EXAMINING PEDAGOGICAL STRATEGIES AND TEACHER AGENCY: A QUANTITATIVE INQUIRY INTO AI INTEGRATION IN INDONESIAN EFL LANGUAGE TEACHING

Introduction

In recent years, the field of language education has undergone a transformative shift with the integration of Artificial Intelligence (AI) technologies. This paradigm shift holds great promise for English as a Foreign Language (EFL) instruction, offering innovative avenues to enhance learning experiences and redefine educators' roles (Hwang et al., 2020; Su et al., 2023; Kasneci et al., 2023). The dynamic landscape of language teaching, shaped by diverse pedagogical approaches, now intersects with the capabilities of AI, ranging from Natural Language Processing (NLP) to Intelligent Tutoring Systems. These technologies present opportunities to tailor language instruction, provide personalized feedback, and engage learners in unprecedented ways (Chen et al., 2020; Haderer & Ciolacu, 2022; Hamid et al., 2023; Gill et al., 2024). Within this context, the role of teacher agency becomes pivotal in determining the successful integration and adaptation of AI tools within the EFL classroom. As AI becomes an integral part of language education, understanding the pedagogical strategies employed by Indonesian EFL teachers and their correlation with teacher agency is essential for shaping effective practices and advancing the discourse in this evolving landscape.

This research focuses on the dynamics of AI integration in Indonesian EFL language teaching by addressing two critical research questions. First, it explores the diverse pedagogical strategies employed by Indonesian EFL teachers to integrate AI technologies into their language instruction. This inquiry aims to provide insights into the innovative approaches educators adopt, ranging from traditional methodologies to emerging AI-assisted strategies. Second, the research investigates the statistical significance of the correlation between teacher agency exhibited by Indonesian EFL teachers and the implementation of AI-assisted language teaching strategies. By quantitatively examining the interplay between teacher agency and AI integration, the study aims to uncover meaningful associations that can inform the effective incorporation of AI technologies in the Indonesian EFL context.

Artificial Intelligence (AI) in Language Teaching

Artificial Intelligence (AI) has revolutionized language teaching through speech recognition technology, seamlessly transforming spoken language into accurate written text. This innovation enhances language learning by providing dynamic opportunities for improving pronunciation skills (Perrotta & Selwyn, 2020; Zou et al., 2023). Interactive tools offer real-time feedback, fostering targeted improvement, while voice-activated exercises create immersive language experiences (Chen et al., 2022; Steinbauer et al., 2021). Speech-to-text applications enable learners to articulate thoughts verbally while generating written transcripts, merging oral and written expression for precise, immediate, and interactive language acquisition.

Machine translation, a vital component of artificial intelligence, has transformed language teaching by automating text translation across languages. Despite its imperfections, advancements in this technology make it a valuable tool for learners. Utilizing sophisticated algorithms, machine

translation swiftly renders written content from one language to another, providing instant access to multilingual resources (Pham & Sampson, 2022; Lee, 2022). In language education, online tools and apps featuring machine translation break down language barriers, allowing learners to explore authentic materials in their target language. While not a replacement for human translation, machine translation serves as an efficient, accessible ally for language learners, bridging global linguistic diversity and enhancing the language learning landscape.

Intelligent Tutoring Systems (ITS), a groundbreaking application of AI, seamlessly integrates personalized and adaptive tutoring into language education. By leveraging AI, ITS serves as a dynamic companion, surpassing traditional methods by assessing individual abilities, tracking progress, and tailoring lessons adaptively (Paek & Kim, 2021). This personalized approach ensures content matches learners' proficiency levels, providing a targeted and effective learning experience. Real-time feedback distinguishes ITS, offering immediate insights and suggestions for improvement (Yang et al., 2021; Chen et al., 2020). AI-driven language platforms, virtual tutors, and adaptive learning apps exemplify ITS applications, offering individualized instruction, interactivity, and adaptability. ITS showcases the synergy between AI and language education, shaping a future where technology serves as an integral and personalized guide for language learners.

