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Artificial Intelligence-Based Technology in English Language Education: A Scoping Review

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Abstract– ***The objective of this article is to conduct a scoping review on the use of artificial intelligence (AI)-based technologies in English as a Foreign Language (EFL) teaching. The methodology employed follows PRISMA ScR guidelines, focusing on synthesizing existing evidence and evaluating the breadth and diversity of the literature on this topic. The main findings reveal that the implementation of various AI technologies, such as neural networks, deep learning, natural language processing, intelligent teaching models, optimization algorithms, and robotic and interactive systems, has significantly improved the personalization of language learning, educational assessment, and student engagement. Neural networks and deep learning have proven particularly effective in optimizing educational processes and enhancing interaction and efficiency in learning. Therefore, AI-based technologies have great potential to enhance learning effectiveness, but they also require well-defined strategies for their responsible and equitable implementation in the educational field.***
Keywords– Artificial Intelligence, English Language Learning, Neural Networks, Deep Learning, Natural Language Processing.

I. Introduction

Students learning English as a foreign language choose to study this language for various reasons, such as personal interests, social needs, professional goals, or academic obligations. Despite the significant effort by teachers, some students face difficulties and fail to meet academic objectives. The literature indicates that success in learning a second language is influenced by environmental, cognitive, social, and affective factors, with the latter being crucial because students' emotions and attitudes can either facilitate or hinder their learning [1]. Based on this premise, artificial intelligence (AI) emerges as a promising technology to improve affective factors in higher education by personalizing language learning and adapting to the individual needs of students [2].

Therefore, exploring how AI-based technologies have been implemented in English as a foreign language (EFL) teaching would provide a comprehensive view of the opportunities and challenges these technologies present to enhance students' academic experience and success. By analyzing large volumes of data, AI systems can tailor learning pathways to students' individual needs, adjusting content according to their strengths and weaknesses [3]. Moreover, AI incorporates gamification and interactive elements, making learning more engaging and enjoyable.

In the educational context, AI also assists teachers by optimizing instruction based on data analysis, allowing them to focus on personalized teaching and tutoring. By automating administrative tasks, AI frees up time for educators to establish more meaningful interactions with students. For example, [4] explores how AI is transforming the role of teachers in higher education, shifting from a phase of technological exclusion to one of technological dependence. Similarly, in [5] investigate the opportunities and challenges of implementing AI in EFL classes, using a phenomenological approach and qualitative data analysis. However, significant challenges were also identified concerning students' use of AI in these courses, highlighting the need for strategies to mitigate these issues in education.

Therefore, the evolution of AI-based technologies has begun to transform various aspects of education, including EFL teaching. Although the literature has recognized the potential advantages of AI in terms of personalized learning and optimized teaching, there is a lack of comprehensive understanding of how these technologies affect or benefit students. Consequently, conducting a scoping review (ScR) is essential to map the current state of knowledge on the use of AI in English language teaching, identify gaps in existing research, and explore both the opportunities and challenges these technologies present.

Furthermore, by identifying the specific challenges and benefits associated with the implementation of AI, this review will contribute to the development of strategies that ensure the responsible and equitable adoption of these technologies in education. Therefore, this review aims to answer the following question: What are the applications and challenges of AI-based technologies in teaching English as a foreign language, and how do these technologies impact learning? The primary objective is to synthesize the existing literature on the use of AI-based technologies in English as a foreign language teaching.

II. Methodology

To achieve the objectives of this article, the PRISMA ScR methodology was adopted. Scoping reviews focus on synthesizing existing evidence and evaluating the breadth and diversity of the literature on a specific topic. These reviews are also useful for identifying potential gaps in knowledge and

determining whether a more detailed systematic review of the literature is warranted [6].

A. *Eligibility Criteria and Information Sources*

The eligibility criteria focused on documents whose titles contained terms related to AI, natural language processing (NLP), language models such as GPT-4, and associated technologies like neural networks and virtual assistants. In addition to including the mentioned terms, the titles were also required to reference English Language Teaching (ELT). Finally, the search was restricted to documents published between 2015 and 2024. The Scopus database was chosen to ensure that the results were recent and relevant within the specified time frame.

