AIM-DEL MODEL: INTEGRATING ARTIFICIAL INTELLIGENCE TO FOSTER METACOGNITIVE AWARENESS AND LITERACY IN EFL CLASSROOM

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Abstract: In an era marked by rapid technological advancement and shifting educational demands, conventional language teaching methods in English as a Foreign Language (EFL) classroom often fall short in nurturing metacognitive awareness and literacy skills. As Artificial Intelligence (AI) tools become increasingly accessible and used, their potential to reshape English language teaching becomes relevant and necessary. The integration of AI into EFL classroom presents new opportunities to enhance students' metacognitive awareness and literacy skills. This study aims to explore how AI can be pedagogically embedded into EFL classrooms through a model that combines current learning atmosphere, such as mindful, meaningful, joyful, and deep learning. The study was grounded in EFL classroom-oriented inquiry and perception-based data from EFL pre-service teachers. The research results propose a structures model, namely AIM-DeL (Artificial Intelligence-Integrated Metacognitive Deep Learning) Model. This model can be a cognitive and metacognitive support system which aligns with future goals in the AI era. The model is designed to foster students' ability to plan, monitor, and evaluate their learning while developing English skills. This study is expected to contribute to current discussions on how AI can be ethically and effectively integrated into English language teaching practices. The AIM-DeL model offers practical implications for the EFL pre-service teachers aiming to implement deep learning approach through AI-supported pedagogical practices.
Keywords: AIM-DeL, Artificial Intelligence, deep learning, literacy, metacognitive awareness

1. INTRODUCTION

In the rapidly evolving landscape of global education, the integration of Artificial Intelligence (AI) in English as a Foreign Language (EFL) classroom is essential. Moreover, fostering higher-order thinking skills such as metacognition and literacy is increasingly emphasized (Chaojing, 2023). These skills are critical for learners to navigate complex information environments and to become autonomous, reflective, and relevant with real-life contexts.

However, despite growing awareness of the importance of metacognitive awareness and literacy skills, such approaches may fall short in promoting students' abilities to plan, monitor, and evaluate their own learning processes (Razavi et al., 2023; Wongdaeng & Higgins, 2023). Moreover, there is a need to investigate how AI can be meaningfully integrated to foster metacognitive awareness and literacy in English learning (Ramli et al., 2025).

Existing studies show the potential of AI in enhancing English learning (Mohamed, 2024; Wei, 2023). Research has also explored AI's role in promoting student engagement and motivation (Alenezi, 2023). Yet, in the era of deep learning, limited attention has been given to how AI can be systematically employed to foster metacognitive awareness and literacy, especially when combined with three atmospheres: mindful, meaningful, and joyful learning. It shows that the intentional use of AI remains relatively new and insufficiently explored.

To address this gap, the present study introduces an initial conceptualization of the Artificial Intelligence-Integrated Metacognitive Deep Learning (hereinafter, AIM-

DeL) model. This model is envisioned to integrate AI meaningfully within the three atmospheres of mindful, meaningful, and joyful learning. In addition, by situating AI not just as a tool but as a reflective partner in English learning, this study contributes to emerging discourses on ethical and pedagogically responsible AI integration. More importantly, it highlights the urgent need to develop structured models in response to the growing reliance on AI in EFL classrooms. Accordingly, this study seeks to answer the following research question: How do EFL pre-service teachers perceive the role of AI in supporting mindful, meaningful, joyful, and deep learning, and what are their expectations for the development of an AI-integrated pedagogical model?

2. LITERATURE REVIEW

2.1 Artificial Intelligence in English Language Education

The use of Artificial Intelligence (AI) in education has gained significant attention in recent years, particularly in language learning contexts. AI-powered tools such as chatbots, automated writing feedback systems, intelligent tutoring systems, and speech recognition technologies have demonstrated their potential to provide personalized learning experiences and real-time feedback (Ayeni et al., 2024; Garg et al., 2024). These tools not only support learners' linguistic competence but also foster learner autonomy and motivation. However, most implementations of AI in EFL contexts remain focused on surface-level language skills, with limited exploration of its role in supporting deeper cognitive processes such as metacognitive awareness and literacy development.