In the evolving landscape of language education, AI-powered chatbots and virtual assistants are dynamic tools reshaping how learners engage with and practice a new language. These conversational agents simulate real-life dialogues, providing authentic and immersive language experiences (Jeon et al., 2023; Bin-Nashwan et al., 2023; Shi & Deng, 2024; Gill et al., 2024). Leveraging natural language processing, chatbots excel in offering conversational practice, refining speaking and comprehension skills. Beyond interactivity, they provide valuable feedback on pronunciation, grammar, and vocabulary (Choudrie et al., 2023; Dalalah & Dalalah, 2023). Acting as responsive companions, they address language queries and offer contextual assistance. Applications extend to language practice apps, where learners engage in interactive conversations with these AI-driven entities. As technology and language acquisition converge, chatbots and virtual assistants innovate, creating a dynamic and accessible platform for learners seeking meaningful linguistic experiences.

The fusion of artificial intelligence with gamification has transformed language education, providing learners with a captivating and personalized approach to mastering a new language. Infused with adaptive learning principles, gamification utilizes AI to create dynamic and interactive language learning experiences (Rachels & Rockinson-Szapkiw, 2018). Seamless integration of gamified elements into language learning platforms makes the process both educational and enjoyable. Powered by AI algorithms, adaptive learning ensures real-time content adjustments based on individual progress, maintaining an optimal challenge level. This approach caters to diverse learning styles, keeping learners engaged, motivated, and immersed in the language acquisition process. Language learning games, designed with AI-driven adaptive elements, evolve into powerful tools dynamically responding to learners' strengths and weaknesses (Chiu et al., 2023). This fusion exemplifies how AI injects excitement and personalization into language education, transforming the learning journey into an interactive and fulfilling adventure.

The integration of AI-driven text and sentiment analysis into language teaching represents a significant advancement in enhancing written

communication skills. AI meticulously analyzes written texts through automated writing assessment tools, evaluating language proficiency and providing constructive feedback on errors and syntactical structures (Park et al., 2022). Sentiment analysis, another powerful AI facet, explores the emotional tone of written language, offering educators insights into learners' expressions (Wandelt et al., 2023). Beyond correctness, this nuanced analysis contributes to a holistic evaluation of language use. These applications aid in developing personalized learning pathways for effective written communication (Curry et al., 2024). As AI refines its linguistic analysis capabilities, the integration of these technologies holds great promise for providing tailored and insightful feedback, enriching the writing proficiency of language learners.

The fusion of artificial intelligence with augmented and virtual reality has revolutionized language learning, offering unprecedented immersive experiences. AI-driven applications transport learners into dynamic language environments in both augmented and virtual reality (Okoye et al., 2023; Luan et al., 2020; Zhai et al., 2021; Müller & Leyer, 2023). Augmented reality overlays digital elements onto the real world, allowing interaction with language content in immediate surroundings (Yeh & Tseng, 2020). Virtual reality creates simulated environments for language practice within realistic scenarios, fostering cultural awareness and fluency. Applications extend to virtual language immersion environments and augmented reality language learning apps, providing unparalleled opportunities for practical language application (Paek & Kim, 2021; Gràcia et al., 2023). This integration of AI and immersive technologies enhances language skills, offering learners a transformative and captivating journey toward proficiency, catering to individual needs and preferences.

Teacher Agency and Its Significance in EFL Education

Teacher agency refers to the authority of teachers to make informed decisions and shape their teaching practice. It recognizes teachers as active agents with the knowledge and skills to adapt to their context, learners' needs, and educational goals (Fosse, 2023). Teacher professional agency includes five facets: inquisitive agency, deliberative agency, recognitive agency, responsive agency, and moral agency (Molla & Nolan, 2020). These facets empower teachers to be active agents of change, continuously seeking knowledge, making thoughtful decisions, recognizing diversity, adapting to student needs, and upholding ethical standards (Montecinos et al., 2022). Cultivating these facets enhances teachers' impact on student learning, fosters a positive classroom environment, and contributes to the broader educational community.

