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RESEARCH ARTICLE

Assessing the Impact of AI Integration Course on Students' AI Competencies and Readiness in Preservice EFL Teacher Education

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ARTICLE INFO	ABSTRACT
	This study aims to conceptualize a research model to assess the impact of AI-integration courses on preservice EFL teachers' AI competencies and readiness. The process requires determining the role of a typical AI integrated EFL teachers and their essential competencies for effective AI integration in EFL classrooms as well as the effect of such courses on preservice EFL teachers. Employing a systematic literature review approach, eight critical AI competencies were identified and synthesized into managing and facilitating learning with AI tools, integrating AI into pedagogical content, employing AI in pedagogy, engaging in reflective AI practice, utilizing AI for personalized learning, developing AI adaptive expertise, understanding AI ethical challenges, and advocating for responsible AI use. This is followed by an explanatory sequential design guided by the Technology Acceptance Model (TAM) and self-perception theory to assess preservice EFL teachers' readiness and competencies for AI adoption. This research provides insights into how AI integration courses can affect the competencies and inclination of preservice teachers to use AI to enhance the quality of EFL teaching and learning.

INTRODUCTION

Recent studies have underscored the significance of integrating Artificial Intelligence (AI) into English as a Foreign Language (EFL) classrooms, highlighting its potential to significantly enhance educational effectiveness and personalize learning experiences. AI technologies, by customizing content to meet individual student needs, optimize the language learning process, offering personalized and adaptive learning experiences (Yang, 2022). Modern educational tools such as intelligent tutoring systems, chatbots, and language learning apps provide immersive and interactive experiences that substantially improve language skills, including vocabulary (Hwang et al., 2023) and writing (Han et al., 2023). These tools also foster student engagement in a safe environment, boosting confidence and motivation (Hwang et al., 2023). Furthermore, AI's capacity to automate routine tasks allows teachers to focus more on addressing complex student needs and facilitating interactive learning experiences (Malik & Solanki, 2021). This approach aligns with the prevailing shift towards student-centered learning and promotes the development of critical thinking skills. AI technologies facilitate continuous assessment, enabling personalized teaching strategies that enhance language learning outcomes (Shin et al., 2022). Recent research emphasizes the critical role of AI integration in EFL teaching to improve language education and prepare students for the digital age, highlighting its growing importance for educators and policymakers (Yang, 2022).

The effectiveness of AI-integration courses in preservice English as a Foreign Language (EFL) teacher education relies heavily on two key factors: AI-integration competence and AI-integration readiness. These elements represent the necessary skills and willingness of educators to effectively utilize AI technologies. They also serve as important benchmarks for assessing the effectiveness of degree programs that incorporate AI-integration courses. According to [7], educators must use AI tools to enhance language teaching and student outcomes. A strong grasp of AI's fundamentals and its educational impact is crucial for this skill. Moreover, the readiness to integrate AI into pedagogy, as highlighted by (Holmström, 2022), is a reflection of educators' preparedness and enthusiasm. This is influenced by their attitudes towards AI technology and its perceived relevance in education (Christensen, 2002), underscoring the need for targeted development and support in these areas to equip future educators for the evolving digital educational landscape.

The use of Artificial Intelligence (AI) in English as a Foreign Language (EFL) classrooms is changing the way we teach and learn. This shift towards incorporating AI in education calls for the inclusion of AI-integration courses in preservice EFL teacher programs (Vera, 2023). To fully harness the power of AI in education and enhance student engagement, a comprehensive approach is required. This includes developing a well-rounded curriculum, providing hands-on training with AI tools, and ensuring an awareness of the ethical considerations surrounding AI in education (Williams et al., 2021). As research has shown that AI technologies have the potential to enhance personalized and interactive learning environments, leading to improved language learning outcomes (Hwang et al., 2023; Rusmiyanto et al., 2023). This highlights the importance of AI as a crucial tool for future educators. As a result, the integration process focuses on providing preservice teachers with the necessary understanding of AI capabilities and the teaching skills needed to effectively use AI.

Against this backdrop, the aim of this study is to conceptualize a research model that investigates the impacts of AI integration course in the development of AI competencies and readiness among preservice EFL teachers. The study emphasizes the significant role of AI in reshaping educational approaches and improving EFL teaching and learning in the digital era.

THEORETICAL FRAMEWORK

We argue that the impact assessment of AI Integration Courses on students' AI competencies and readiness in preservice EFL Teacher Education involve combining three major theories: the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and the Self-Perception Theory. This integrative approach examines how perceived usefulness and ease of use (TAM), attitudes, subjective norms, and perceived behavioral control (TPB), alongside actions influencing attitudes (Self-Perception Theory), interact to enhance AI competencies and readiness among preservice EFL teachers.

According to the TAM, the integration course aims to enhance perceived ease of use and usefulness of AI tools, thereby fostering acceptance and readiness among preservice teachers (Woosnam et al., 2018). The TPB adds depth by examining how teachers' attitudes, influenced by subjective norms and perceived behavioral control, determine their intentions to use AI in teaching (Pokrivcakova, 2023). Complementing this, the Self-Perception Theory posits that preservice teachers infer their attitudes towards AI from their behavior in the course, promoting a natural integration of AI into their pedagogical practices (Luo & Xie, 2018). By integrating these theories, the model seeks to not only gauge the proficiency of preservice teachers in AI tools but also their ability to apply these technologies effectively in educational scenarios, advocating for a balanced focus on both technical skills and thoughtful pedagogical application (Song & Song, 2023).

LITERATURE REVIEW

The use of Artificial Intelligence (AI) in English as a Foreign Language (EFL) classrooms is changing the way we teach and learn. This shift towards incorporating AI in education calls for the inclusion

of AI-integration courses in preservice EFL teacher programs (Vera, 2023). To fully harness the power of AI in education and enhance student engagement, a comprehensive approach is required. This includes developing a well-rounded curriculum, providing hands-on training with AI tools, and ensuring an awareness of the ethical considerations surrounding AI in education (Williams et al., 2021). As research has shown that AI technologies have the potential to enhance personalized and interactive learning environments, leading to improved language learning outcomes (Hwang et al., 2023; Rusmiyanto et al., 2023). This highlights the importance of AI as a crucial tool for future educators. As a result, the integration process focuses on providing preservice teachers with the necessary understanding of AI capabilities and the teaching skills needed to effectively use AI.