2.2 Deep Learning and Literacy in EFL Contexts

Deep learning, in the educational sense, refers to an approach to facilitate students connect information with existing knowledge, critically analyze content, and apply it in meaningful ways (McPhail, 2021). It contrasts with surface learning, which is often associated with memorization. Within EFL contexts, deep learning has been linked to the development of metacognitive awareness and literacy (Rui et al., 2024). However, fostering deep learning in EFL classroom requires more than traditional instruction; it calls for learning environments that are mindful, meaningful, and cognitively engaging. While AI tools offer the potential to support these environments, there remains a lack of structured models guiding their use integrated with deep learning approach in EFL classrooms.

2.3 Metacognitive Awareness

Metacognition is defined as “thinking about thinking” (Dennis & Somerville, 2023). It refers to students’ ability to reflect on and regulate their own cognitive processes. It encompasses two main components. Building upon this foundation, metacognitive awareness specifically refers to the conscious recognition and active use of these metacognitive processes during learning. In the context of English language learning, metacognitive awareness enables students to become more self-directed and strategic, leading to enhanced language proficiency and long-term academic success. Numerous studies in EFL contexts have highlighted the significant role of metacognitive awareness in learning effectively (Akcaoğlu et al., 2023; Özçakmak et al., 2021). However, it is often not systematically cultivated in many EFL classrooms, especially those still rooted in teacher-centered approaches.

2.4 Contribution of the Study

This study introduces the AIM-DeL model as a response to the fragmented nature of the current literature. The model is planned to bridge AI tools with pedagogical strategies that nurture metacognitive awareness and literacy in a deep learning context. By doing so, it aims to provide both a theoretical and empirical framework for EFL pre-service teachers, in integrating AI ethically and meaningfully into English instruction. Through perception-based inquiry and classroom-oriented analysis, this study contributes to the growing body of literature on future-oriented education, offering a structured pathway to support the transformation of EFL learning in the AI era.

3. METHODOLOGY

3.1 Research Design

This study employed a descriptive survey design to explore the perceptions and practices of pre-service English language teachers regarding the integration of AI into English language learning and teaching, particularly in connection with metacognitive awareness, literacy skills, and deep learning approaches. The study also aimed to initiate a pedagogical model development based on participant responses and current classroom-oriented contexts.

3.2 Participants

The participants of this study were 44 pre-service teachers enrolled in the English Language Education Study Program. Among them, 33 participants were female and 11 were male. All participants were in advanced semesters and had prior experience using digital platforms and AI-based tools in the context of English language teaching.

3.3 Data Collection

The survey was administered online using a Google form distributed via WhatsApp. A structured online questionnaire was used as the main instrument for data collection. The questionnaire consisted of both closed-ended and open-ended questions. The closed-ended items were designed to capture participants' demographic profiles, their perceptions of four aspects: mindful, meaningful, joyful, and deep learning. Meanwhile, the open-ended responses provide qualitative insight into the expectations and aspirations of pre-service English teachers regarding the role of AI in future pedagogical practice. Participants were informed about the research purpose and assured of the confidentiality of their responses. Participation was voluntary and consent was obtained prior to completing the questionnaire.

3.4 Data Analysis

Quantitative data from the closed-ended questions were analyzed using descriptive statistics to determine the frequency and percentage of responses. This included identifying the most commonly used AI tools and the extent of participants' familiarity with AI in English teaching. Qualitative data from open-ended responses were analyzed thematically to extract key patterns and insights related to metacognitive awareness, deep learning, and AI integration in EFL pedagogy.

4. RESULTS

A total of 44 EFL pre-service teachers joined the survey. The survey results revealed that 100% of the participants are both familiar with and actively use AI in their English language teaching and learning process. Among the various tools used, ChatGPT emerged as the most frequently used AI tool (77.3%), followed by Google Translate (9.1%). These findings suggest a high level of engagement with generative AI tools, particularly those that support real-time text generation and language translation.