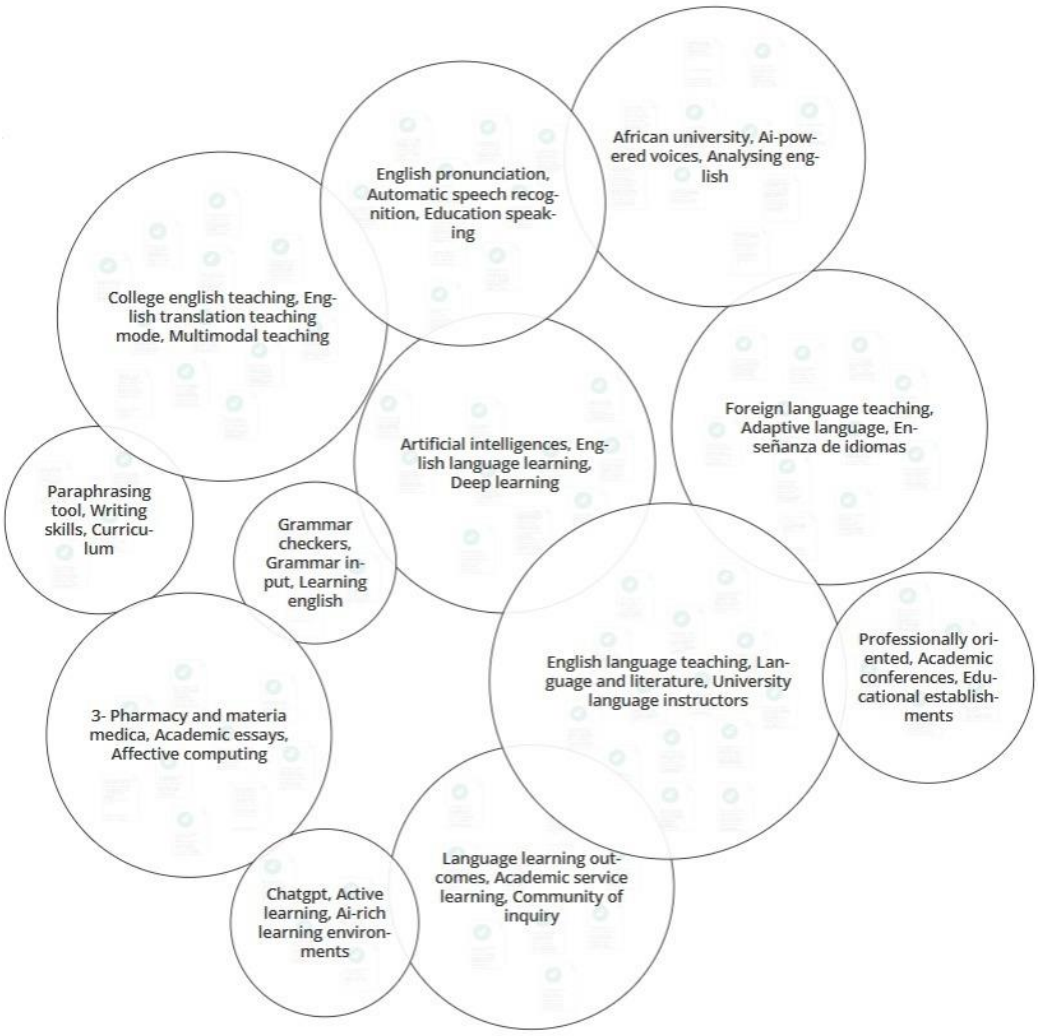
Teacher professional agency encompasses five key facets: inquisitive agency, deliberative agency, recognitive agency, responsive agency, and moral agency (Molla & Nolan, 2020). Inquisitive agency involves teachers actively seeking relevant professional learning opportunities to enhance their knowledge and adapt to industry changes. Deliberative agency empowers teachers to thoughtfully reflect on their practices, critically examine assumptions, and engage in collaborative reflection for continuous improvement. Recognitive agency focuses on the importance of mutual respect, acknowledging teachers' professional roles, and fostering creativity within institutional constraints. Responsive agency highlights teachers utilizing their specialized abilities to address individual student needs, adapt to diverse learning styles, and promote inclusivity. Moral agency emphasizes teachers' ethical decision-making, sensitivity to students' well-being, and commitment to professional integrity in relationships with

students, families, and colleagues. Cultivating these facets enhances teachers' impact on student learning and contributes positively to the broader educational community.

Previous Research on Artificial Intelligence in English Language Teaching

Figure 1 presents a compilation of 100 studies, meticulously mapped by Open Knowledge Maps, exploring diverse applications of Artificial Intelligence (AI) in English Language Teaching (ELT). The clusters cover innovative teaching modes in college English instruction, integration of automatic speech recognition for enhanced pronunciation, use of AI-powered voices in analyzing language patterns, and adaptive methodologies in foreign language teaching. Studies also delve into the impact of academic conferences on language education, the broad spectrum of ELT including language and literature, and insights from university language instructors. Technology-assisted learning is highlighted, featuring studies on integrating ChatGPT in active learning and AI-rich environments, with specific focuses on pharmacy education, affective computing, and the influence of paraphrasing tools and grammar checkers on writing and language learning. This comprehensive compilation illuminates the multifaceted applications of AI in ELT, emphasizing its evolving landscape and innovative methodologies.