The integration of artificial intelligence (AI) in education has become increasingly significant, impacting teaching methodologies and learning environments. Educator competence in AI involves a balanced pedagogical approach, which is essential for fostering AI readiness among students, particularly in STEM fields (Fong et al., 2022). Moreover, the awareness, readiness, and practical use of AI technologies among educators, especially at the university level, are pivotal for the successful integration of AI tools in educational practices (Sysoyev, 2023). However, challenges exist, including the need for substantial professional development and overcoming the apprehension towards adopting AI technologies. The effectiveness of AI integration in teaching is influenced by the educators' technological readiness, perceived usefulness, and the ease of use of AI tools (Nouraldeen, 2023). Additionally, understanding and addressing the educators' attitudes towards AI, alongside developing their competencies through targeted training, are crucial for the successful adoption of AI in education (Andani et al., n.d.). Overall, a comprehensive approach encompassing training, support, and awareness is essential for enhancing educator competence and readiness for AI integration in educational settings.

Against this backdrop, the aim of this study is to conceptualize a research model that investigates the impacts of AI integration course in the development of AI competencies and readiness among preservice EFL teachers. The following inquiries served as the basis for the research:

1. What are the tasks of AI integrated EFL teachers?

2. What are the competencies of AI integrated EFL teachers?

3. How can we assess the impact of AI-integrated courses on the development of AI competencies and readiness in preservice EFL teachers?

MATERIALS AND METHODS

After reviewing the literature, it was found that no study was done to develop a research model that assess the impact of an online AI integration course on Students' AI competencies and readiness in preservice EFL teacher education. This study was set out to conceptualize a research model that can be used to study the impact of online AI integration course on students' perceived AI integration competences, and readiness.

Research Design

This study's research design utilizes a systematic literature review method, guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) standard to synthesize knowledge and findings on AI Integrated EFL teachers and their competencies from a diverse range of published literature (Basenach et al., 2023). Employing a stepwise, rigorous approach, it involves the meticulous collection, critical evaluation, and in-depth analysis of relevant scholarly articles, books, and other academic resources. This comprehensive exploration aims to identify the tasks, roles, and competencies of typical AI-integrated EFL teachers. By adopting the PRISMA framework, the study ensures the reporting quality of systematic reviews and meta-analyses is enhanced, providing a structured, transparent reporting that supports evidence-based practice and decision-

making. The adherence to PRISMA guidelines aids in presenting the review process and findings with clarity, thereby facilitating their replicability, utility, and validity within the scientific community. The research design is inspired by (Foucrier & Wiek, 2019) and (Lasekan et al., 2021) on the conceptual research model of sustainable entrepreneurship competence and teacherpreneurial competence, respectively. The research is divided into three sections (Figure 1).

Search Strategy

Our meticulous search strategy, aligned with the PRISMA criteria, sought to cover a wide spectrum of literature on the role of AI integrated EFL teachers and their competencies within EFL education. Using Google Scholar for its broad academic research collection and cross-verifying with SCOPUS for scholarly rigor, we targeted search terms like "AI integration EFL teacher," "AI integration in EFL education," "AI integration competencies," and "AI integrated competencies in EFL education". This approach ensured the identification of relevant studies, establishing a solid foundation for our review

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were defined to focus on the most relevant and robust studies.

Inclusion Criteria:

- Peer-reviewed articles from 2019 onwards to reflect the latest advancements in AI integration within EFL education.
- Studies providing clear definitions and a synthesized review of AI integration tasks and competencies in EFL teaching.
- Exclusion Criteria:
- Non-peer-reviewed literature and publications before 2019 were excluded to ensure relevance and academic rigor.
- Research lacking clear definitions or synthesis of existing literature was also excluded to maintain clarity and contribution to the field.
- Study Selection
- The study selection protocol unfolded in a structured manner to ensure rigorous and unbiased identification of research pertinent to AI integrated EFL teachers and their competencies:
- Initial Search Yield: The comprehensive search across designated databases produced a substantial corpus of literature, encompassing a wide array of 36 and 52 studies potentially relevant to AI integration EFL teachers' roles and AI integration core competencies respectively.
- Duplicate Removal: Recognizing the possibility of overlapping records between Google Scholar and SCOPUS, the initial step involved systematically eliminating duplicate entries to refine the dataset to unique studies, ensuring no repetition in the analysis.
- Screening Process: With a refined pool of unique records, the next phase entailed a meticulous screening of titles and abstracts. This screening was guided strictly by the inclusion criteria, which focused on publication year, peer-review status, clarity of AI integrated EFL teachers' roles and their competencies in the synthesized literature review. This step was critical in preliminarily assessing the relevance of each study without delving into full texts, thereby efficiently narrowing down the pool of potential studies.
- Selection for In-Depth Review: Following the initial screening, a subset of studies 5 out of the initial 36 (AI Integrated EFL teacher's role) and 5 out of the initial 52 (AI Integrated Competencies) were deemed to align sufficiently with the research criteria to warrant further examination. These selected studies underwent a comprehensive full-text evaluation to scrutinize their content against the inclusion and exclusion criteria in detail, confirming their

direct relevance and contribution to the topic of AI integrated EFL teachers' roles and core competencies.

- Final Analysis Inclusion: Only those studies that met all criteria upon full-text review were ultimately included for detailed analysis and synthesis. This selective process ensured that the final set of studies was not only relevant and of high quality but also offered significant insights into the research question, ready to contribute to the synthesis of existing knowledge on AI's role and competencies.

Compilation and Organization

The findings from the literature review are organized into structured formats to include:

Table 1: Tasks and Functions of AI-Integrated EFL Teachers. This table will summarize the tasks and functions identified in the literature, providing a clear overview of how AI is applied in EFL teaching

AI Integrated Teachers	Reference Justification	Reference
Facilitator of Personalised Learning	Use of AI for personalized learning paths and assessment.	(Nguyen et al., 2022)
Integrator of Technology and Curriculum	Development of an AI-powered online teaching system to enhance language learning	(Guofang, 2019)
Curator of Digital Resources	Lecturers as AI creator and facilitators of digital tools	(Lestari, 2020)
Collaborator with AI for Instructional Design	collaboration between conversational AI and human teachers	(Ji et al., 2023)
Mentoring for Digital Literacy and Ethical Use of AI	Educator using AI tools for developing digital competencies of students through training modules.	(Falloon, 2020)

Table 2: Core Competencies of AI Integrated EFL Teachers. This table will detail the competencies required for effectively integrating AI in EFL teaching, as derived from the literature

Core Competencies	Reference Justification	Reference
Pedagogical Expertise	Emphasizes AI's role in supporting collaborative and personalized learning, highlighting the need for pedagogical adaptability.	(Kim et al., 2022)
Technical Proficiency	Discusses generative AI's application in education, underscoring the importance of teachers' proficiency in these technologies.	(Su & Yang, 2023)
Adaptive Teaching Strategies	Addresses AI integration to adapt teaching strategies, highlighting responsive and flexible teaching methods.	(Brusilovsky, 2023)
Ethical and Responsible Use of AI	Emphasizes responsible and ethical use of AI in education, underlining ethical considerations in AI applications.	(Mhlanga, 2023)
Lifelong Learning	Discusses the evolving landscape of AI in education, indicating the necessity for continuous learning.	(Wu, 2023)

Framework synthesis of the core competencies

The new competency structure was generated using a limited set of criteria to design curriculum/course for AI integration EFL courses. Several criteria from the design protocol of (Lasekan et al., 2021) were followed:

- Definition and Standardization of Core Competencies: This first step involves con-ducting a thorough review of existing literature to identify definitions of the identified "AI integration core competencies" and "AI core competencies." The goal here is to cre-ate a comprehensive but non-redundant list of competencies specific to AI integration in EFL contexts.