Regarding the four aspects on the survey, Table 1 provides survey results on their perception related to mindful learning aspect. It shows positive perceptions from EFL pre-service teachers regarding the integration of AI in their learning processes. For instance, 43.2% of the respondents agreed and 11.4% strongly agreed with the statement 1, indicating that AI potentially fosters metacognitive self-awareness. Similarly, in the statement 2, 70.5% agreed and 15.9% strongly agreed, showing a strong recognition of AI's role in supporting self-monitoring and evaluation during learning activities. Regarding the ability to plan learning more effectively, 47.7% agreed and 15.9% strongly agreed that they can plan their learning process in a more structured way when using AI. Moreover, the statement 4 also received high agreement (65.9% agreed and 13.6% strongly agreed). However, perceptions were more varied on the statement 5, with only 38.6% agreed and 6.8% strongly agreed, while 38.6% responded neutrally and 15.9% disagreed.

Table 1: The Results of Mindful Learning Aspect

No	Statement	Response (%)				
		SD	D	N	A	SA
1	I became more aware of my thought processes and learning strategies when using AI-based technology.	0	2.3	43.2	43.2	11.4
2	AI helps me evaluate how I understand and complete tasks.	0	0	13.6	70.5	15.9
3	I can plan my learning process in a more structured way when using AI.	0	2.3	34.1	47.7	15.9
4	The presence of AI makes me more reflective about mistakes or shortcomings in learning.	0	0	20.5	65.9	13.6
5	I realized my learning goals more clearly when using AI.	0	15.9	38.6	38.6	6.8

The analysis of responses related to the meaningful learning aspect also reveals predominantly positive perceptions from EFL pre-service teachers regarding how AI contributes to understanding and connecting knowledge in English language learning. Table 2 shows that 56.8% of the participants agreed and 22.7% strongly agreed with the statement 1, indicating that AI applications are perceived to assist in building meaningful cognitive links between existing and new learning materials. Likewise, in the statement 2, 59.1% agreed and 22.7% strongly agreed, showing that AI is widely recognized as a supportive tool in comprehending content delivered in the English language.

In the statement 3, 54.5% of participants agreed and 11.4% strongly agreed, although 27.3% responded neutrally and 6.8% disagreed. A similar pattern is observed in the statement 4, with 59.1% agreed and 18.2% strongly agreed, reflecting a high level of engagement with AI tools for content access and understanding. Finally, in the statement 5, 65.9% agreed and 13.6% strongly agreed, indicating that

the majority of respondents found AI integration beneficial in improving comprehension of English learning materials.

Table 2: The Results of Meaningful Learning Aspect

No	Statement	Response (%)				
		SD	D	N	A	SA
1	AI helps me connect new knowledge with what I already know.	0	2.3	18.2	56.8	22.7
2	AI supports my understanding of texts and concepts in English.	0	0	18.2	59.1	22.7
3	AI helps me develop literacy skills in English language learning.	0	6.8	27.3	54.5	11.4
4	I use AI to understand various materials in English.	0	0	22.7	59.1	18.2
5	Learning English with AI helps me understand English lessons.	0	0	20.5	65.9	13.6

The analysis of responses related to the joyful learning aspect highlights participants' emotional engagement and motivation in learning English through AI-supported environments (see Table 3). In response to the statement 1, 50% of participants agreed and 6.8% strongly agreed, while 34.1% were neutral and 9.1% disagreed. This shows that AI contributed positively to their learning motivation. The statement 2 received agreement from 38.6% and strong agreement from 11.4% of participants, with 50% responding neutrally and none expressing disagreement.

Regarding confidence, 47.7% agreed and 11.4% strongly agreed with the statement 3, while 40.9% were neutral. Then, for the statement 4, 47.7% agreed, 9.1% strongly agreed, and 40.9% remained neutral, while a small proportion (2.3%) disagreed. These responses suggest that AI contributes to learners' sense of satisfaction, although some may still be undecided. Lastly, in the statement 5, 40.9% agreed, 6.8% strongly agreed, and 43.2% responded neutrally, with 9.1% selecting "Disagree." This result reflects moderate emotional engagement, though not as strongly as in other aspects of joyful learning.