Figure 1. AI in English Language Teaching



This present research significantly contributes to the knowledge on AI integration in English Language Teaching (ELT), specifically within the context of Indonesian EFL teachers. While prior studies have explored AI applications in education broadly, a research gap exists regarding the pedagogical strategies employed by Indonesian EFL teachers when integrating AI technologies into language teaching. This study addresses this gap by examining these strategies, highlighting demographic and professional nuances among educators. Additionally, it introduces a novel dimension by exploring the correlation between teacher agency and the implementation of AI-assisted language teaching strategies, bridging the gap between AI applications and teacher agency in the literature. The nuanced insights gained offer valuable implications for educational practices, policy decisions, and future research in the dynamic landscape of language education and technology integration.

Methodology

This research utilizes a quantitative methodology to systematically investigate the integration of AI technologies in language teaching by Indonesian EFL teachers and its correlation with teacher agency. Numerical data collected through survey questionnaires and analyzed using statistical methods, including Partial Least Squares Structural Equation Modeling (PLS-SEM), aims to provide a structured and empirical understanding of pedagogical strategies and the statistical significance of the correlation between teacher agency facets and AI-assisted

language teaching strategies (Hair et al., 2018). This approach ensures a rigorous examination of relationships within the dataset, contributing to an evidence-based exploration of the research questions and generating insights for educational practices, policy decisions, and future research in the dynamic landscape of language education and technology integration.

The study involves 100 diverse Indonesian EFL teachers, spanning various age groups, career stages, and educational backgrounds, with a deliberate effort to maintain gender balance and inclusive representation. The cohort's intentional diversity ensures a comprehensive outlook on AI technology integration in language teaching, enhancing generalizability and fostering a nuanced understanding of the research questions.

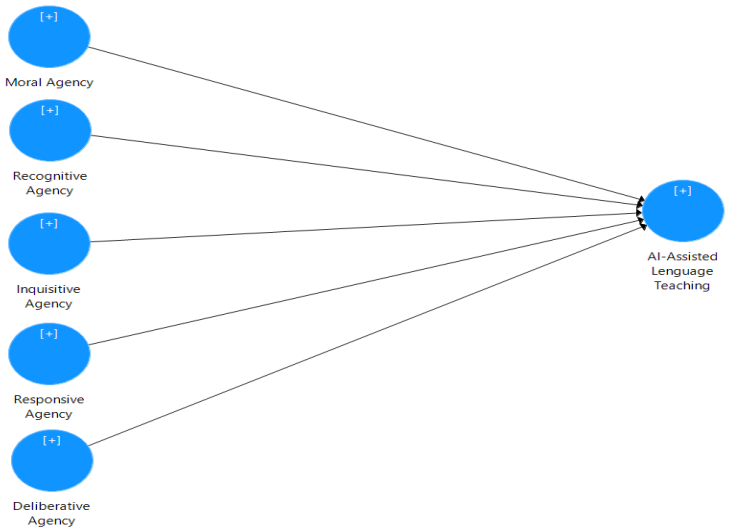
Data Collection Techniques

The primary data collection method involves administering a structured survey questionnaire to 100 Indonesian EFL teachers adapted from Molla and Nolan (2020). The survey is meticulously designed to gather quantitative data on pedagogical strategies in AI technology integration for language teaching. It aims to elicit detailed insights into teachers' preferences, practices, and experiences, providing a comprehensive understanding of diverse approaches in AI-assisted language teaching. The survey also investigates the correlation between teacher agency facets and the adoption of AI-assisted language teaching strategies.

Data Analysis Techniques

In this research, quantitative data collection and analysis are conducted using descriptive statistics. This method systematically examines numerical data to offer a comprehensive overview of pedagogical strategies employed by Indonesian EFL teachers and the characteristics of participating educators (Creswell & Creswell, 2018). Descriptive statistics aim to provide a clear and concise summary of key features within the dataset, offering valuable insights into prevalent patterns, trends, and variations in both pedagogical strategies and teacher demographics.

