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## A SYSTEMATIC REVIEW OF RESEARCH ON THE USE OF ARTIFICIAL INTELLIGENCE IN ENGLISH LANGUAGE TEACHING AND LEARNING (2015-2021): WHAT ARE THE CURRENT EFFECTS?

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### ABSTRACT

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|--------------|--|
| Aim/Purpose  | This study carried out a systematic review of the literature on artificial intelligence (AI) in English language teaching (ELT). The objective was to delineate the current research progress in the field and to further understand the challenges.   |
| Background   | The study analyzed articles published between 2015 and 2021.   |
| Methodology  | The qualitative research method was employed. Five steps were taken to steer the review. 200 articles were scrutinized; 64 were retained.  |
| Contribution | Prior research on AI in ELT has not investigated how the literature is progressing or what areas of AI are being covered. Without a holistic picture, some important research findings could be missed. Understanding how studies on AI in ELT are designed and implemented will contribute to a greater understanding of the existing state of research.  |
| Findings     | Findings show that there is a promising future for AI in ELT. AI in ELT yielded positive results in terms of optimizing the English language skills, translation, assessment, recognition, attitude, satisfaction, etc. It was also found out that more and more articles on the topic are being published; the mixed research method is the most commonly used, higher education level is the most sampled, students as participants are the most sampled, and most studies developed |

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|-----------------------------------|---|
|                                   | <p>novel AI-based systems. Various AI approaches have been identified in the reviewed studies, including machine learning, neural network, support vector machine, genetic algorithms, deep learning, decision tree, expert system, natural language processing, data mining, cloud computing, and edge computing. However, AI in ELT is still in its infancy, where little research has been conducted and gaps in the literature are still present, especially in terms of inherent issues related to body language, gestures, expressions, emotions, translation, lack of elaborate description of teaching material used for learning driven by AI, uncertainties and vagueness with regards to what can be considered under the realm of AI, and most authors being outside of the ELT discipline.</p> |
| Recommendations for Practitioners | <p>This literature review is likely to provide practitioners with an overview of the current adopted technology, research method, instruments and/or tools, educational level, language skill, and the effects reported by the AI-based studies for designing effective systems for the use of AI in their ELT classrooms.</p>  |
| Recommendations for Researchers   | <p>Researchers need to conduct research on AI in ELT along with a detailed in-depth description of the methodology, research design, and the proposed systems used to achieve AI in ELT. Furthermore, it is recommended that researchers explore the efficiency of AI-based systems used in previous research and ensure their relevance and functionality. They are also required to provide in-depth analysis of the challenges inherent to systems that have been highlighted in the literature, which will maximize the potentials of these AI-based technologies.</p>  |
| Impact on Society                 | <p>The findings of this paper can provide visualization of research findings that could particularly benefit researchers, educators, and AI specialists who are involved in the study of the applications of AI in ELT.</p>   |
| Future Research                   | <p>Future AI research needs to seriously include more detailed descriptions of the method in further research.</p>  |
| Keywords                          | <p>artificial intelligence, AI challenges, English language teaching, systematic literature review, analysis of AI-based articles</p>   |

## INTRODUCTION

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AI has profound effects on all walks of life, affecting individuals' lives, from applications on smart devices to manufacturing, transportation, health, and other fields. AI technology is progressing, and its upper limit is far from known. The impact of AI on the field of education is also gaining momentum, not least in the field of ELT. AI is a broad discipline that involves a fusion of "computer science, cybernetics, information theory, neurophysiology, psychology, philosophy, linguistics, and other disciplines" (Bin & Mandal, 2019, p. 1). The term can be built on the "Dartmouth Conference" in 1956 (Stewart, 2016), when it was introduced by Minsky and McCarthy. The literature in the field is very wide, including intelligent robots, voice recognition, "image recognition, natural language processing, and expert systems", to name a few (Z. Hou, 2021, p. 2).