- Filling Gaps in the Literature: Identifying and addressing gaps in the literature is crucial for ensuring the competency framework covers unestablished or emerging roles and competencies not yet recognized in existing models.

- Practice-oriented AI Integration: To avoid the creation of a mere list of skills ("laundry listing"), this criterion emphasizes behavioral focus of the AI competencies. This means mapping competencies is to ensure the competencies are actionable and tied to real-world tasks.

Conceptual Research Model Development

Using core competencies in different studies as a guide to connect the on-going debate of competency in different areas of studies. To assess the readiness and impact of an AI integration course, we built a simple conceptual research model from insights from teacherpreneurship education studies (Lasekan et al., 2021), and from our literature review. The impact is modelled through the assessment of perceived AI integration competencies and readiness.
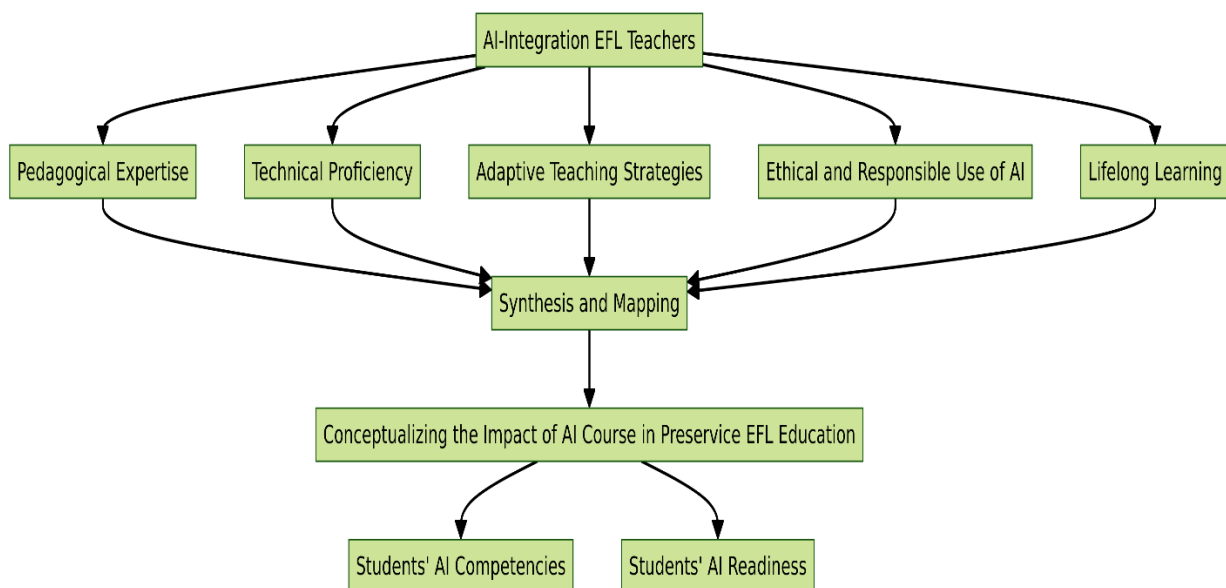

Figure 1. Overview of research design adapted from "A process-oriented framework of competencies for AI integration" adapted from (Lasekan et al., 2021). International Journal of Learning, Teaching and Educational Research, p.1693

RESULTS

Task of AI-integration EFL Teacher (what does an AI integration English teacher do?)

Drawing on an extensive literature review and research findings, the principal roles and activities of an AI integration EFL teacher, supported by references, are:

- Facilitator of Personalized Learning: Teachers use AI tools to customize English language learning experiences for students, significantly improving outcomes through personalized and adaptive learning pathways (Nguyen et al., 2022)

- Integrator of Technology and Curriculum: AI integration EFL teachers incorporate AI-driven tools and resources into the curriculum to enhance language learning with more engaging and interactive content (Guofang, 2019).

- Curator of Digital Resources: They compile a comprehensive collection of digital resources and AI-based applications to support all aspects of English learning, such as grammar, vocabulary, pronunciation, and cultural competence (Lestari, 2020).

- Collaborator with AI for Instructional Design: Teachers work with AI systems to create effective English language learning activities and assessments (Ji et al., 2023).

- Mentor for Digital Literacy and Ethical Use of AI: Teachers guide students in the ethical use of digital tools and AI, fostering digital literacy and critical thinking about technology's societal implications (Falloon, 2020)

In summary, Figure 2 below illustrates that AI integration EFL teachers facilitate personalized learning with AI tools, integrate AI tools into the curriculum, manage a repository of AI resources, collaborate with AI for instructional design, and mentor students on the ethical use of AI.
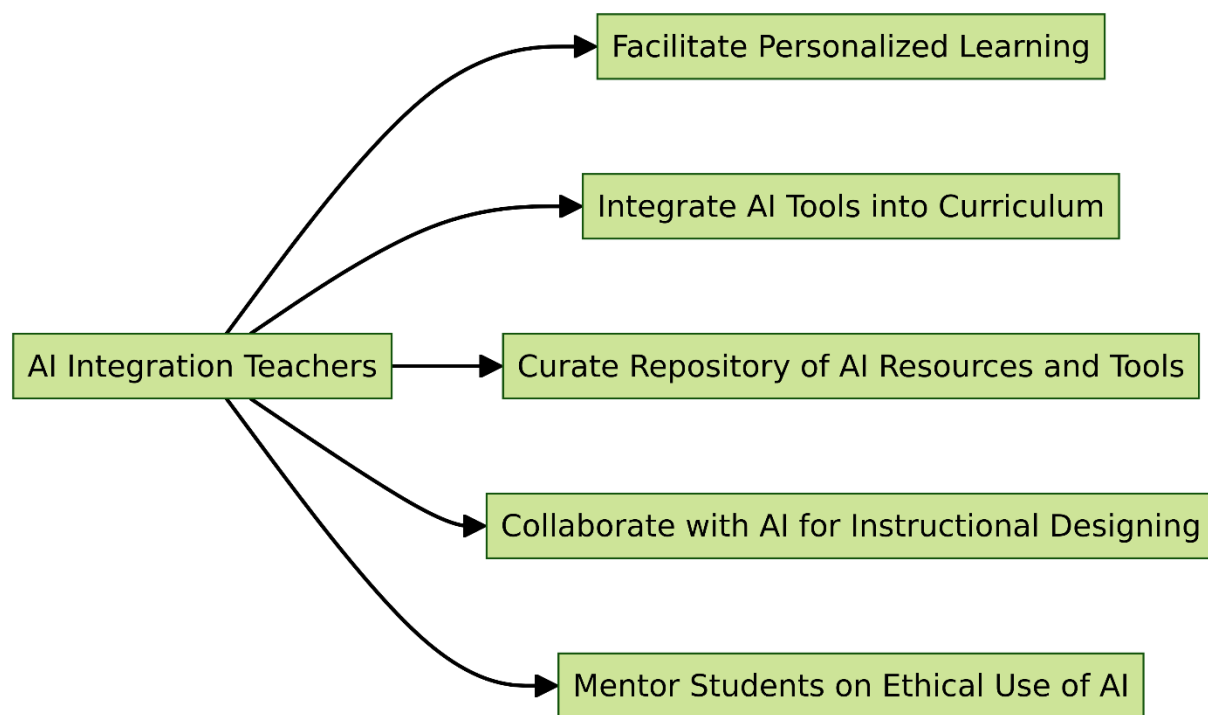

