

DESIGNING AN AI-ASSISTED VIRTUAL LEARNING ENVIRONMENT FOR DEVELOPING ENGLISH COMMUNICATIVE COMPETENCE

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Abstract

The rapid advancement of artificial intelligence (AI) has significantly reshaped English language education by expanding the possibilities of virtual learning environments. However, many existing digital platforms still lack intelligent support for personalized learning, continuous formative assessment, and the systematic development of communicative competence. This paper proposes a conceptual framework for an AI-assisted virtual learning environment designed to enhance English communicative competence among pre-service preschool and primary education teachers through the Reading and Writing Practice course. The proposed framework integrates a learning management system with AI-driven learning support to provide structured learning materials, personalized feedback, automated writing assessment, learning analytics, and progress monitoring. The study employs a conceptual research design based on a comprehensive review and synthesis of recent literature on artificial intelligence, virtual learning environments, communicative language teaching, and self-directed learning in higher education. The proposed framework highlights the pedagogical and technological components required to create an effective virtual English learning environment that promotes learner autonomy, engagement, and continuous language development. The study contributes to the growing body of research on AI-enhanced language education by offering a theoretically grounded framework that can support future empirical research and guide the implementation of intelligent virtual learning environments in English language teaching.

Keywords: Artificial intelligence, virtual learning environment, English language teaching, communicative competence, higher education, personalized learning.

Introduction

Artificial intelligence (AI) has become one of the most influential technological innovations driving digital transformation in higher education. The rapid evolution of intelligent educational technologies has significantly reshaped teaching, learning, and assessment practices by enabling adaptive instruction, personalized feedback, learning analytics, and intelligent tutoring systems. Consequently, AI has attracted considerable attention in English language teaching (ELT), where it offers new opportunities to improve learners' communicative competence through technology-enhanced and learner-centred instruction.

Simultaneously, virtual learning environments (VLEs) have evolved from simple content delivery platforms into comprehensive educational ecosystems that facilitate independent learning, collaboration, and continuous assessment. Learning management systems such as Canvas, Moodle, and Google Classroom have become widely adopted in higher education because they enable instructors to organize learning resources, monitor learners' progress, and support flexible learning regardless of time and location. Nevertheless, despite these technological advances, many existing VLEs still provide limited adaptive support, delayed formative feedback, and insufficient personalization, particularly in English language courses where continuous interaction and immediate feedback are essential for developing communicative competence.

Recent advances in artificial intelligence have addressed some of these limitations by introducing intelligent writing assistants, automated assessment systems, conversational agents, and generative AI applications capable of providing individualized feedback and learning support. Studies increasingly report positive effects of AI on language learning outcomes, learner motivation, self-regulated learning, and writing performance. However, much of the existing research has concentrated on evaluating individual AI tools rather than examining how AI can be

systematically integrated into pedagogically grounded virtual learning environments designed specifically for English language education.

Although previous studies have confirmed the educational potential of AI, relatively little attention has been devoted to developing comprehensive conceptual frameworks that integrate artificial intelligence, virtual learning environments, communicative language teaching principles, formative assessment, and learning analytics into a unified instructional model. This limitation is particularly evident in the preparation of pre-service preschool and primary education teachers, whose professional development requires the simultaneous acquisition of English communicative competence, digital literacy, and autonomous learning skills. Therefore, there remains a need for a pedagogically grounded framework capable of supporting technology-enhanced English language learning within higher education.

Accordingly, this study proposes a conceptual framework for an AI-assisted virtual learning environment designed to develop English communicative competence through the Reading and Writing Practice course. The proposed framework integrates artificial intelligence, learning management systems, personalized feedback, learning analytics, and formative assessment within a coherent pedagogical model intended to support independent learning and continuous language development. By synthesizing current theoretical and empirical evidence, the study contributes to the growing body of research on AI-enhanced English language education and provides a foundation for future empirical investigations and practical implementation in higher education.