AI is a computer system that simulates human intelligence (Sindermann et al., 2021; Z. Sun et al., 2021). Thereby machines can "think and act like humans" and can do what originally only humans could do (Zhang & Chen, 2021, p. 6) in terms of learning, inferring, judging, remembering, understanding human language (Xiaohong & Yanzheng, 2021), planning, calculating, thinking, and handling complex problems (Cuiye, 2016). In particular, AI research studies how to create machines that can imitate the human brain and provide the users with a similar experience to interacting with real humans.

Certainly, when talking about AI, smart mobile devices are present in most, if not all, fields, including education. This dominance of mobile devices that could be used by educators and learners is due to the ease of use and popularity of this technology owing to its flexibility in connection with time and place (Rosyid & Hidayati, 2020). Language learning supported by smart devices “has the characteristics of mobility, efficiency, universality, interaction, sharing, and individuality” (G. Ma, 2021, p. 675). The emergence of mobile devices and mobile learning based on AI has made the personalized learning innovation develop rapidly (Yunjie, 2021). Students can practice language learning with the help of Apps on their mobile devices that are tailored to their actual needs (Luo & Cheng, 2020). Smart mobile devices and AI-based applications use “big data, speech synthesis, intelligent marking system and electronic partners” to bring new vitality to education (M. Huang & Yubao, 2020, p.52). However, Papadakis (2021) stresses the fact that there is a scarcity of well-designed applications intended for education, as most are designed to entertain rather than facilitate active and creative learning. Papadakis (2021) also points to the absence of an industry standard for mobile applications and to the fact that evaluation tools that are available freely to assess the quality of educational Apps lack “scientific evidence and significantly omit important App assessment aspects” (p. 1).

In recent years, communication between humans and electronic devices has constantly been growing. Likewise, the last decade has seen dramatic developments in the construction of AI-based systems. For instance, “Apple Siri”, “Amazon Alexa”, “Microsoft Cortana”, and “Google Home Assistant” are chatbots that can respond to human voice commands. Moreover, AI technology has led to the development of humanoid robots that can talk to people, such as Erica and Sophia. Hiroshi Ishiguro and his colleagues, from Kyoto University and Osaka University, created the humanoid female robot Erica, which can engage in more human-like conversations and is deemed a fully autonomous android bot with very human-like qualities and expressivity, and with sophisticated multimodal sensing capabilities (Sindermann et al., 2021). Similarly, Sophia is a social intelligent humanoid robot that has a human-like appearance and behavior and is capable of interacting with people; it was “made by Hong Kong-based association Hanson Robotics” (Akib et al., 2019). Such AI products can bring great opportunities to ELT by changing the way students learn and by increasing the productivity of teachers. Overall, the role of AI in ELT seems to be promising (Dizon & Tang, 2019; Haristiani, 2019), yet it is still in the development stage (Gera & Chadha, 2021; Woschank et al., 2020).

Generally, AI can facilitate learning by providing personalized learning contexts, which expedites students’ independent learning (Liang et al., 2021; Yong, 2020). It enables students to study at their convenience, receive feedback, and be assisted and guided in their learning with minimal intervention from the teacher (Keerthiwansha, 2018). AI can make students more relaxed when talking to a machine, repeat tasks endlessly, practice the language skills (Kim, 2019); it can provide learning experiences tailored to students’ individual needs (H. Gao, 2021), offer revise suggestions, and record students’ progress (Zhou, 2019). For educators, AI “provides a new platform for the creation of an intelligent and personalized English teaching environment” (Li, 2017, p. 35). AI-based systems can assist educators in a variety of ways and reduce the burdens (Yong, 2020); this includes checking attendance using facial recognition, automatically evaluating students, correcting English pronunciation (Na, 2021), “track[ing] and record[ing] the expressions and behaviors of students” (Z. Hou, 2021, p. 5), collecting resources, marking homework, and answering questions for students (Y. Hou, 2020).