Figure 2. The roles of an AI- integration EFL Teacher

What are the competencies of AI- integration EFL Teacher?

The competencies of AI-integration EFL teachers likely consist of a blend of traditional teaching skills and new roles enabled by artificial intelligence. While specific competencies for AI-integration EFL teachers were not directly identified in the literature, inferences from related studies suggest that they might include:

- Pedagogical Expertise: Proficiency in conventional teaching methods while integrating AI tools to enhance learning, such as developing and implementing AI-enriched curricula for personalized experiences (Kim et al., 2022).

- Technical Proficiency: Understanding and employing AI-powered educational tools and platforms, including AI-driven content systems, language apps, and analytics to monitor student progress (Su & Yang, 2023).

- Adaptive Teaching Strategies: The ability to alter teaching approaches based on AI-driven insights into students' learning styles, levels, and progress, integrating diverse AI-supported resources into lessons (Brusilovsky, 2023).

- Ethical and Responsible Use of AI: Consciousness of ethical issues in using AI tools, such as data privacy, bias, and equity in technology access (Mhlanga, 2023).

- Lifelong Learning: A commitment to ongoing professional growth in teaching methodologies and AI technology, essential for keeping up with AI's rapid advancements (Wu, 2023).

- These core competencies, inferred from the broader AI in Education field, provide a foundational framework for understanding the skills and knowledge needed by EFL teachers in AI-integrated learning settings.

Cluster 1 in Table 1 shows that pedagogical expertise underscores the integration of AI and technological tools in education, highlighting five main areas. This includes the ability to effectively manage and facilitate learning, personalizing student experiences with AI enhancements (Purnama et al., 2021), and merging pedagogical content knowledge with AI to craft engaging English language lessons (Yazdanmehr et al., 2020). Additionally, the incorporation of technology to foster interactive learning environments is essential (Hartatik et al., 2022), as is the development of Technopedagogical Content Knowledge (TPACK), which is key in blending technology with traditional teaching methods (Cihat et al., 2019). Lastly, teachers must continuously engage in reflective practice and learning to adapt their pedagogical strategies to the evolving landscape of AI technologies, reflecting the dynamic nature of educational competence in today's digital age (Yangjun et al., 2020).

Table 1: Pedagogical expertise as a Competence Area

Cluster 1-Pedagogical expertise		
Competence area	**Behavioral focus**	**Literature sources**
1. Competence to Manage and Facilitate Learning	Teachers must have the ability to manage and facilitate the learning process effectively, utilizing AI tools to enhance classroom interaction and personalize learning experiences.	(Purnama et al., 2021)
2. Competence to Integrate Pedagogical Content Knowledge	Expertise in integrating pedagogical content knowledge with AI tools to design engaging and effective English language lessons.	(Yazdanmehr et al., 2020).
3. Competence in Using Technology in Pedagogy:	Competence in employing technology effectively within pedagogical practices, creating an interactive and engaging learning environment.	(Hartatik et al., 2022)

4. Development of Technopedagogical Content Knowledge:	Development and application of technopedagogical content knowledge (TPACK) to blend technological tools with pedagogical methods and content knowledge.	(Cihat et al., 2019)
5. Reflective Practice and Continuous Learning:	Engaging in reflective practice and continuous learning to improve pedagogical strategies and adapt to new AI technologies in the educational context.	(Yangjun et al., 2020)

Cluster 2 in Table 2 reveals that technical competence in education stresses the fusion of AI and digital tools into teaching, meaning educators should be adept with AI-based tools like adaptive learning software and intelligent tutoring systems to enhance educational experiences (Nong et al., 2021). They need to integrate technology into their teaching seamlessly to boost engagement and effectiveness (Torrato et al., 2020) and have a thorough understanding of digital literacy to skillfully navigate and employ online resources (Falloon, 2020). Utilizing the TPACK framework is critical, as it aids in crafting educational experiences that effectively merge content, pedagogy, and technology (Aslam et al., 2021). Moreover, educators should quickly adapt to new technologies and methodologies, showcasing an ongoing commitment to their professional development in the dynamic digital age (Mardiana, 2020).

Table 2. Technical competence as a Competence Area

Cluster 2- Technical competence		
Competence area	**Behavioral focus**	**Literature source**
6. Familiarity with AI and Technological Tools:	Proficiency in using AI-based tools and platforms for language learning, including adaptive learning software and intelligent tutoring systems.	(Nong et al., 2021)
7. Integration of Technology into Pedagogy:	Ability to integrate technology seamlessly into teaching practices to enhance pedagogical effectiveness and foster a more engaging learning environment.	(Torrato et al., 2020)
8. Digital Literacy:	Comprehensive understanding of digital literacy, including the ability to find, evaluate, utilize, share, and create content using information technologies and the internet.	(Falloon, 2020)
9. Technological Pedagogical Content Knowledge (TPACK):	Understanding of the TPACK framework and its application in designing and implementing technology-rich educational experiences that effectively integrate content knowledge, pedagogical strategies, and technology use.	(Aslam et al., 2021)
10. Adaptation to New Technologies:	Ability to quickly adapt to new technologies and methodologies for teaching and learning, demonstrating a commitment to continuous professional development in the digital age.	(Mardiana, 2020)

Cluster 3 in Table 3 illustrates that adaptive teaching strategies are vital for tailoring educational experiences to individual learners' needs. Educators must design and implement unique learning experiences tailored to each student's needs, preferences, and performance levels, with AI supporting these adaptations(Demertzi & Demertzis, 2020). They should use Adaptive Educational Systems (AES) to customize teaching materials and strategies based on analyses of students' learning models (Demertzi & Demertzis, 2020). Additionally, the integration of ICT tools and digital resources in teaching enriches the learning environment, making it more dynamic (Nordin & Yunus, 2021). Educators must master adaptive content delivery to ensure that teaching aligns with every student's learning style and pace (Peng et al., 2019). Furthermore, developing adaptive expertise enables educators to apply their deep knowledge flexibly across different teaching scenarios, meeting a variety of educational challenges (Männikkö & Husu, 2019). Overall, these strategies underscore a modern, responsive approach to education, fostering effective and personalized learning.