Figure 2. Framework of Structure Model Analysis



The research employs Partial Least Squares Structural Equation Modeling (PLS-SEM) as an advanced statistical technique (Hair et al., 2018). The derived correlation coefficients will be scrutinized to assess statistical significance and practical relevance. This approach allows for a comprehensive examination of the

relationships between teacher agency facets and AI-assisted language teaching strategies. Systematic evaluation of correlation coefficients aims to discern meaningful associations and patterns, shedding light on the intricate dynamics between teacher agency and AI technology integration. PLS-SEM serves as a powerful tool to extract nuanced insights and contribute to a deeper understanding of the research questions.

Finding and Discussion

Research Question 1: Understanding Pedagogical Strategies and AI Integration in Indonesian EFL Teaching

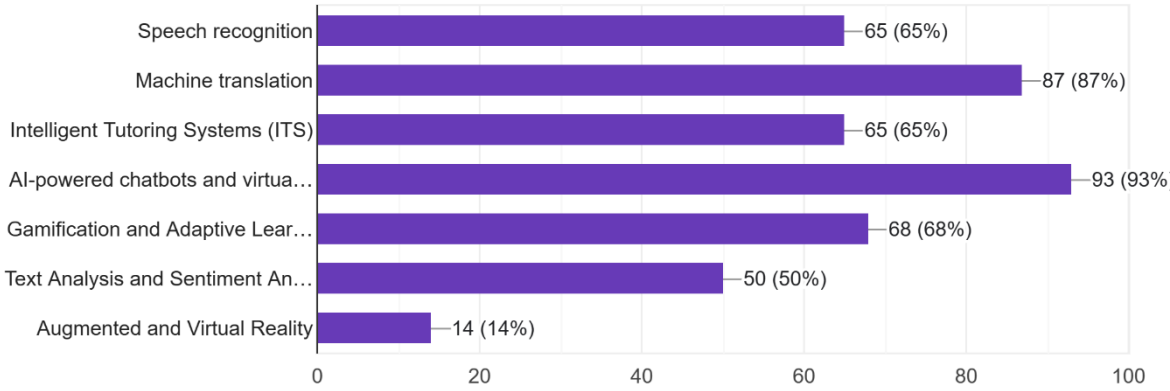
The examination of pedagogical strategies employed by Indonesian EFL teachers in integrating AI technologies has provided insightful demographic and professional revelations, offering a nuanced perspective on language education in Indonesia. The surveyed teachers predominantly fall into a mid-career demographic, suggesting active involvement of educators in their peak professional years in incorporating AI technologies into their teaching practices. This characterization emphasizes the importance of tailored professional development initiatives aligned with the preferences and pedagogical philosophies prevalent among mid-career educators.

Table 1. Demographic Characteristics of Participants

N	Aspect	Category	Frequency	Percentage
1.	Age	20 – 30 years	28	28%
		31 – 40 years	64	64%
		41 – 50 years	8	8%
2.	Gender	Male	49	49%
		Female	51	51%
3.	Teaching Experience	0 – 5 years	26	26%
		6 – 10 years	46	46%
		11 – 15 years	21	21%
		16 – 20 years	7	7%
4.	Professional Information	Elementary	8	8%
		Junior High	20	20%
		Senior High	72	72%

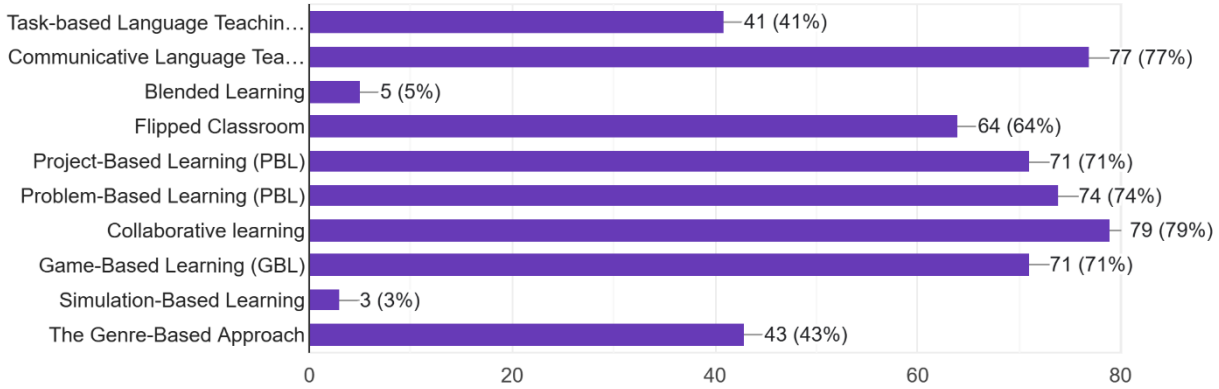
The surveyed cohort features a significant number of educators with substantial professional tenure, bringing valuable pedagogical expertise to the discourse on AI integration. The prevalence of experienced educators underscores the need for tailored professional development programs aligned with the preferences and methodologies within this demographic. Additionally, the nearly equal distribution of gender signifies an inclusive and diverse group of educators actively shaping language education through AI integration. This gender balance underscores the inclusivity of initiatives promoting AI adoption, ensuring equal participation and opportunities for both male and female teachers.