### ***AI APPLICATIONS IN ELT***

AI in education refers to the integration of AI into the educational practices to ensure that the entire learning process is effectively supported. The literature has discussed the application of AI technology in education in general and ELT in particular. In this regard, the literature expects AI-based technology products to bring about good changes in English education. For example, Yong (2020) states that “AI + big data” marked the start of a system capable of automatic correction of English composition, one that uses a large corpus to correct lexical items, collocations, and sentence structure. In terms of listening skills, AI-based technology can select appropriate listening material from a large corpus in keeping

with students' needs and abilities in English. In the field of oral training, the AI-based robots are able to speak, put questions and respond to students' questions (Thin et al., 2020). In the field of translation, AI machine translation is constantly improving with the various kinds of software that are widely used (Dai, 2022).

AI plays an important role in implementing one-to-one personalized teaching and learning (J. Huang et al., 2021). AI systems are able to collect and analyze students' characteristics, and thus automatically adjust lessons and present them to students in a manner that suits their needs and abilities (H. Gao, 2021; Wu, 2020). According to J. Huang et al. (2021), AI-driven systems can create personalized situational learning plans tailored to the students' abilities, so systems can provide learning activities, track student progress, create tests and evaluate students, and provide instructions as needed. Based on big data, AI can record all kinds of data of students, including modeling, analyzing, evaluating learners, and providing data support for teachers so they adjust their teaching methods and meet the requirements of teaching (Yang, 2020).

Speech recognition has also led to wider applications in ELT. The integration of speech recognition technology in existing systems has led to the development of applications offering unprecedented benefits for language learning, particularly related to speaking (Kannan & Munday, 2018). One of the widely used applications that enable students to engage in a spoken dialogue is chatbots or chat robots (Luo & Cheng, 2020). Chatbots have a great scope; they can be utilized both as a tutor and as a personalized learning tool (Haristiani, 2019). In particular, Rebman (2006) underlined two main qualifications related to speech recognition technology: translation of speech to text and conversion of text to speech.

Image recognition, face recognition, and text recognition are AI technologies that can provide technical support for instructors, students, and institutions. Utilizing AI-based recognition, issues like safety on campus and classroom monitoring can be addressed and tackled (J. Huang et al., 2021). Moreover, face analysis using face recognition technology can help in checking student attendance and accurately identifying the current class size, which helps reduce teachers' tasks and enables them to manage class more effectively (Thin et al., 2020). Image recognition technology can considerably reduce the workload of teachers by scanning and marking exams and obtaining text content from digital text images for instance.

In education, another application of AI is machine translation. The emergence of machine translation in the realm of AI has made great strides in expediting the teaching of English (Yong, 2020). Although machine translation is still not perfectly accurate (H. Li et al., 2021), Fedosov et al. (2019) posit that it can be employed whilst working with training materials when teaching a foreign language. Machine translation can also serve as a tool to motivate learners to learn English and to alleviate their learning fears (Tsai & Liao, 2021).

The development of chatbot systems that can respond to the human voice has brought tremendous opportunities to ELT. Chatbot is an AI-based computer program that engages in oral and written conversations and interacts with learners in any theme by providing intelligent conversations using human-like lingo (Haristiani, 2019). According to Haristiani (2019), many chatbots offer text combined with speech, which enables learners to take part in both listening and reading activities. Chatbots have many advantages for language learners such as improving student autonomy and allaying learner anxiety as well as their being convenient since users can use them regardless of the time and location (D. Shin et al., 2021).

The creation of AI-based humanoid robots such as Erica and Sophia would help promote ELT. Humanoid robots are professional robots designed to mimic human movements and interactions (Sowmiya et al., 2022). According to Thin et al. (2020), using robots as instructors could have advantages for students, including “repeatability; flexibility; digitization; humanoid appearance; body movement/motion; interaction; anthropomorphism; sensing capability, intelligence and automatic speech recognition; language understanding and dialogue management; emotional Expression” (p.