Literature Review

The application of artificial intelligence (AI) in education has attracted increasing scholarly attention over the last decade, particularly following the rapid advancement of machine learning and generative AI technologies. Zawacki-Richter et al. (2019) identified intelligent tutoring systems, adaptive learning, automated assessment, and institutional management as the dominant areas of AI implementation in higher education while simultaneously noting that pedagogical perspectives remained considerably underrepresented. Building upon this observation, Holmes et al. (2022) argued that the future success of AI in education

depends less on technological sophistication than on its pedagogically meaningful integration into teaching and learning processes. Similarly, Luckin and Cukurova (2019) emphasized that AI should be regarded as a tool for augmenting teachers' instructional capacity rather than replacing human interaction, whereas Crompton and Burke (2023) demonstrated that recent research has increasingly shifted towards learner-centred AI applications capable of providing adaptive learning experiences, immediate feedback, and personalized instructional support. These findings collectively suggest that the educational value of AI lies not in automation itself but in its ability to improve teaching effectiveness and learner engagement through carefully designed pedagogical frameworks.

Within English language education, researchers have reported substantial progress in applying AI to support language acquisition, particularly in writing instruction, speaking practice, vocabulary development, and learner autonomy. Chapelle (2001) was among the first to argue that technology-enhanced language learning should facilitate authentic communication rather than merely digitize traditional instruction. Expanding this perspective, Richards (2006) and Richards and Rodgers (2014) maintained that communicative competence develops most effectively through meaningful interaction supported by appropriate instructional strategies. More recently, Lo (2023), Kasneci et al. (2023), Kohnke, Moorhouse, and Zou (2023), and Godwin-Jones (2021) examined the educational implications of generative AI and reported that intelligent language models can significantly improve learners' writing quality, idea generation, language accuracy, and independent learning. Likewise, Crompton et al. (2024) concluded that AI-assisted language learning contributes positively to learner motivation, formative assessment, and personalized instruction while simultaneously requiring teachers to develop new digital pedagogical competencies. Despite these advantages, Yan et al. (2023), Holmes et al. (2022), and Kasneci et al. (2023) cautioned that excessive reliance on AI may reduce critical thinking, learner creativity, and authentic teacher–student interaction if pedagogical guidance is insufficient.

Parallel to advances in AI, virtual learning environments have become fundamental components of higher education. Garrison and Vaughan (2008) argued

that effective virtual learning environments should support collaboration, learner autonomy, and continuous interaction rather than merely providing digital access to instructional materials. Similarly, Martin, Sun, and Westine (2020) identified instructional design, interaction quality, and learner engagement as the principal determinants of successful online education. Drawing upon constructivist learning theory, Vygotsky (1978) emphasized the importance of social interaction in cognitive development, a principle that remains highly relevant to contemporary virtual language learning. More recent investigations by Liu et al. (2025), Cong-Lem (2025), and Wang et al. (2026) demonstrate that AI-integrated virtual learning environments can enhance learner autonomy, adaptive learning, formative assessment, and academic engagement by combining learning management systems with intelligent feedback mechanisms. Nevertheless, these studies consistently report that most existing platforms continue to function primarily as repositories of learning materials rather than comprehensive pedagogical ecosystems capable of supporting continuous communicative language development.

Although the literature consistently demonstrates the educational benefits of both artificial intelligence and virtual learning environments, a number of important research gaps remain. Most previous investigations have examined individual technologies—including ChatGPT, automated writing evaluation systems, conversational agents, or intelligent tutoring systems—as separate instructional interventions. Comparatively limited attention has been devoted to designing comprehensive AI-assisted virtual learning environments that integrate learning management systems, personalized feedback, formative assessment, learning analytics, and communicative language teaching principles within a unified pedagogical framework. Furthermore, relatively few studies have focused specifically on pre-service preschool and primary education teachers, despite their need to simultaneously develop English communicative competence, digital literacy, and autonomous learning skills. Addressing these gaps, the present study proposes a pedagogically grounded conceptual framework that systematically integrates artificial intelligence into a virtual learning environment to support the development of English communicative competence through the Reading and Writing Practice course.