Table 3: Adaptive Teaching Strategies as a Competence Area

Cluster 3- Adaptive Teaching Strategies		
Competence area	**Behavioral focus**	**Literature source**
11. Personalized and Adaptive Learning Approaches:	Proficiency in designing and implementing personalized learning experiences that adapt to individual student needs, preferences, and performance levels, utilizing AI to support these efforts.	(Demertzi & Demertzis, 2020)
12. Utilization of Adaptive Educational Systems (AES):	Ability to effectively employ AES to adjust teaching content and strategies based on real-time analysis of student data, enhancing learning outcomes.	(Demertzi & Demertzis, 2020)
13. Incorporation of ICT and Digital Tools:	Competence in integrating information and communication technology (ICT) tools and digital resources into lesson plans to create engaging and dynamic learning environments.	(Nordin & Yunus, 2021)
14. Adaptive Content Delivery:	Mastery in delivering content that is adapted to the learning style and pace of each student, facilitating a more effective and individualized learning process.	(Peng et al., 2019)
15. Development of Adaptive Expertise:	Development of adaptive expertise characterized by the ability to apply deep knowledge flexibly across different teaching scenarios and challenges.	(Männikkö & Husu, 2019)

Cluster 4 in Table 4 demonstrates that the essence of ethical and responsible AI use in education involves tackling ethical challenges like privacy, fairness, transparency, and accountability linked with AI technologies (Akgun & Greenhow, 2022). Educators are encouraged to promote and apply ethical AI practices in learning settings, ensuring that AI tools are used responsibly to support student learning (Sanusi & Olaleye, 2022). Critically assessing AI tools for biases and ensuring they meet ethical standards and educational goals is vital (Salas-Pilco et al., 2022). Integrating ethical considerations into AI curriculum design is essential to educate students on AI's societal effects (Bae et al., 2022). There's also a push for advocating responsible AI deployment in education, reflecting on its impact on students, teachers, and the overall educational system (Bu, 2022). Collectively, these responsibilities underscore the need for educators to maneuver through AI's complexities with ethical integrity, creating a safe, equitable, and transparent learning environment.

Table 4: Ethical And Responsible Ai Use of Ai as a Competence Area

Cluster 4- Ethical and Responsible Use of AI:		
Competence area	**Behavioral focus**	**Literature source**
16. Understanding and Addressing Ethical Challenges:	Knowledge of the ethical challenges and dilemmas of using AI in education, including issues of privacy, fairness, transparency, and accountability.	(Akgun & Greenhow, 2022)
17. Promoting Ethical AI Usage in Learning Environments:	Advocating for and implementing ethical AI practices in the classroom, ensuring AI tools are used responsibly to support student learning.	(Sanusi & Olaleye, 2022)
18. Critical Evaluation of AI Tools:	Ability to critically evaluate AI tools and applications for potential biases, ensuring they align with ethical standards and educational goals.	(Salas-Pilco et al., 2022)
19. Ethical Considerations in AI Curriculum Design:	Incorporating ethical considerations into AI curriculum design and instruction, helping students understand the impact of AI on society	(Bae et al., 2022)
20. Advocacy for Responsible AI Deployment:	Advocacy for the responsible deployment of AI technologies in education, considering the potential impacts on students, teachers, and the broader educational landscape.	(Bu, 2022)

Cluster 5 in Table 5 states that the prevailing framework for lifelong learning in education highlights the importance of ongoing professional development, especially with the advent of new AI technologies and teaching methods (Siregar, 2020). It emphasizes the need for educators to be adaptable and flexible, integrating new AI tools and approaches as technology evolves (Garcia-Esteban et al., 2021). Lifelong learning principles should be integrated into educational practices, encouraging a culture of continuous learning and adaptability among students (Kirsanova & Lazarev, 2019). Educators are urged to actively pursue self-directed learning, seeking further qualifications and certifications to broaden their teaching skills (Khomenko et al., 2021). Additionally, engaging in reflective practice and being open to feedback are essential for effective teaching and ongoing professional development (Nong et al., 2021). These competencies together promote a dynamic approach to education, ensuring that educators stay effective and relevant in the fast-evolving educational environment.

Table 5: Lifelong learning as a Competence Area

Cluster 5 - Lifelong Learning		
Competence area	**Behavioral focus**	**Literature source**
21. Continuous Professional Development:	Engagement in ongoing professional development and learning, including staying updated on the latest AI technologies and pedagogical strategies.	(Siregar, 2020)
22. Adaptability to Technological Changes:	Adaptability and flexibility in incorporating new AI tools and methods into teaching practices, responding to the evolving digital landscape.	(Garcia-Esteban et al., 2021)

23. Integration of Lifelong Learning in Teaching:	Implementing lifelong learning principles in their teaching, encouraging students to develop a continuous learning mindset.	(Kirsanova & Lazarev, 2019)
24. Self-Directed Learning and Improvement:	Commitment to self-directed learning and self-improvement, including the pursuit of additional qualifications and certifications.	(Khomenko et al., 2021)
25. Reflective Practice and Feedback Incorporation:	Regular engagement in reflective practice, including seeking and incorporating feedback to enhance teaching effectiveness.	(Nong et al., 2021)

As shown in Table 6, numerous competencies within AI-enhanced education exhibit significant overlaps in meanings and functions, indicating a strong connection in behavioral focus and literature sources. For example, the ability to manage and facilitate learning (Yang, 2022) and the integration of technology into pedagogy (Holmström, 2022) both aim to establish effective learning environments, with the former broadly addressing learning management and facilitation, and the latter focusing on enhancing pedagogical effectiveness through technology integration. Similarly, competencies like integration of pedagogical content knowledge (Hwang et al., 2023), development of technopedagogical content knowledge (Hwang et al, 2023), and technological pedagogical content knowledge (TPACK) (Vera, 2023) share the objective of combining content knowledge with pedagogical strategies and technology to create meaningful learning experiences.