Figure 3. Types of AI Technologies Used



The extensive use of speech recognition and machine translation technologies highlights their strategic importance, emphasizing the focus on developing oral proficiency and language translation skills. Additionally, the widespread adoption of AI-powered chatbots and virtual assistants acknowledges the advantageous features of interactive and conversational AI applications, enhancing language practice and providing personalized learning experiences.

Figure 4. Pedagogical Approaches in AI Integration



The survey findings reveal diverse pedagogical approaches employed by Indonesian EFL teachers in AI integration. Communicative Language Teaching (CLT) stands out as a prevalent approach, reflecting a dedicated focus on enhancing communication skills through AI technologies. Additionally, there is significant adoption of Project-Based Learning, Problem-Based Learning, Collaborative Learning, and Game-Based Learning (GBL), highlighting educators' enthusiasm for using AI to create interactive, problem-solving, and collaborative learning environments.

The concurrent use of Communicative Language Teaching (CLT) alongside widespread AI technologies suggests a potential correlation between communicative pedagogical approaches and technology integration. Examining the alignment of distinct pedagogical philosophies with technology preferences can serve as a basis for informed support and training initiatives. However, the relatively lower adoption of Task-Based Language Teaching (TBLT) raises questions about potential challenges or considerations. A comprehensive investigation into the perceived effectiveness and barriers associated with TBLT holds the promise of providing valuable insights.

The findings emphasize a deliberate alignment of technology, particularly speech recognition, machine

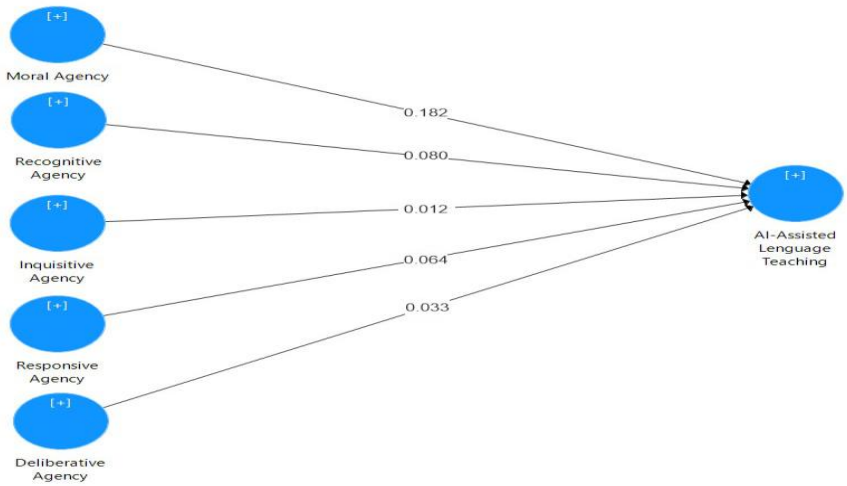
translation, and AI-powered chatbots, with language teaching objectives. Leveraging these technologies has the potential to enhance language proficiency, refine translation skills, and facilitate interactive language practice. The substantial use of AI-powered chatbots and virtual assistants in elementary schools reflects an acknowledgment of the advantages associated with interactive AI applications for younger learners, highlighting the importance of incorporating age-appropriate technology. However, the relatively modest adoption of augmented reality and virtual reality (VR) technologies prompts inquiries into potential impediments or challenges. A comprehensive exploration of the reasons for this limited adoption can provide valuable insights into practical considerations, resource constraints, or the perceived effectiveness of such pedagogical tools.