Materials and Methods

This study employed a conceptual research design to develop an AI-assisted virtual learning environment aimed at enhancing English communicative competence among pre-service preschool and primary education teachers. Rather than collecting primary empirical data, the study synthesized existing theoretical and empirical evidence to construct a pedagogically grounded framework for virtual English language instruction.

Relevant literature was retrieved from the Scopus and Web of Science databases, as these are internationally recognized sources of peer-reviewed research. The search focused on studies published between 2019 and 2025 using combinations of the keywords *artificial intelligence*, *virtual learning environment*, *English language teaching*, *communicative competence*, *learning management system*, *higher education*, and *generative AI*. Only peer-reviewed journal articles published in English and directly related to AI-supported language learning or virtual learning environments were included, while conference papers, book chapters, dissertations, duplicate records, and studies unrelated to English language education were excluded.

The selected studies were examined using thematic analysis, which enabled the identification, comparison, and synthesis of recurring pedagogical and technological themes across the literature. The analysis followed a structured process of literature screening, coding, theme development, and conceptual integration to ensure methodological rigor in framework development. Thematic analysis is widely recognized as an appropriate approach for developing conceptual models from qualitative evidence.

Based on the synthesized evidence, a conceptual framework was developed by integrating the major dimensions consistently identified in previous studies, including artificial intelligence, virtual learning environments, personalized learning, formative assessment, learning analytics, and communicative language teaching. The proposed framework was designed to demonstrate how these interconnected components can collectively support the development of English communicative competence within a technology-enhanced learning environment.

Results

The comprehensive analysis of the selected literature enabled the development of an AI-assisted virtual learning environment that integrates pedagogical and technological components into a unified instructional framework for English language education. Unlike many existing virtual learning environments, which primarily function as repositories of instructional materials, the proposed framework emphasizes intelligent interaction, personalized learning, continuous formative assessment, and data-driven instructional support. The framework was developed by synthesizing recurring themes identified across previous studies, including artificial intelligence, virtual learning environments, communicative language teaching, learning analytics, formative assessment, and learner autonomy.

The proposed framework is organized around five interconnected components that collectively support the development of English communicative competence. The first component, the Learning Management System (LMS), functions as the central digital platform where learning materials, assignments, assessments, and communication activities are organized. Integrated within the LMS is the Artificial Intelligence Module, which provides automated writing evaluation, immediate language feedback, personalized learning recommendations, and intelligent academic assistance throughout the learning process. These AI functions reduce feedback delays and provide individualized support that is difficult to achieve in conventional classroom settings.

The third component comprises interactive learning resources, including digital reading texts, academic writing activities, collaborative tasks, multimedia materials, and self-directed learning exercises aligned with communicative language teaching principles. The fourth component, learning analytics, continuously collects and analyzes learner performance, participation, task completion, and assessment data, enabling instructors to monitor students' progress and identify individual learning needs. The final component, formative assessment, combines AI-generated feedback with teacher evaluation to promote continuous improvement while preserving the pedagogical role of the instructor.

The interaction of these five components establishes an integrated virtual learning ecosystem in which students actively engage in independent learning, receive

immediate feedback, revise their written work, monitor their learning progress, and gradually strengthen their communicative competence. Simultaneously, instructors utilize learning analytics and AI-generated reports to provide timely pedagogical support and make evidence-informed instructional decisions. Consequently, the proposed framework extends existing approaches by integrating artificial intelligence into every stage of the teaching and learning process rather than limiting its role to isolated instructional tasks.

The proposed framework demonstrates that effective AI integration in English language teaching requires the balanced combination of intelligent technologies, pedagogically meaningful instructional design, continuous assessment, and learner-centred interaction. Therefore, the framework provides a theoretical basis for designing AI-assisted virtual learning environments capable of supporting sustainable communicative competence development in higher education.