Competencies emphasizing the use of technology in education, such as use of technology in pedagogy (3), familiarity with AI and technological tools (Shin et al., 2022), and incorporation of ICT and digital tools (Pokrivcakova, 2023), highlight the critical role of technology and AI tools in creating engaging learning environments. reflective practice and continuous learning (Malik & Solanki, 2021), continuous professional development (Foucrier & Wiek, 2019), self-directed learning and improvement (Guofang, 2019), and reflective practice and feedback incorporation (Lestari, 2020) all emphasize the importance of ongoing learning and reflective practice for professional development.

Competencies centered on creating personalized and adaptive learning experiences, like personalized and adaptive learning approaches (Rusmiyanto et al., 2023), utilization of adaptive educational systems (AES) (Woosnam et al., 2018), and adaptive content delivery (Luo & Xie, 2018), stress designing individualized learning experiences using AI and AES. development of adaptive expertise (Song & Song, 2023) and adaptability to technological changes (Fong et al., 2022) focus on the ability to flexibly apply knowledge in various teaching scenarios.

Ethical considerations in AI use, such as understanding and addressing ethical challenges (16), promoting ethical ai usage (Sysoyev, 2023), critical evaluation of AI tools (Nouraldeen, 2023), and ethical considerations in AI curriculum design (Andani et al., n.d.), deal with the responsible use of AI and its evaluation for bias. advocacy for responsible AI deployment (Basenach et al., 2023) and integration of lifelong learning in teaching (Nguyen et al., 2022) emphasize a forward-looking approach to education, with distinct focuses on responsible AI advocacy and embedding lifelong learning principles.

Recognizing these overlapping competencies can assist educators in streamlining their professional development, promoting a unified approach to integrating AI into educational practices.

Table 6: Proposed AI Competencies

Proposed AI- integration EFL Teacher Competencies	Literature sources

1. Ability to manage and facilitate learning	(Purnama et al., 2021; Torrato et al., 2020)
2. Integration of pedagogical content knowledge	(Aslam et al., 2021; Cihat et al., 2019; Garcia-Esteban et al., 2021; Yazdanmehr et al., 2020).
3. Use of technology in pedagogy:	(Hartatik et al., 2022; Nong et al., 2021; Nordin & Yunus, 2021).
4. Reflective practice and continuous learning	(Falloon, 2020; Nong et al., 2021; Siregar, 2020)
5. Personalized and adaptive learning approaches	(Demertzi & Demertzis, 2020; Garcia-Esteban et al., 2021; Männikkö & Husu, 2019; Peng et al., 2019)
6. Development of adaptive expertise	(Garcia-Esteban et al., 2021; Männikkö & Husu, 2019)
7. Understanding and addressing ethical challenges	(Akgun & Greenhow, 2022; Bae et al., 2022; Salas-Pilco et al., 2022; Sanusi & Olaleye, 2022)
8. Advocacy for responsible AI deployment	(Bu, 2022; Kirsanova & Lazarev, 2019)

Impact of AI integration Course on Students' AI competencies and readiness

This study explores the integration of AI into preservice EFL education, highlighting its potential to enhance the educational experience through personalized learning, improved engagement, and the development of essential 21st-century skills. The justification for incorporating AI includes its ability to offer personalised learning experiences, as evidenced by the success of Automated Writing Evaluation (AWE) tools in improving Chinese EFL learners' writing skills (Wei et al., 2023), thereby ensuring education is more accessible and effective. Furthermore, AI tools like ChatGPT have been shown to significantly boost students' writing skills by providing interactive and engaging learning experiences (Song & Song, 2023). Moreover, the incorporation of AI prepares students for a digitally driven future, equipping them with necessary digital literacy and AI competencies (Young & Shishido, 2023), and caters to diverse learning needs (Luo & Xie, 2018). This holistic approach not only enhances the learning environment but also ensures that future educators are well-prepared to utilize technology effectively and ethically in their teaching practices.

The initial phase in incorporating AI into preservice EFL education involves defining the role of AI-integrated EFL teachers. Their practice should center on their capacity to personalize learning with AI tools, integrate AI tools into the curriculum, manage a repository of AI resources, collaborate with AI for instructional design, and mentor students on the ethical use of AI. Eight detailed constructs—ability to manage and facilitate learning, integration of pedagogical content knowledge, use of technology in pedagogy, reflective practice and continuous learning, personalized and adaptive learning approaches, development of adaptive expertise, understanding and addressing ethical challenges, and advocacy for responsible AI deployment—were derived from prevailing competencies such as pedagogical expertise, technical proficiency, adaptive teaching strategies, ethical and responsible use of AI, and lifelong learning. This initiative, inspired by prior research on conceptual frameworks for AI integration in EFL education (Wei et al., 2023), marks the commencement of curriculum or syllabus development needed for AI-integration in EFL courses.

Hence, assessing the impact of AI-integrated English as a Foreign Language (EFL) education in preservice programs is critical for understanding its effect on students' AI competencies and their readiness to integrate AI into their classroom in future. This comprehensive evaluation is necessary due to AI's potential to improve educational experiences, especially in language learning, and its role in fostering skills relevant to AI integration in teaching. The evaluation should cover the constructed eight AI competencies, such as managing and facilitating learning; integrating pedagogical content knowledge; employing technology in teaching; engaging in reflective practice and continuous

learning; personalizing and adapting instruction; developing adaptive expertise; addressing ethical challenges; and promoting responsible AI use. This approach underscores the relationship between competencies gained from AI-enhanced learning environments and students' future readiness to employ AI in educational settings.

To deepen the understanding of AI integration within EFL education in preservice programs, a self-assessment of AI integration competence can be implemented. This competence includes teachers' abilities to effectively integrate AI technologies into their teaching, which encompasses understanding AI tools, incorporating them into curriculum designs, and enhancing student learning outcomes with AI. Teachers' AI integration competence covers their knowledge of educationally relevant AI applications, proficiency in using AI tools for teaching, and the capacity to critically assess AI technologies for educational use (Sun et al., 2023). According to self-perception theory, individuals deduce their attitudes from their actions under perceived free choice (Woosnam et al., 2018). Thus, impact can be assessed by how they view the identified and synthesised eight competencies. Moreover, mastering the identified eight AI integration competencies is essential for equipping students to effectively apply AI technologies in language teaching. Therefore, evaluating students' competencies should not only measure their proficiency with specific AI tools but also their ability to apply these technologies thoughtfully in teaching scenarios (Song & Song, 2023).

AI readiness encompasses a combination of eagerness to learn about AI, motivation to incorporate AI into current teaching methods, and adaptability to the evolving landscape of educational technologies (Holmström, 2022). The Technology Acceptance Model (TAM) by (Davis, 1989) posits that perceived usefulness and ease of use significantly influence technology acceptance, highlighting a meaningful connection between AI integration competence and readiness. This model indicates that as teachers progress in the eight proposed areas of AI competence, their perception of AI tools as accessible and beneficial increases, thereby enhancing their readiness to implement these tools in their teaching practices. Empirical research supports this notion, demonstrating that educators' and students' familiarity with AI positively impacts their attitudes towards AI and readiness for its educational integration (Christensen, 2002). These insights underscore the critical nature of assessing AI integration competencies' impact on readiness, pivotal for the effective integration and evaluation of AI in teacher training programs.

