened significant opportunities in transforming learning processes, including English language instruction. Research conducted by Prayudha et al. (2023) demonstrated that the rapid development of information and communication technology (ICT) has brought significant changes to the educational world, particularly in English language learning processes. ICT integration not only expands access to learning resources but also promotes innovation in teaching and learning methods that are more interactive, collaborative, and adapted to the needs of today's digital generation. One technological breakthrough that is rapidly developing and beginning to be integrated into education is artificial intelligence (AI).

AI in the context of language education has introduced various applications that can facilitate more adaptive, responsive, and individualized learning. Applications such as Grammarly, ChatGPT, Duolingo, Quillbot, and Elsa Speak have been widely used by students to improve grammar, enhance vocabulary, practice speaking skills, and receive instant feedback. Various international studies indicate that the use of AI in language learning can increase learning motivation, accelerate comprehension, and expand opportunities for linguistic practice outside the classroom (Wei, 2023). However, the effectiveness of AI implementation in higher education contexts, particularly in science and technology-based study programs in Indonesia, remains relatively underexplored systematically, especially from a user experience perspective (Yusriadi et al., 2023).

The use of AI in English language learning by science students has great potential to bridge the gap between academic language requirements and students' actual abilities. AI enables personalized learning that can be adapted to individual needs, for example through automatic grammar correction, pronunciation training, or academic text composition with appropriate language structure. Moreover, AI offers learning opportunities that are not limited by space and time, allowing students to access learning whenever and wherever they are. However, the implementation of this technology is not without various challenges, both technical in nature such as internet access and user interface issues, and conceptual such as AI limitations in understanding scientific or local cultural contexts. Globally, Chan & Zary (2019) found that technical challenges such as network errors, system failures, and AI limitations in deeply understanding scientific concepts also constitute major barriers in AI-based higher education.

Science students have specific English language needs because the academic content they study contains technical terminology, complex sentence structures, and scientific writing styles that differ from everyday language use (Stoddart et al., 2002). Therefore, it is important to examine the extent to which AI can provide relevant and effective linguistic support for students with science academic backgrounds. Additionally, understanding students' perceptions and

experiences in using AI is also important to ensure that the technology truly contributes to improving learning quality rather than merely serving as a mechanical tool.

This research was conducted at STKIP Darud Da'wah Wal Irsyad (DDI) Pinrang in response to the institution's increasing attention to technology integration in learning. This campus is one of the higher education institutions in South Sulawesi that has begun utilizing digital platforms in teaching-learning activities, although AI implementation in English language instruction is still in its early stages. This research is expected to provide a comprehensive overview of how science students utilize AI technology in learning English, their perceptions of the effectiveness and ease of use of such technology, and the challenges they face during the learning process.

Specifically, this research focuses on exploring students' experiences in using AI to improve writing and speaking skills, two productive skills that are crucial in academic contexts. Research by Song & Song (2023) demonstrated that the use of AI, such as chatbots, automatic writing applications, and virtual conversation platforms, can significantly improve students' writing and speaking abilities in terms of writing organization, grammar, vocabulary, as well as confidence and speaking motivation. Through a descriptive qualitative approach, this research aims not only to describe occurring phenomena but also to understand the subjective meanings formed by students in their interactions with technology. It is hoped that the results of this research can provide both theoretical and practical contributions, both for technology-based curriculum development at STKIP DDI Pinrang and for other higher education institutions seeking to integrate artificial intelligence into English language teaching processes.

Given this background, this research focuses on the main question: How do science students at STKIP DDI Pinrang perceive and experience the use of artificial intelligence technology to support English language learning? From this question, this research aims to: (1) describe the forms of AI use by students in English language learning, (2) identify students' perceptions of the effectiveness and ease of use of such technology, and (3) reveal challenges faced by students in integrating AI into their learning processes. This research is expected to serve as an initial foundation for developing technology-based learning strategies that are more inclusive, adaptive, and suited to the needs of science students in facing the digital era. Additionally, the results of this research can also provide input for educators, curriculum developers, and policy makers in higher education institutions in developing English language teaching programs based on innovation and technology, particularly those relevant to artificial intelligence developments.

LITERATURE REVIEW

Computer-Assisted Language Instruction and Artificial Intelligence Integration

The integration of artificial intelligence (AI) into computer-assisted language instruction (CALI) has emerged as a transformative approach in English language education, particularly for students in specialized fields such as science

and technology. Recent mixed-methods investigations have demonstrated the significant impact of AI-mediated language instruction on English learning achievement, L2 motivation, and self-regulated learning (Abdullah et al., 2023). This technological evolution represents a paradigmatic shift from traditional CALI methodologies toward more adaptive, personalized, and intelligent learning systems.