B. *Search Strategy*

To identify relevant studies on the topic, a specific search equation was used that combined key terms related to artificial intelligence (AI) and English language teaching. The search included broad and specific terms to capture various technologies and AI applications.

The terms used were "Artificial intelligence", "IA", "ChatGPT", "Natural language processing", "GPT-4", "Language models", "Text generation", "Virtual assistant", "Machine learning", "Deep learning", "OpenAI", "Automated conversation", "Chatbot", "Text analysis", "Automated responses", "Neural networks", "Language algorithms", "Conversation simulation", "Language technology", "Human-computer interaction", "Conversational AI", and "Response generation".

Specific terms were also included to identify studies focused on English language teaching, such as "English course", "English lessons", "English instruction", "English studies", "English language class", "English language course", "English training", "English education", "English language lessons", and "English tutorial". Additionally, the search was restricted to publications between 2015 and 2025 to ensure that the studies considered were recent and relevant in the context of current technologies. Finally, a term combination strategy was employed using Boolean operators (OR and AND) to ensure that the studies included both AI-related terms and English language teaching terms in their titles, providing greater search accuracy.

C. *Data Extraction Process and Synthesis Method*

Once the studies were identified using the search strategy, they were downloaded for selection based on the established criteria, ensuring that the articles were aligned with the objectives of the work. This process included reading the titles and abstracts of each identified article, following the guidelines detailed in the PRISMA ScR methodology. Subsequently, it was verified that all selected articles were available in full text, allowing them to be included in the analysis.

Finally, the information was organized into different categories based on the technologies applied in English language teaching, such as Neural Networks, Deep Learning, Natural Language Processing, Intelligent Teaching Models, Optimization Algorithms, and Robotic and Interactive Systems. The documents were analyzed using an informative approach, focused on presenting facts, summaries, and key data objectively and structurally, without biases or personal interpretations, presenting the information as it is, based on the available data.

III. Results and Discussion

In the identification phase, a total of 58 records were found, all of which came from a Scopus database, as detailed in Figure 1. Before proceeding to the screening phase of these records, 4 were removed because they were marked as ineligible by automation tools. No duplicate records were identified or removed, nor were any discarded for other reasons at this stage.

During the screening phase, 53 records were evaluated. Of these, 10 were excluded for not meeting the initial inclusion criteria. Subsequently, attempts were made to retrieve 43 reports for more detailed analysis, but 5 of them could not be retrieved, which reduced the number of reports available for eligibility assessment. As a result, 38 reports were reviewed for eligibility. Finally, in the inclusion phase, no additional searches were conducted. Therefore, no new studies were included in the review.

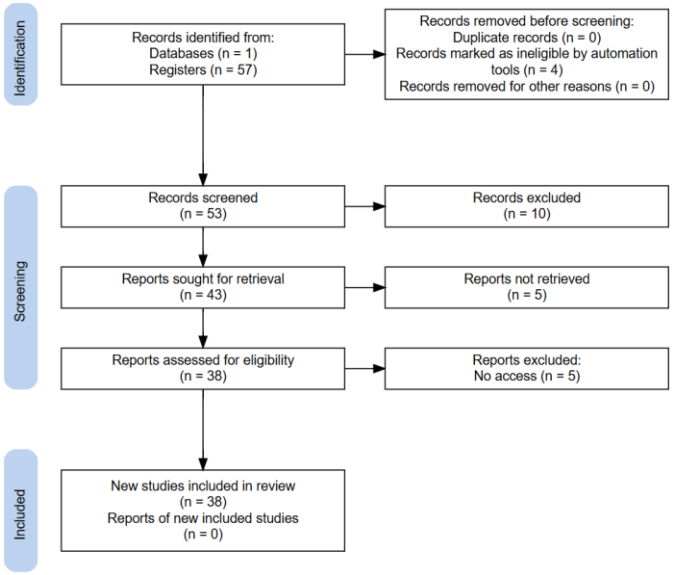

Fig. 1 Results of Evidence Following the PRISMA Flow Diagram.