The effectiveness of integrating AI courses in English as a Foreign Language (EFL) teacher training programs largely hinges on key factors such as attitudes towards AI, exposure to AI in educational settings, and the creation of collaborative learning environments. These elements significantly influence preservice teachers' readiness to integrate AI into their teaching. Moreover, the Theory of Planned Behavior (TPB) offers a significant framework for understanding the integration of Artificial Intelligence (AI) in English as a Foreign Language (EFL) classrooms by focusing on teachers' attitudes towards AI (Pokrivcakova, 2023). This is because positive attitudes toward AI, highlighting its usefulness and ease of use, play a crucial role in motivating students to embrace AI technologies in language instruction (Hopcan et al., 2023). Additionally, first hand experiences with AI applications in education help demystify the technology and demonstrate its potential for enhancing teaching methodologies (Vlasova et al., 2019). Incorporating case studies, simulations, and hands-on AI interactions into the curriculum equips preservice teachers with a practical understanding of AI's role in language teaching. Furthermore, fostering collaborative learning spaces where preservice teachers can share AI experiences and strategies enhances their readiness for AI integration by offering peer support and promoting collaborative learning (Maulidevi & Ahmad, 2006). Essentially, these elements—positive attitudes, practical AI exposure, and cooperative learning—are crucial for successfully integrating AI into EFL teacher training programs, underscoring the importance of developing training programs that effectively prepare educators to integrate AI into language teaching, thereby improving the quality of EFL education.
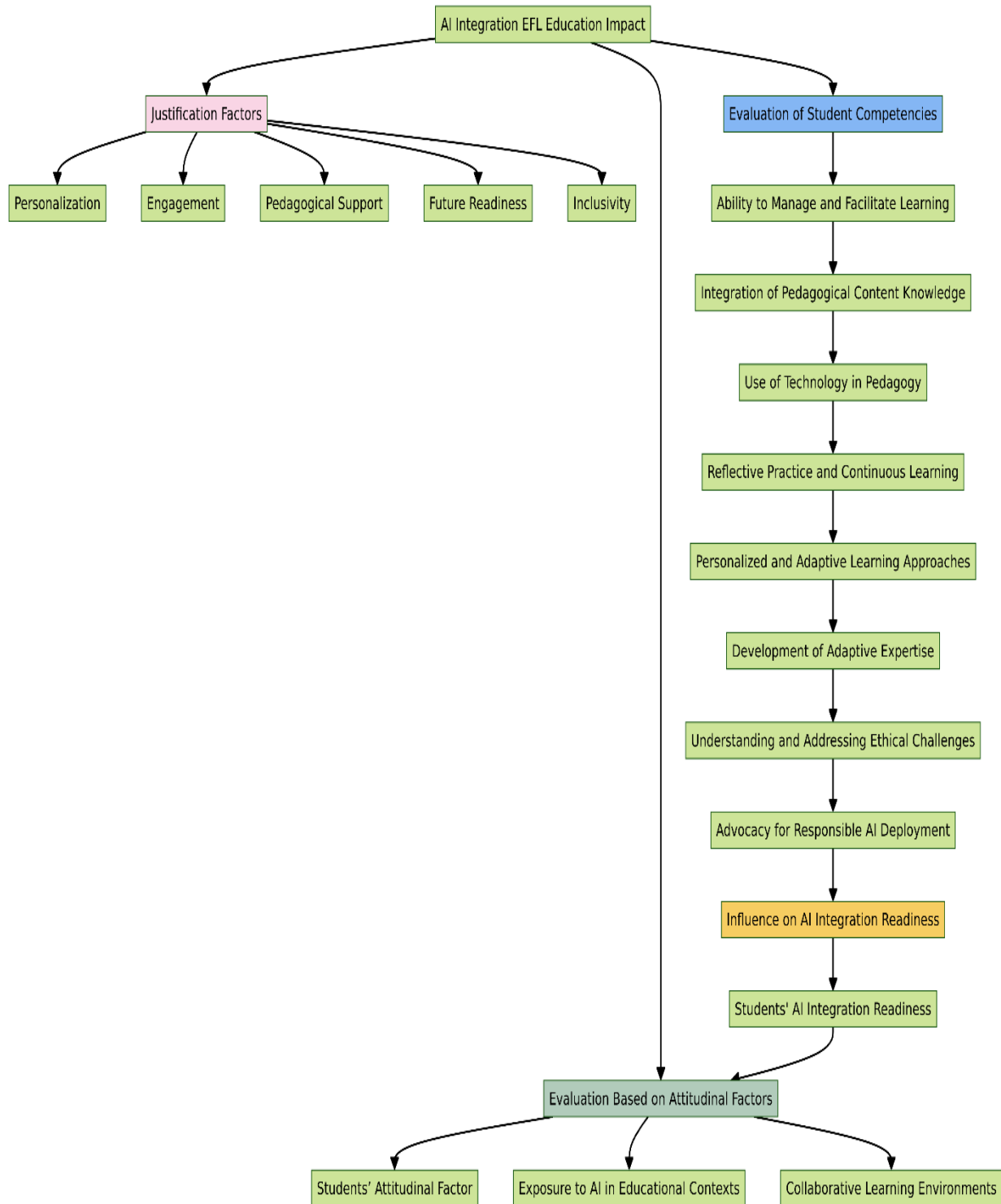
Figure 3. Conceptual Research Model to Investigate the Impact of AI Integration Course on Students' AI Competencies and Readiness (Created by the authors)

DISCUSSION

The review literature yielded no data on integrating AI integration course in EFL teacher education program. To plug this gap, it is critical to develop a competency framework that can be used to

generate curriculum and syllabus for to this course. Consequently, this research set out to develop a research competency model a AI integration course that can be used t to assess the impact of its education on Students' AI Competencies and readiness.

The adopted framework consists of a model that commences with a validated competency. It is method of generating a model based on an existing competency model that includes the requisite generic competencies (Lucia & Lepsinger, 1999). For example, pedagogical expertise, technical proficiency, adaptive teaching strategies, ethical and responsible use of AI and lifelong learning are picked up as the core competencies of AI integration course. Key competencies from every one of these were synthesized to generate competencies for AI integration. A similar approach was taken in the development of a system of competencies for online teacherpreneurship by (Lasekan et al., 2021).