The variety of pedagogical approaches highlights the adaptability of AI integration across diverse instructional paradigms, emphasizing the need for ongoing research and the dissemination of exemplary methodologies. This diversity underscores the importance of establishing a collaborative environment where educators can systematically explore and incorporate effective AI-assisted language teaching strategies. In summary, the findings provide a nuanced understanding of the current landscape of AI integration in Indonesian EFL teaching, offering valuable insights to educators, policymakers, and researchers shaping the trajectory of language education. The distinctive and noteworthy findings emphasize the imperative for continuous investigation and enhancement of AI-assisted language teaching strategies to meet the dynamic requirements of language learners in the digital era.

Research Question 2: The relationship between the teacher agency of Indonesian EFL teachers and the implementation of AI-assisted language teaching strategies

This study aims to uncover insights into how teacher agency among these educators influences or aligns with the adoption and effective utilization of AI-assisted language teaching strategies in English language instruction. The investigation may reveal correlations that contribute to a deeper understanding of the dynamics between teacher agency and the integration of AI technology in language education within the specified context.

Figure 5. The Relations between Teacher Agency and AI-Assisted Language Teaching Strategies



The investigation of the association between teacher agency and the adoption, as well as the effective implementation, of AI-assisted language teaching strategies in English language instruction utilized the Partial Least Squares Structural Equation Modeling (PLS-SEM) methodology. This approach integrates variables encompassing moral agency, recognitive agency, inquisitive agency, responsive agency, and deliberative agency into the conceptual framework of AI-assisted language teaching. A comprehensive examination is conducted, systematically scrutinizing how all facets of teacher agency are interlinked and their impacts on both the adoption and effective utilization of AI-assisted language teaching strategies.

Table 2. Evaluation of the Structural Model

Variable	Path Indeks			Confidence Indeks	
	β	t-value	p	2,5%	97,5%
Deliberative Agency -> AI-Assisted Language Teaching	0.040	2.206	0.033	0.405	0.717
Inquisitive Agency -> AI-Assisted Language Teaching	0.170	3.171	0.012	0.314	0.519
Moral Agency -> AI-Assisted Language Teaching	-0.038	0.813	0.182	-0.314	0.355
Recognitive Agency -> AI-Assisted Language Teaching	-0.009	1.047	0.080	0.424	0.522
Responsive Agency -> AI-Assisted Language Teaching	0.149	1.016	0.064	0.277	0.554

Following Hair et al (2018), the observed correlation coefficient of 0.033 between deliberative agency and AI-assisted language teaching demonstrates statistical significance, falling below the conventional threshold of 0.05. This finding suggests that educators with heightened deliberative agency show a discernible proclivity toward increased adoption and utilization of AI-assisted language teaching strategies. The statistically significant effect indicates a meaningful association between this facet of teacher agency and the pronounced integration of AI-assisted language teaching methodologies. Meanwhile, the computed correlation coefficient of 0.012 between inquisitive agency and AI-assisted language teaching is also deemed statistically significant, given its position below the conventional threshold of 0.05. Although this coefficient is relatively lower in magnitude compared to the correlation observed for deliberative agency, the result implies a substantive impact. It signifies that a heightened level of inquisitive agency is correlated with an increased adoption of AI-assisted language teaching strategies. This discerned statistical significance underscores the meaningful association between this facet of teacher agency and the increased integration of AI-assisted language teaching methodologies.

Discussion

The study provides nuanced insights into the integration of AI in EFL teaching in Indonesia, revealing diverse pedagogical strategies and the relation of teacher agency on the adoption of AI-assisted language teaching. The prevalence of speech recognition and machine translation technologies emphasizes a strategic focus on oral proficiency and translation skills (Chen et al, 2020; Perrotta & Selwyn, 2020; Zou et al., 2023; Chen et al., 2022; Steinbauer et al., 2021; Pham & Sampson, 2022; Lee, 2022;

Hamid et al., 2022). The popularity of AI-powered chatbots and virtual assistants reflects recognition of the benefits of interactive AI applications, contributing significantly to personalized learning experiences (Jeon et al., 2023; Bin-Nashwan et al., 2023; Shi & Deng, 2024; Gill et al., 2024; Choudrie et al., 2023; Dalalah & Dalalah, 2023; Southworth et al., 2023; Su & Yang, 2023; Liu et al., 2024). The dominance of a mid-career demographic among teachers implies active engagement and acceptance of AI technologies, emphasizing the need for targeted professional development for this group. Considerable teaching experience underscores the importance of tailored programs for educators in their peak professional years. The observed gender balance signifies inclusivity in AI adoption initiatives, ensuring equal opportunities for both male and female teachers.