The results show a variety of technologies applied in English learning, which are addressed as follows: Neural Networks, Deep Learning, Natural Language Processing, Intelligent Teaching Models, Optimization Algorithms, and Robotic and Interactive Systems.

A. *Neural Networks*

Table I presents studies that have employed neural networks in English language learning, showcasing their diverse applications and impacts. For instance, [7] enhanced English course recommendations by optimizing the BP neural

network's weight and threshold parameters using the artificial bee colony (ABC) algorithm, leading to significant improvements in accuracy and efficiency. In [8] developed an English education model that integrated audiovisual data with Convolutional Neural Networks (CNN), which resulted in a 15% reduction in recognition error rates. In [9] utilized RBF neural networks in conjunction with natural language processing for accurate, real-time evaluation of English teaching quality. In [10] applied a BP neural network with gray wolf optimization to improve engineering students' English learning, thereby enhancing teaching outcomes. In [11] used a firefly algorithm-BPNN (FA-BPNN) to predict English course performance, achieving a remarkably low average error rate of 0.5%. In [12] employed neural network clustering in MOOC courses to foster autonomous learning and increase participation, whereas [13] designed an online evaluation system combining C/S and B/S modes to boost English proficiency. Collectively, these studies demonstrate the significant potential of neural networks in advancing educational infrastructure, particularly in the domain of English language learning.

TABLE I
IMPLEMENTATION OF NEURAL NETWORKS

Article	Type of AI	Applied Strategy
[7]	BP neural network algorithm	This study optimizes BP neural networks with an artificial bee colony (ABC) algorithm, enhancing accuracy and convergence applied to English curriculum recommendations.
[8]	Convolutional Neural Network (CNN)	This paper presents a neural network-based algorithm for English education, using Convolutional Neural Networks (CNNs) for audiovisual fusion.
[9]	RBF neural network	This study proposes a neural network and natural language processing-based method to evaluate English teaching quality, using principal component analysis and RBF neural networks.
[10]	A backpropagation neural network (BPNN)	This paper addresses issues in engineering English teaching by introducing a BPNN network optimized with a gray wolf algorithm, creating a multi-dimensional interactive learning framework.
[11]	Algorithm-back propagation neural network (FA-BPNN) method	This paper presents a firefly algorithm-back propagation neural network (FA-BPNN) for predicting student performance in English courses.
[12]	Natural language processing (NLP)	This study explores using fuzzy statistics and neural network clustering for multimedia English courses, enhancing automatic scoring and reflecting students' autonomous learning and language skills.
[13]	Combination of C/S mode and B/S mode	This paper designs an online automatic evaluation system for higher vocational English, combining C/S and B/S modes.

B. *Deep Learning*

Table II presents the results of various studies that have implemented deep learning in English language learning. First, [14] underscores the urgent need for language education reform, aiming to better prepare students for future challenges by addressing issues like low learning efficiency and the prevalent reliance on rote learning. Similarly, in [15] emphasize the critical role of deep learning in English education, particularly using RNN and STLM, which enhance evaluation fairness and transparency, ultimately fostering deeper learning. Furthermore, in [16] explore how Human-Computer Interaction (HCI) systems can significantly improve oral English skills, reducing student anxiety and leading to better learning outcomes. In addition, in [13] develops an AI-driven automated evaluation system specifically for vocational English, which enhances test flexibility and contributes to improved English proficiency among students. Collectively, these studies demonstrate the transformative impact of deep learning and AI technologies on language education.