The second research question of this study involves conceptualizing a model that can assess AI integration education's impact on students' AI integration competence and readiness, and factors that fosters the sustainability of the education in preservice EFL teacher education. We argue that main objective of creating and integrating the course in student-EFL teacher education is centered on personalization of learning, promote students' engagement, provide pedagogical support, prepare students for the future, and promote inclusivity in classroom. This is followed by a robust AI integration education that is expected to address all the competencies (ability to manage and facilitate learning, integration of pedagogical content knowledge, use of technology in pedagogy, reflective practice and continuous learning, personalized and adaptive learning approaches, development of adaptive expertise, understanding and addressing ethical challenges, advocacy for responsible AI deployment) of an AI integration EFL teacher. Level 1, then is the impact assessment of this education. AI integration readiness, level 2, is directly proportion to the level 1: Impact of AI integration education. So, the level of students' AI integration readiness gained is directly proportion to the level of AI integration competencies acquired by the students (Malik & Solanki, 2021). The impact assessment of the course and the level of students' AI integration readiness, in level 1 and 2 respectively, are also influenced by some attitudinal antecedents, by students' exposure to AI in educational contexts and by establishment of collaborative learning environments in which such education is being offered. Some alikeness can be observed with the model developed for examining the impact of entrepreneurship education on entrepreneurial competencies and entrepreneurial intentions (Draksler & Širec, 2018).

The study's conceptual model sheds light on the benefits of AI-integration education for preservice EFL teachers' readiness and competencies, representing a significant contribution by identifying the need for AI-focused courses within the existing teacher preparation curriculum. This initiative has the central goal of enhancing personalized learning, fostering engagement, and providing essential pedagogical support to shape future educators capable of navigating transforming classroom dynamics and promoting inclusivity. Furthermore, the model illustrates that students' AI-integration readiness depends on the extent of their competency development, suggesting that comprehensive AI-integration courses are necessary for preservice EFL teachers to acquire the modern skill set expected today. This includes effective management and facilitation of learning, integration of pedagogical content knowledge, adaptation of technological knowledge to meet English language learners' needs, and a commitment to reflective practice and continuous professional growth. Moreover, while the model could guide the modification of both preservice and in-service EFL education programs—necessitating a shift towards a more positive attitude toward AI and ensuring significant opportunities for authentic AI experiences. It also emphasizes the importance of cultivating a learning and collaboration social context, as recommended by (Ayala & Yano, 1998). This is crucial for fostering not only the technological skills required of contemporary EFL teachers but also for nurturing the disposition to use technology to meet diverse learners' needs and uphold ethical standards. Consequently, the adaptability and innovation fostered by such a disposition may come to define the future of effective teaching methodologies. In summary, the findings from this

study have the potential to extend beyond preservice education, inspiring future research and innovative instruction not only for novices but also for seasoned in-service professionals, all of whom will ultimately be evaluated on their ability to meet the needs of learners with the best tools the twenty-first century has to offer.

Based on the conceptualize research model, AI integration in preservice EFL teacher education be optimized, it would be pertinent to advocate for the strategic integration of Artificial Intelligence (AI) technologies within English as a Foreign Language (EFL) classrooms (Reiss, 2021). This is because AI offers personalized learning experiences that adapt to individual student needs (Hashim et al., 2022). For example, the deployment of AI language learning tools can significantly improve interaction and engagement, fostering a more immersive and practical language learning environment (De la Vall & Araya, 2023). Additionally, integrating AI can support inclusive education, ensuring that diverse learner needs are met, thereby democratizing language learning (Gupta & Chen, 2022). Moreover, we advise that lifelong learning be emphasized as a cornerstone for EFL educators and preservice teachers to remain abreast of continuous AI advancements (Poquet & De Laat, 2021), thereby augmenting their professional competencies and pedagogical methodologies (Abdalina et al., 2022). Educators need to engage in ongoing learning to adapt to technological changes and leverage AI's potential to enhance language teaching effectiveness and student engagement (Westberry et al., 2015). It is also suggested that curricula policy should focus on integrating AI through a holistic approach encompassing multidimensional competencies such as technological, pedagogical, and interpersonal skills (Sanusi & Olaleye, 2022). This approach should be supported by interdisciplinary, project-driven courses that provide hands-on experiences and foster learning communities (Eaton, 2017). Furthermore, it is proposed that fostering collaborative learning environments is vital for the effective sharing of AI integration strategies, enhancing the community of practice model (Ayala & Yano, 1998). The implementation of AI in educational settings offers an opportunity for collaborative problem-solving and project-based learning, where educators and students can work together on real-world AI applications. This hands-on experience is essential for understanding AI concepts and developing relevant skills. By incorporating AI projects into the curriculum, educators can create an immersive learning experience that fosters critical thinking, creativity, and collaboration among students (Emara et al., 2021). Lastly, policymakers are advised to support the ethical integration of AI into educational frameworks, specifically within EFL teaching, ensuring a balance between technological advancement and educational ethics. Emphasis should be placed on professional development programs that encompass both AI technological skills and ethical considerations, promoting an inclusive and equitable learning environment (Nguyen et al., 2023). The authors state the need to develop educational policies that address concerns such as data privacy, bias, and the preservation of cultural nuances, thereby ensuring a balanced, fair, and productive integration of AI technologies in education.

Lastly, regarding the significance of AI integration in preservice EFL teacher education, further investigation is essential to assess the impact of AI integration courses on students' competencies and readiness. Specifically, future research should focus on longitudinal studies to track the long-term impact of AI competency development on teaching practices, exploring areas such as curriculum design, teacher attitudes and beliefs, and the effectiveness of teaching experiences in developing AI skills. Additionally, evaluating the redesign of teacher education programs to include AI and technology integration, mapping technology integration learning to course experiences, and assessing the effects on preservice teachers' knowledge are critical for advancing the field. This comprehensive approach will illuminate the multifaceted relationship between AI integration in education and the preparation of future EFL teachers, contributing to a deeper understanding of how to effectively incorporate AI into educational settings.

CONCLUSION

In sum, this research aimed to develop and validate a model for assessing the impact of AI integration courses on preservice EFL teachers' competencies and readiness. The competencies framework identified includes pedagogical expertise, technical proficiency, adaptive teaching strategies, ethical and responsible use of AI, and lifelong learning. These are crucial for future AI-integrated EFL teachers to create effective learning environments and harness the educational advantages of AI tools. The key contribution of this study lies in devising a method to evaluate the influence of AI integration courses on the preparedness and abilities of student-teachers. This evaluation is vital for determining the effectiveness of the course and future educators' ability to effectively integrate AI into their teaching methodologies. However, this investigation recognizes that the proposed framework may not cover all specific competencies due to the broad nature of existing literature. Therefore, it highlights the necessity for further empirical research to refine and tailor the framework, ensuring it corresponds with actual AI-integration EFL teaching practices. This tailored approach will improve the AI integration model's relevance and applicability in varied educational contexts, supporting the professional growth of preservice EFL teachers.

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