The intentional integration of speech recognition, machine translation, and AI-powered chatbots into language instruction aims to enhance language proficiency and foster interactive language practice (Jeon et al., 2023; Bin-Nashwan et al., 2023; Shi & Deng, 2024; Gill et al., 2024). The prevalence of AI-powered chatbots in elementary schools reflects an awareness of age-appropriate technology for younger learners (Choudrie et al., 2023; Dalalah & Dalalah, 2023; Southworth et al., 2023; Su & Yang, 2023; Liu et al., 2024). However, the limited adoption of augmented reality and virtual reality (VR) technologies requires a detailed exploration of potential challenges (Okoye et al., 2023; Luan et al., 2020; Zhai et al., 2021; Müller & Leyer, 2023; Paek & Kim, 2021; Gràcia et al., 2023). A thorough investigation into the determinants of this limited adoption can provide valuable insights into practical considerations, resource constraints, or the perceived efficacy of immersive pedagogical tools.

The prominence of Communicative Language Teaching as a predominant approach highlights a dedicated commitment to developing communicative competencies through AI integration. The elevated adoption rates of methodologies like Project-Based Learning, Problem-Based Learning, Collaborative Learning, and Game-Based Learning demonstrate educators' enthusiasm for fostering interactive, problem-solving, and collaborative learning environments with AI (Osman & Kriek, 2021; Mabley et al., 2020). The observed parallelism between Communicative Language Teaching and widespread AI adoption suggests a potential correlation between communicative pedagogical methodologies and technology integration (Adem & Berkessa, 2022). However, the subdued adoption of Task-Based Language Teaching prompts inquiries, necessitating a nuanced exploration into potential challenges and considerations.

The examination of teacher agency reveals a significant correlation between specific facets and the adoption of AI-Assisted Language Teaching (AILT) strategies. The observed correlation coefficients, particularly the statistically significant relationship between deliberative agency and AILT integration, suggest that educators with heightened deliberative agency exhibit a pronounced inclination toward incorporating AILT methodologies (Molla & Nolan, 2020; Wang et al., 2021; Guenther, 2021). Similarly, while the correlation coefficient for inquisitive agency and AILT adoption is of relatively lower magnitude, its substantive impact remains noteworthy (Molla & Nolan, 2020; Jeon et al., 2022). These insights emphasize the profound association between teacher agency facets and the infusion of AILT methodologies, highlighting the pivotal role of teacher agency in shaping the adoption and effective utilization of AI technology in language education.

The use of a quantitative research methodology, employing survey questionnaires and PLS-SEM analysis,

facilitates a structured and empirical investigation, contributing to a robust and evidence-based exploration (Law & Fong, 2020; Mohammadi et al., 2020; Capatina et al., 2023: Badghish et al., 2024). The deliberate diversity in the participant sample enhances the study's generalizability, providing a comprehensive outlook on AI technology integration. Descriptive statistics offer valuable insights into prevalent patterns, trends, and variations in pedagogical strategies and teacher demographics. The PLS-SEM analysis scrutinizes correlation coefficients for statistical significance and practical relevance, providing nuanced insights into the intricate dynamics between teacher agency and AI integration in language education.

Conclusion

In conclusion, this research offers a comprehensive understanding of AI integration in Indonesian EFL teaching, emphasizing the adaptability of AI across various instructional approaches. The observed correlation between teacher agency and AI-assisted language teaching strategies highlights the pivotal role of educators' deliberative and inquisitive agency. This suggests the need for targeted professional development initiatives to enhance successful AI integration.

The findings have implications for educators, policymakers, and researchers. Educators can leverage insights into prevalent pedagogical strategies and the correlation with teacher agency to inform their practices. Policymakers may tailor professional development for mid-career educators engaged in AI integration. Researchers can delve deeper into perceived effectiveness, barriers to Task-Based Language Teaching, and explore limited adoption of augmented reality and virtual reality technologies.

For future research, it is recommended to explore challenges and considerations in Task-Based Language Teaching and investigate reasons behind limited augmented reality and virtual reality adoption. Further studies can focus on AI impact on diverse learners, considering proficiency, cultural backgrounds, and learning styles for a nuanced understanding of AI, language education, and learner diversity.

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