TABLE II
IMPLEMENTATION OF DEEP LEARNING

Article	Type of AI	Applied Strategy
[14]	Deep learning algorithm	In reforming college foreign language education, a key discussion point is whether the curriculum prepares students for future challenges and careers.
[15]	RNN and STLM	This study explores using deep learning for text recognition and scoring, aiming to enhance the effectiveness of college English courses through advanced algorithms.
[16]	human-computer interaction (HCI) system	The role of human–computer interaction (HCI) systems in enhancing college students' oral English learning is analyzed, focusing on the use of support vector machines and multimodal methods for interactive teaching.
[13]	combination of C/S mode and B/S mode	This paper presents an online automatic evaluation and correction system for higher vocational English, combining C/S and B/S modes.

C. *Natural Language Processing*

Table III presents the results of various studies that implement natural language processing in English language learning. Firstly, [17] emphasizes the benefits of integrating ChatGPT into language education, particularly in enhancing motivation and overall course effectiveness. Building on this, [18] explore ChatGPT's application across all linguistic skills, underlining its potential to transform traditional teaching methods and improve English proficiency. In a similar vein, [19] demonstrate ChatGPT's effectiveness in developing professional English courses, significantly improving both efficiency and resourcefulness. Meanwhile, [20] showcase AI-driven educational games, which have been shown to increase engagement and satisfaction in English learning.

Additionally, [21] focuses on the role of ChatGPT in automatic question generation, which helps personalize learning experiences. Complementing these findings, [22] introduce PEEP-Talk, a chatbot designed to enhance conversational practice, effectively reducing anxiety and improving fluency. [14] discusses the use of deep learning algorithms to improve educational assessments, while presents a dual-sensor speech recognition system aimed at enhancing listening and speaking skills. Together, these studies highlight the transformative impact of AI on English education, offering

innovative tools that enhance language proficiency and reshape traditional teaching methods.

TABLE III
IMPLEMENTATION OF NATURAL LANGUAGE PROCESSING IN ENGLISH LEARNING

Article	Type of AI	Applied Strategy
[17]	ChatGPT	This paper explores the integration of ChatGPT in tertiary English education, highlighting its potential to enhance student motivation and advocating for its inclusion in curricula.
[18]	ChatGPT	This study examines ChatGPT's potential in English education, exploring its ability to enhance proficiency across all language skills.
[19]	ChatGPT	This paper discusses the development of a Law English course using ChatGPT, highlighting its role in creating a curriculum, syllabus, and textbook.
[20]	(NPCs) and (NLP)	This study develops educational games with AI-driven Non-Player Characters (NPCs) using Natural Language Processing.
[21]	(AQG) and (LLMs) like ChatGPT	An automatic question generation (AQG) system utilizing large language models (LLMs) like ChatGPT.
[22]	Chatbot called PEEP-Talk	This paper introduces PEEP-Talk, a chatbot designed for English learners that offers real-world situational dialogues, accurate feedback, and grammar correction, effectively reducing learning barriers and improving speaking skills.
[14]	Deep learning algorithm	The paper discusses the use of deep learning algorithms, particularly deep convolution networks, in analyzing English education data to address challenges in student learning efficiency and enhance their problem-solving skills.
[23]	System based on recurrent neural networks	The paper introduces a dual-sensor speech recognition system using recurrent neural networks to improve English listening and speaking efficiency, showing enhanced accuracy in noisy environments.

D. Intelligent Teaching Models

Table IV presents the results of various studies that implement intelligent teaching models in English language learning. To begin with, [24] emphasizes the Ministry of Education's initiative to integrate AI into education, aiming to modernize English language teaching. Following this, [25] highlight the Personalized Education System (PES) that utilizes Brain Neural Networks (BNN) to tailor English word learning to individual memory patterns, thereby enhancing personalized education. Building on the theme of personalized learning, [26] advocates for the application of deep learning in higher education, specifically to improve cognitive skills and English composition scores. In addition, [27] introduces the PDA Blended Teaching model, which combines AI with traditional methods to reform English education. Expanding on the impact of AI, [28] explores its broader effects on classroom teaching, research, and campus management, emphasizing its transformative potential. Furthermore, Wu and [29] examine the integration of deep learning with virtual reality, offering an immersive approach to English learning. Collectively, these studies underscore AI's critical role in advancing college English education, enhancing learning efficiency, and better preparing students for future challenges.