Table 3: The Results of Joyful Learning Aspect

No	Statement	Response (%)				
		SD	D	N	A	SA
1	I feel more motivated to learn English with the help of AI.	0	9.1	34.1	50	6.8
2	AI makes learning English more interactive and enjoyable.	0	0	50	38.6	11.4
3	I feel more confident in learning English with the help of AI.	0	0	40.9	47.7	11.4
4	AI provides satisfaction in learning English.	0	2.3	40.9	47.7	9.1
5	The use of AI makes me more emotionally involved in learning English.	0	9.1	43.2	40.9	6.8

Table 4 presents that, for statement 1, 56.8% of participants agreed and 11.4% strongly agreed, while 31.8% responded neutrally. Regarding the statement 2, 65.9% agreed and 9.1% strongly agreed while 25% responded neutrally. This suggests that the majority of participants actively utilize AI to combine and make sense of multiple inputs in their learning process. In the statement 3, 45.5% agreed, 4.5% strongly

agreed, and 43.2% responded neutrally, reflecting a more moderate level of perceived support for critical thinking development through AI.

When asked about real-life application, 38.6% of participants agreed and 4.5% strongly agreed, while 54.5% responded neutrally and 2.3% disagreed. This indicates more varied perceptions on the role of AI in bridging academic content with authentic language use. Finally, in the statement 5, 65.9% agreed and 9.1% strongly agreed, while 25% were neutral, emphasizing AI's role in facilitating deeper yet manageable learning experiences.

Table 4: The Results of Deep Learning Aspect

No	Statement	Response (%)				
		SD	D	N	A	SA
1	AI helps me understand the important parts of the material that need to be mastered and taught in English learning.	0	0	31.8	56.8	11.4
2	I use AI to compile and synthesize information from various sources to support English language learning.	0	0	25	65.9	9.1
3	AI encourages me to think critically in understanding English material.	0	6.8	43.2	45.5	4.5
4	I am better able to apply English concepts in real-life contexts thanks to AI.	0	2.3	54.5	38.6	4.5
5	AI helps me explore English language materials in greater depth, yet in a practical way.	0	0	25	65.9	9.1

Furthermore, the open-ended responses reveal how pre-service English teachers envision the role of AI in shaping their future classroom practices. Their expectations reflect not only practical hopes for teaching efficiency but also deeper pedagogical aspirations that resonate with the conceptual foundation of the AIM-DeL model. Below, selected participant quotes are presented.

A prominent theme among participants was the expectation that AI could help in designing diverse and engaging instructional materials. Many respondents hoped that AI could facilitate the creation of interactive learning resources. *"My hope is that AI can support the development of innovative and diverse teaching materials, such as digital quizzes, interactive dialogues, and simulation-based exercises."* Another frequently mentioned hope was that AI could provide real-time, automated feedback, particularly in aspects like writing and pronunciation. As one respondent stated, *"Providing automatic feedback on student assignments, especially in terms of writing and pronunciation, so that students can learn independently and quickly correct their mistakes."* This expectation underscores AI's potential role in formative assessment and immediate corrective support.

Participants also saw AI as a means to personalize instruction, adapting learning content and strategies to individual student needs. One respondent wrote, *"I hope that AI-based learning models can help me design materials that meet the needs of students."* In addition, some participants mentioned that AI could help them become more creative and productive in their teaching preparation. For example, one said, *"I hope AI can help me develop English teaching materials... and provide recommendations for effective teaching strategies."* One thoughtful response stated, *"I hope AI remains within its boundaries as a tool, rather than completely replacing the role of teachers."* Finally, several responses showed that participants

hoped AI would also support student engagement and motivation by making learning more fun and relatable. *"I hope that AI-based learning can make the teaching process more effective and interesting."* noted one participant.

5. DISCUSSION

The findings from this study highlight how EFL pre-service teachers perceive the integration of Artificial Intelligence (AI) tools as supportive in nurturing essential dimensions of learning, namely mindful, meaningful, joyful, and deep learning. The results suggest that AI is not only utilized for surface-level tasks but is also perceived as a metacognitive and pedagogical support system, aligning with the core principles of the proposed AIM-DeL Model.