AI Applications in English Language Teaching

The landscape of AI-powered English language teaching has expanded considerably, with widespread use of Artificial Intelligence (AI) in language education contexts motivating scholars worldwide to uncover the advantages and challenges of these technological interventions (Kohnke & Moorhouse, 2024). English learners face many challenges in gaining English language skills, and AI technologies offer unprecedented opportunities to address these difficulties through personalized and adaptive learning experiences (Crompton et al., 2024).

Contemporary AI applications in language learning encompass a broad spectrum of tools and platforms. The integration of Artificial Intelligence (AI) applications into language learning and teaching is currently a growing trend in higher education, with systematic reviews highlighting the potential for enhancing learners' affective factors such as motivation, confidence, and engagement (Rahman et al., 2024). Over the past few decades, artificial intelligence (AI) has undergone exponential growth and has been overwhelmingly permeated in the educational field, demonstrating measurable effectiveness in improving English language learning achievement (Yu, 2024).

AI Implementation in Educational Settings

Practical implementation of AI technologies in language learning contexts has shown promising results. University students learning English as an applied foreign language with B2 and C1 levels of English proficiency have participated in experimental studies demonstrating the viability of chatbot integration in foreign language learning environments (Tunyová & Drieniková, 2024). Furthermore, research conducted with Chinese English as a Foreign Language learners has investigated the effectiveness of artificial intelligence-based instruction in improving second language (L2) speaking skills and speaking self-regulation in natural settings (Lu et al., 2023).

English for Specific Purposes and AI Integration

The application of AI technologies in English for Specific Purposes (ESP), particularly for science students, represents a specialized area of growing interest. Research has investigated the demands for AI-based English for Specific Purposes (ESP) from students, schools, and society, advising that curriculum development be forward-thinking, using new information technologies and diversifying teaching techniques (Tang, 2023). English for Specific Purposes (ESP) courses are designed to meet the language needs of learners in specific professional contexts, and the possibility to integrate Artificial Intelligence (AI) tools into ESP teaching has attracted significant attention (Rahmani & Sadeghi, 2024).

The specialized nature of scientific English requires targeted pedagogical approaches. English for Specific Purposes students' perspectives on using ChatGPT for business emails have been explored, indicating the potential for AI applications in professional communication contexts (Utami et al., 2024). This research underscores the importance of understanding learner perspectives when implementing AI technologies in specialized language learning contexts.

Challenges and Opportunities

Despite the promising potential of AI in language education, several challenges remain. Artificial intelligence (AI) can bring immediate and long-term benefits, but also challenges and risks to education systems, necessitating careful consideration of stakeholder views in English language teaching and learning contexts (BERA, 2024). The balance between technological innovation and pedagogical effectiveness requires ongoing research and evaluation to ensure optimal learning outcomes.

The literature suggests that while AI technologies offer significant opportunities for enhancing English language learning, particularly for science students requiring specialized linguistic competencies, successful implementation requires careful consideration of learner needs, institutional capabilities, and pedagogical frameworks. The emerging body of research indicates a need for continued investigation into the effectiveness, challenges, and best practices associated with AI-integrated language learning environments.

RESEARCH METHOD

This research employs a qualitative approach with descriptive research design. This approach was selected as it aligns with the research objectives, namely to explore and describe in depth the experiences, perceptions, and ways science students at STKIP Darud Da'wah Wal Irsyad Pinrang utilize artificial intelligence (AI) in English language learning. The qualitative approach enables researchers to understand social reality holistically through the research subjects' perspectives and capture the meanings that emerge from their interactions with AI technology in learning contexts.

This research was conducted at STKIP DDI Pinrang campus, a private higher education institution in South Sulawesi that offers various study programs. This location was purposively selected because it has demonstrated positive tendencies toward technology integration in learning, including the use of AI-based digital platforms in teaching-learning processes. The research was conducted over three months, beginning in March 2024. During this period, the researcher collected data through observation, in-depth interviews, and documentation to obtain a comprehensive picture of AI use in English language learning by science students.

The research subjects were active students from science-based study programs, particularly those who had experience using AI technology as a learning tool in English language learning. The established criteria included: active students in fourth semester and above, having used at least one AI-based application (such as Grammarly, ChatGPT, Duolingo, or similar) in English language learning, and

willingness to provide information openly through interviews. Eight students were selected as primary informants considering variations in study programs, digital backgrounds, and intensity of AI use in daily learning activities.