TABLE IV
APPLICATION OF INTELLIGENT TEACHING MODELS

Article	Type of AI	Applied Strategy
[24]	Artificial intelligence technology into education.	This article explores the challenges and development strategies for enhancing college English teaching through AI-driven language education planning.
[25]	(PES) that utilizes a brain neural network (BNN)	This paper uses a brain neural network (BNN) to customize English learning based on the forgetting curve, showing improved adaptability and effectiveness over traditional models.
[26]	Learning process questionnaire scale as a metric for deep learning	This paper introduces a deep learning model that significantly improves English teaching and offers a replicable method for modernizing education.
[27]	Blended teaching model whit IA and big data.	This paper examines blended teaching's evolution, evaluates an AI and big data-integrated model, and discusses its benefits and challenges in English education.
[28]	College English education and discussing how AI can enhance it	This paper explores how artificial intelligence integrates into various aspects of college education and proposes a new AI-based model to enhance college English teaching.
[29]	Virtual reality	This study explores how combining deep learning with virtual reality in English education can enhance learning effectiveness, based on experimental and comparative analysis.
[24]	Intelligence technology into education.	This article examines the integration of artificial intelligence in college English education, addressing key issues and development strategies to enhance teaching under modern educational planning.
[30]	Quality of English pronunciation through DBN	This paper introduces an AI-based English education model, demonstrating its effectiveness in improving pronunciation and overall skills with high accuracy compared to manual evaluations.

E. Optimization Algorithms

Table V presents the results of studies that implement optimization algorithms in English language learning. The integration of artificial intelligence (AI) into English education is driving significant advancements, greatly enhancing both teaching and learning outcomes. For instance, [31] demonstrate the effectiveness of neural networks in optimizing English video courses, achieving higher classification accuracy while reducing processing time. Similarly, [32] introduces the IGA-WNN model, which accurately assesses university English teaching effectiveness by optimizing wavelet neural networks with genetic algorithms. In addition, [33] highlights the role of big data in English writing instruction, particularly in enhancing lexical chunk learning and boosting student motivation. Further supporting these findings, [34] explore the impact of AI on English education

platforms, illustrating how machine learning can improve student engagement and performance. Moreover, [35] combines multimedia technology with BP neural networks to enhance spoken English training outcomes, showcasing the practical benefits of integrating AI into language education. Collectively, these studies underscore the transformative potential of optimization algorithms in improving English language education through AI.

TABLE V
IMPLEMENTATION OF OPTIMIZATION ALGORITHMS

Article	Type of AI	Applied Strategy
[31]	PDCNO algorithm	The paper shows that neural networks and the optimized PDCNO algorithm enhance video-based English teaching by improving accuracy, reducing execution time, and aligning with student preferences.
[32]	an evaluation method based on IGA-WNN	This paper proposes an IGA-WNN-based evaluation method to enhance the accuracy of English teaching assessments in universities, demonstrating improved evaluation quality and effectiveness.
[33]	AI and big data	This paper presents a big data-driven English writing model focusing on lexical chunks, improving student feedback and writing skills.
[34]	IA, machine learning, and deep learning	This paper examines how AI and machine learning improve student engagement and performance in English courses through online and offline integration.
[35]	BP neural network into spoken English	This paper integrates multimedia and BP neural networks to enhance spoken English training, demonstrating improved effectiveness through experimental evaluation.

F. Robotics, and Interactive Systems

Table VI presents the findings from studies that integrate robotics and interactive systems into English language teaching. These advancements in AI are playing a crucial role in transforming English education, especially through the development of innovative teaching models. Notably, the application of artificial intelligence in this context has yielded promising outcomes by creating more realistic and personalized learning environments.