In terms of mindful learning, participants demonstrated strong agreement that AI facilitates greater self-awareness, reflection, and structured planning. Over 70% agreed that AI helps them evaluate their task performance and encourages reflective thinking. The findings are in line with studies by Drigas et al. (2023) and Yang (2025) which emphasize the importance of fostering metacognitive regulation through digital tools. However, a more varied response was observed regarding AI's role in helping students clarify long-term learning goals, indicating that while AI promotes task-level awareness, its support in strategic goal setting may require more targeted scaffolding.

Under the meaningful learning aspect, participants agreed that AI supports their ability to connect prior knowledge with new content, understand complex English materials, and build literacy skills. These results echo previous research (Akpabio et al., 2025; Hong & Guo, 2025), which illustrates how AI-supported environments enable personalized content access and enhanced language comprehension. Despite the overall positive trend, some neutral and disagree responses suggest variability in digital literacy or familiarity with AI functionalities across the students.

The joyful learning dimension revealed positive emotional engagement with AI tools. Over half of the participants reported increased motivation and confidence when learning English with AI. Statements like "AI makes learning more interactive and enjoyable" received high agreement, indicating that AI not only enhances cognitive processes but also fosters affective learning experiences. These findings support the argument made by Fan and Zhang (2024) and Huang (2025), who noted that affective factors such as enjoyment and emotional engagement significantly impact learning outcomes in AI-assisted environments.

For deep learning, most participants acknowledged AI's role in helping them identify key content, synthesize information, and explore materials in a practical and critical way. Notably, ChatGPT emerged as the most frequently used AI tool, with 77.3% of participants indicating it as their primary platform. This finding is consistent with recent literature on the rise of Generative AI in language education (Asad et al., 2024; Chang & Kidman, 2023; Law, 2024), which emphasizes the accessibility and interactive nature of tools like ChatGPT in supporting both knowledge acquisition and metacognitive reflection. Generative AI, particularly large language models, provides students with instantaneous responses, adaptive feedback, and personalized interaction, making it a popular choice among digital-native learners.

The results from the open-ended responses further emphasize the EFL pre-service teachers' desire for AI models that are not only intelligent but also pedagogically purposeful. Many participants expressed hopes for AI to help design

interactive materials, support student evaluation, enhance creativity, and offer personalized learning pathways. Their responses reflect a growing awareness that while AI can enhance teaching, it must remain a tool which is guided by pedagogical principles for the sake of facilitating the students' needs through AI utilization (Pramerta, 2025). It shows that the potential of incorporating AI into educational context also addressing crucial need for pedagogical adaptability (Wu, 2024).

The findings underscore the urgent need for ethical, intentional, and metacognitively supportive use of AI in English language teaching. The current study serves as an initial step in conceptualizing such a model, laying the groundwork for future development. However, this study also has several limitations. First, the sample size was small, which may limit the generalizability of the findings. Second, while the study relied on perception-based survey data, future research should integrate classroom-based observation and experimental designs to evaluate the actual impact of AI on learning outcomes.

6. CONCLUSION

This study explored EFL pre-service teachers' perceptions of AI integration in English language learning across four critical learning dimensions: mindful, meaningful, joyful, and deep. The survey results indicate that AI tools, particularly generative AI like ChatGPT, are widely used and perceived as supportive in enhancing metacognitive awareness, language comprehension, motivation, and critical thinking. Participants reported that AI helps them reflect on their learning processes, connect prior knowledge with new content, engage more emotionally in learning, and deepen their understanding of English language materials.

Open-ended responses further revealed the participants' expectations for AI-supported learning environments that are interactive, personalized, and pedagogically grounded. These insights affirm the need for a clear framework that not only integrates AI tools into the classroom but also aligns them with broader educational goals such as literacy development and learner autonomy.

The findings of this research highlight the urgent need to design and develop a structured, pedagogically sound framework for AI integration in English language education. In response to this, the study proposes the Artificial Intelligence-Integrated Metacognitive Deep Learning (AIM-DeL) Model as a conceptual and practical guide for incorporating AI in ways that promote metacognitive growth and meaningful learning experiences. While the model is still in its early conceptual phase, the results from this preliminary investigation lay a strong foundation for its future development.

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