Data collection was conducted through semi-structured in-depth interviews as the primary technique. These interviews were conducted face-to-face and lasted between 10 to 25 minutes for each informant. The interview guide was developed based on indicators in the Technology Acceptance Model (TAM) as well as aspects of technology use experience and perceptions of AI effectiveness in language learning contexts. Additionally, the researcher conducted non-participatory observations of students' learning activities, particularly when using AI applications in computer laboratories or study rooms. Additional documentation such as screenshots of student interactions with AI and results of English assignments edited using AI applications were also collected to strengthen interview data.

The collected data were analyzed using thematic analysis technique based on Braun and Clarke's (2006) approach. This analysis was conducted through six stages: data transcription, initial coding, theme identification, review, theme naming, and interpretation writing. The researcher used an inductive approach, where themes were developed from empirical data, then analyzed critically within relevant theoretical frameworks such as CALL (Computer-Assisted Language Learning), TAM (Technology Acceptance Model), and ZPD (Zone of Proximal Development). To maintain data validity, the researcher conducted source and technique triangulation by comparing data from interviews, observations, and documentation, as well as conducting member checking by confirming data interpretations with informants to ensure that analysis results accurately represented their experiences.

FINDINGS AND DISCUSSION

This research was conducted to explore the experiences, perceptions, and dynamics of using artificial intelligence (AI) technology in English language teaching among science students. Through in-depth interviews with eight informants from STKIP DDI Pinrang higher education institution and direct observation of AI application usage in learning contexts, several important findings were obtained and classified into five major themes.

AI as an Adaptive Language Learning Facilitator

Students stated that the presence of AI technology enables them to learn flexibly, independently, and according to their personal pace. Applications such as Grammarly, ChatGPT, and Duolingo have become daily tools in the English language learning process. They feel that AI is very helpful in aspects of grammar, vocabulary, and pronunciation. The instant feedback provided by AI is considered to make the learning process more efficient compared to waiting for corrections from lecturers or tutors.

"I can learn writing and immediately know what's wrong. AI immediately tells me and explains why it's wrong," revealed one informant from the Physics Education Study Program. Additionally, AI-based speaking training features are

also highly appreciated by students because they allow them to practice without having to find speaking partners who are fluent in English.

Students' Level of Acceptance toward AI Technology

Generally, students show high enthusiasm toward using AI in language learning. They feel that AI increases learning efficiency and enriches their learning experience, especially because AI features can be adapted to their academic needs. Most informants stated that they feel more confident writing and speaking in English after using AI-based tools.

"In my opinion, AI helps a lot, especially for improving sentences that I make in practicum reports. The available features can be adjusted, for example for scientific writing or daily conversation. So I feel my learning is more efficient and on target," expressed one student from the Mathematics Education study program.

Technical and Semantic Constraints in AI Usage

Several informants revealed that although AI helps in learning, there are quite noticeable limitations. One of the most frequently mentioned is AI's lack of ability to understand scientific or technical contexts specifically. Students from science study programs reported that AI explanations of technical concepts are often too general and not in accordance with the scientific standards they study.

Other technical problems that frequently arise are the need for stable internet connections and user interfaces that are sometimes complicated or unresponsive. These obstacles cause the learning process to be disrupted, especially when students are in locations with limited internet access.

An interview conducted with one Physics Education student who stated: "I once used AI to explain quantum physics concepts, but the explanation used very simple language and didn't match the standards we usually study. It seems AI cannot yet understand specific scientific details."

Changes in English Language Learning Strategies

Before using AI, most students learned English through conventional methods such as books, modules, and written exercises. However, after using AI technology, their learning strategies changed. They became more active in producing language (productive skills) such as writing and speaking. AI encourages students to try composing complex sentences, practice pronunciation, and write paragraphs that conform to academic style.

Students also began using AI in academic activities such as writing practicum reports, creating scientific presentations, and composing research proposals. They integrate language learning with their daily academic needs directly. "Before AI existed, writing research proposals felt difficult because I was confused about arranging sentences. Now I use AI to help create frameworks and suggest appropriate words according to academic style," expressed one final-year student from the Mathematics Education study program.

AI as a Companion, Not a Lecturer Replacement

All informants agreed that AI is very helpful, but cannot replace the role of lecturers or teachers. AI is considered a technical tool that provides quick solutions to language problems, while lecturers still play an important role in providing direction, deep understanding, and cultural and academic context.