Discussion

The proposed AI-assisted virtual learning environment contributes to the ongoing discourse on artificial intelligence in English language education by offering a pedagogically integrated framework rather than focusing on isolated technological applications. Previous studies have consistently demonstrated that AI can improve writing performance, learner engagement, adaptive learning, and formative assessment (Zawacki-Richter et al., 2019; Holmes et al., 2022; Crompton & Burke, 2023; Kasneci et al., 2023). However, these studies primarily examined the effectiveness of individual AI tools without explaining how such technologies can be systematically incorporated into a comprehensive virtual learning environment. The framework proposed in the present study addresses this limitation by integrating artificial intelligence with learning management systems, communicative language teaching, learning analytics, and continuous formative assessment within a single pedagogical model.

The findings also reinforce the argument that artificial intelligence should function as a pedagogical facilitator rather than an instructional substitute. Holmes et al. (2022) emphasized that the educational value of AI depends on its alignment with sound pedagogical principles, while Luckin and Cukurova (2019) highlighted the

importance of maintaining meaningful teacher–student interaction in AI-supported learning. Consistent with these perspectives, the proposed framework positions AI as a supportive technology that enhances instructional quality by providing immediate feedback, personalized recommendations, and continuous learning support, while preserving teachers' central role in planning, monitoring, and evaluating the learning process. Such an approach minimizes the risk of excessive dependence on automated technologies and promotes balanced collaboration between artificial intelligence and human pedagogy.

Another important contribution of the proposed framework is its emphasis on learner autonomy and communicative competence. Earlier studies largely focused on improving specific language skills, particularly writing accuracy or vocabulary acquisition, whereas the present framework integrates reading, writing, interaction, reflection, and self-directed learning into a unified instructional process. By combining AI-supported feedback with learning analytics and formative assessment, the framework encourages students to monitor their own progress, revise their work, and gradually develop independent learning habits. This learner-centred perspective is consistent with communicative language teaching principles and contemporary theories of self-regulated learning, suggesting that AI can facilitate not only language acquisition but also lifelong learning competencies.

Despite its theoretical contributions, the proposed framework has several limitations. As this study adopted a conceptual research design, the effectiveness of the framework has not yet been empirically validated in authentic educational settings. Consequently, the proposed relationships among AI technologies, virtual learning environments, and communicative competence remain theoretical and require experimental verification. Future research should implement the framework in higher education institutions and examine its influence on students' communicative competence, academic achievement, digital literacy, learner autonomy, and overall learning engagement. Comparative studies involving different learning management systems and AI technologies may further refine the framework and extend its applicability across diverse educational contexts.

Conclusion

The rapid advancement of artificial intelligence has created new opportunities for transforming English language teaching through intelligent, adaptive, and learner-centred virtual learning environments. Based on a comprehensive synthesis of contemporary literature, this study proposed a conceptual framework for an AI-assisted virtual learning environment designed to enhance English communicative competence among pre-service preschool and primary education teachers. The framework integrates artificial intelligence, learning management systems, interactive learning resources, formative assessment, personalized feedback, and learning analytics into a coherent pedagogical model that supports continuous language development and independent learning.

The proposed framework contributes to the existing literature by addressing an important gap in AI-enhanced English language education. While previous studies have primarily investigated individual AI applications, the present study offers a holistic model that demonstrates how multiple technological and pedagogical components can function together within a single virtual learning environment. Consequently, the framework extends current understanding of AI integration by emphasizing the interaction between technology, pedagogy, assessment, and learner autonomy rather than viewing artificial intelligence as an isolated instructional tool.

From a practical perspective, the proposed framework may assist higher education institutions, curriculum developers, and English language instructors in designing more effective AI-supported learning environments. By integrating intelligent feedback mechanisms with established pedagogical approaches, the framework has the potential to improve students' communicative competence, self-directed learning, and digital literacy while supporting instructors in monitoring learning progress and providing individualized guidance.

As this study is conceptual in nature, its findings should be interpreted within the limitations of theoretical research. Future studies are recommended to implement and empirically validate the proposed framework in authentic higher education contexts to examine its effectiveness in improving English language proficiency, learner engagement, academic achievement, and communicative competence. Such

investigations will provide further evidence regarding the practical applicability of AI-assisted virtual learning environments in English language education.

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