TABLE VI
IMPLEMENTATION OF ROBOTICS AND INTERACTIVE SYSTEMS

Article	Type of AI	Applied Strategy
[36]	Educational robots can create real learning situations for spoken language	This study develops an AI-driven English education model using robots to create realistic learning environments and personalize instruction, resulting in improved student language and cognitive skills.
[37]	Lens of deep learning and educational big data mining	This paper examines the role of deep learning in English education, emphasizing its potential in big data mining and offering development suggestions.

For instance, [36] developed an AI-driven educational model using robots to simulate real-life conversational situations, which significantly enhanced students' language and cognitive skills. Similarly, [37] investigated the impact of deep learning and big data mining on English education, emphasizing its potential to optimize educational processes and introduce novel teaching strategies. Collectively, these studies highlight the pivotal role of AI in modernizing English language education, providing innovative tools to enhance learning effectiveness.

G. Advanced Communication Technologies

Table VII presents the advanced communication technologies applied in English classes. The integration of 5G and AI technologies is revolutionizing university-level English education by enhancing student engagement and learning outcomes. For example, [38] explores the combination of 5G with AI-driven tools like holograms and gesture recognition to create an immersive online oral teaching model. This model has shown surpasses traditional methods in boosting student interest and hands-on abilities. Similarly, [39] underscores the role of 5G and AI in fostering critical thinking and personalized learning, demonstrating that these technologies significantly improve student comprehension and engagement. Additionally, [40] investigate AI's impact on online English education, revealing that AI-driven platforms greatly enhance student satisfaction and teaching effectiveness compared to traditional methods, particularly during the pandemic.

TABLE VII
ADVANCED COMMUNICATION TECHNOLOGIES IN ENGLISH CLASSES

Article	Type of AI	Applied Strategy
[38]	5G + AI + Education	Sun (2021) demonstrates that integrating 5G and AI into online teaching enhances student engagement and learning through immersive technology and gesture recognition, showing improved effectiveness over traditional methods.
[39]	artificial intelligence and 5G communication technology	Zang et al. (2022) demonstrate that integrating 5G and AI technologies into college English education boosts teaching effectiveness and student engagement, outperforming traditional methods.
[40]	advancements in artificial intelligence technology (AIT)	Duan & Duan (2021) show AI advances boost online English education, with 67% student satisfaction in new models vs. 46% in traditional ones.

These results highlight the transformative impact of AI on EFL teaching through the implementation of various advanced technologies. Neural networks have proven highly effective in optimizing educational processes, such as curriculum recommendation and teaching evaluation, enabling precise adaptation of content to individual student needs. Deep learning has emerged as a key tool for improving assessment methods and promoting more interactive and efficient learning, effectively addressing common issues like low efficiency and rote memorization.

Natural Language Processing (NLP) has revolutionized English teaching by offering interactive practice, instant feedback, and highly personalized learning experiences, which significantly boosts both motivation and learning effectiveness. Furthermore, intelligent teaching models have integrated AI into educational planning, allowing for

personalized learning that aligns with individual student patterns and better prepares them for future challenges.

Moreover, optimization algorithms have substantially improved the precision and efficiency of English teaching, particularly in contexts requiring real-time personalization and adaptation, such as video-based instruction and writing enhancement. Finally, robotics and interactive systems have created more immersive and personalized learning environments, leading to significant improvements in students' linguistic and cognitive skills, surpassing traditional teaching methods.

IV. CONCLUSIONS

This scoping review has enabled the identification and analysis of various applications of Artificial Intelligence in EFL teaching, highlighting both the opportunities and challenges these technologies present.

AI-based technologies have shown considerable potential for personalizing learning, enhancing teaching efficiency, and increasing student engagement and motivation. However, they also pose significant challenges that must be addressed, such as the need to develop effective strategies for integrating these technologies into educational programs and addressing ethical and private concerns.

As the implementation of AI in English teaching continues to evolve, it is important for future research to keep exploring and evaluating these advancements.

Developing a framework that combines the benefits of these technologies with effective pedagogical practices will be essential to ensure responsible and equitable adoption in education.

Ultimately, the integration of AI has the potential to transform English teaching, making learning more accessible, personalized, and effective for students worldwide.

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