Students stated that the combination of traditional learning with AI assistance is the best approach. They hope AI can be used more systematically in class, with supervision and guidance from lecturers. As revealed in an interview with one student who stated: "If AI is used systematically in class with lecturer guidance, I'm sure the results will be much better. So AI is not to replace the lecturer's role, but to complement it."

Discussion

The findings of this research contribute to understanding how artificial intelligence technology can be effectively integrated into English language learning, particularly in the context of science-based higher education. Several important aspects from the research results will be discussed based on theoretical frameworks and previous studies.

a. The Role of AI in Language Learning: CALL and ZPD Perspectives

The finding that students feel assisted by instant feedback from AI demonstrates that this technology functions as an intelligent tutoring system within the Computer-Assisted Language Learning (CALL) context. Within this framework, AI acts as a learning partner that can provide linguistic assistance in real-time. This aligns with research by Jin (2019), where tools such as AI enable students to complete language tasks that were previously beyond their reach.

Thus, AI helps students remain within the Zone of Proximal Development (ZPD), namely the area where they can complete tasks with assistance before being able to do so independently.

b. Technology Acceptance Based on TAM

Davis (1989) in the Technology Acceptance Model (TAM) states that technology acceptance by users is determined by two factors: perceived usefulness and perceived ease of use. Students in this research consistently reported that AI helps increase learning efficiency, thus perceived usefulness is very high. However, perceptions of ease of use remain varied. Students with non-ICT backgrounds sometimes find it difficult to navigate complex AI platforms. This indicates that developing beginner-friendly user interfaces becomes a key factor in increasing widespread adoption of AI technology among students.

c. AI Limitations and Specific Needs of Science Students

One important finding is that AI has not yet been fully capable of providing explanations or corrections appropriate to certain scientific contexts. This becomes a major challenge in science content-based English language teaching, where

technical terminology requires deep semantic understanding. In previous literature, Schleiss et al. (2023) also emphasized that AI capabilities in CALL contexts are still limited by the scope of training data used. If AI is trained with general language data, it will tend to produce answers that are generic and not sufficiently appropriate for technical contexts. Therefore, AI integration in higher education, especially in science fields, requires system training based on domain-specific corpora to provide more relevant answers.

d. AI's Influence on Learning Strategies and Language Learning Orientation

The change in students' learning strategies from previously passive to more active, productive, and contextual shows that AI contributes to facilitating competency-based language learning communication. This aligns with the Communicative Language Teaching (CLT) approach, where teaching focus is not only on language rules but on language use as a real communication tool. Research conducted by Oka Agustini (2023) states that AI enables learning personalization, adaptive material development, automatic assessment, and technology-based interactions such as chatbots and educational applications, all of which can improve real communication skills and student engagement.

AI supports this approach by providing a simulative learning environment that resembles real-world conditions. With interactive speaking practice, automatic writing correction, and academic vocabulary recommendations, students are encouraged to continuously develop scientific communication abilities.

e. AI as a Companion in the Blended Learning Model

The finding that students do not consider AI as a lecturer replacement but as a complement strengthens arguments about the importance of the blended learning model. According to Sewang (2022), blended learning between technology and direct instruction can create a more effective learning ecosystem because it combines the advantages of technology flexibility with pedagogical guidance from instructors.

Therefore, AI integration into English language learning must be done strategically, namely through curriculum planning that combines technology use with pedagogical and reflective lecturer interventions.

CONCLUSION

This research demonstrates that the implementation of artificial intelligence (AI) technology in English language learning for science students at STKIP Darud Da'wah Wal Irsyad (DDI) Pinrang provides positive contributions to language skill improvement, particularly in writing and speaking aspects. AI functions as an adaptive learning facilitator, providing instant feedback, and enabling learning personalization according to individual needs. Students feel more confident and motivated to practice English because AI provides a flexible learning environment that is not limited by space and time and can be accessed through various digital devices.

The use of applications such as Grammarly, ChatGPT, and Duolingo has proven to help students improve grammar, expand vocabulary, and understand academic writing structure. Nevertheless, this research also found limitations, such as AI's suboptimal ability to understand specific scientific contexts in science fields, limited technical vocabulary, and technical barriers such as dependence on stable internet connections. Additionally, students still require lecturer guidance to ensure that AI use is not only focused on technical language improvement but also on developing critical thinking skills and academic sensitivity.

Therefore, it can be concluded that AI is effectively used as a companion for English language learning among science students, but its implementation will be more optimal if integrated into the curriculum systematically and supported by training for lecturers and clear usage guidelines for students. This research also recommends developing learning programs that combine AI strengths with human learning interactions, creating a balanced learning ecosystem between technology and pedagogical approaches.

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