1307). Robots can act as a teaching assistant that collects data of each student, provides analysis and recommendations, helps the instructor diagnose students' problems, and points out the learning level of students (Li, 2019).

It is apparent that some experimental studies have been undertaken on using AI in English language skills. Z. Sun et al. (2021) put forward a deep learning-based intelligent English teaching system in order to improve ELT efficiency. They found that the system improved students' learning efficiency and that the system fared better than other systems. Hu (2021) suggested the implementation of the particle swarm optimization (PSO) algorithm in the EFL listening module of a flipped classroom. Findings of the research demonstrated that the overall performance of the students was enhanced remarkably. Junaidi et al. (2020) investigated the effectiveness of Lyra virtual assistance (LVA) on EFL speaking in a classroom environment. Their research concluded that Lyra is an efficient AI application "for EFL students to improve their speaking skill" (p. 6735). Xiao and Hu (2019) applied an AI approach to explore elements that distinguished high from low achieving ESL students in reading literacy in Canada. They asserted that their pedagogy would facilitate improvements in ESL reading education. Chong (2021) established a blended ELT model of writing assisted by AI. The study found out that the model could promote students' writing ability and increase their interest in writing.

In addition, experimental studies explored AI-based systems with regards to positioning, translation, evaluation, and satisfaction. Aiyuan and Hui (2021) constructed an online ELT model based on AI technology implementing the received signal strength indication (RSSI) positioning method. The RSSI positioning method estimates the user's position through some algorithms based on the strength of signal received by the device (Ye et al., 2019). The findings showed that the model could intelligently locate students' positions. Wei (2020) developed English translation software based on CAT technology. The study found that the used English translation software based on AI is fast and accurate and that it meets the needs for translation. Z. Wang (2022) investigated the effectiveness of online automated essay evaluation (AEE) system. Students wrote and submitted essays on the AEE system. Then, two raters were asked to evaluate the essays of students. The study then compared the evaluation results from the AEE system and the raters. The study showed that the "computer scoring feedback was higher than that of teacher scoring feedback" (p. 1). An and Zhao (2021) constructed a hybrid ELT mode to analyze students' satisfaction with AI-based Rain Classroom (a free App available on WeChat). The study stated that the platform stimulates interest in English learning (76.4%) and enhances classroom learning atmosphere (67.9%).

In this review, all the selected studies that will be presented in the next sections address AI in ELT. The current article has limited the search to most recent articles published between 2015 and 2021. An effort was made to bring all the research studies under one umbrella and present a systematic review of the actual applications of AI in ELT to function as a reference for teachers and researchers in this area. The reason for selecting these studies from among the limited relevant studies is that these selected studies showed evidence of high-quality research design, research problem, methodology, and they were published in peer-reviewed journals. Additionally, the studies were chosen in line with strict inclusion criteria such as having the term "artificial intelligence" as a primary component in the title, being mainly about ELT, and being written in English. Generally, the inclusion of articles is justified as long as there are no major shortcomings noted in the content of the studies.

Prior research on AI in ELT has not investigated how literature is progressing or what areas of AI are being covered. Without a holistic picture, some important research findings could be missed. Understanding how studies on AI in ELT are designed and implemented will contribute to greater understanding of the existing state of research. Therefore, it is necessary to carry out a systematic review of the literature on AI in ELT by analyzing selected articles and providing a visualization of research findings that could particularly benefit researchers, educators, and AI specialists who are involved in the study of the application of AI in ELT. The present study analyzes articles published between 2015 and 2021 on the applications of AI in ELT. The following questions are addressed:

RQ1: What is the overall state of current research on AI in ELT from 2015 to 2021?

RQ2: What are the challenges that confront current research on AI in ELT?

RQ3: What are possible gaps in the literature on AI in ELT that call for further research?

The significance of this study stems from the fact that AI in ELT is still a dynamic research domain which is worth exploring. Currently, there exist no studies that exclusively document the state of AI in ELT in the period between 2015 and 2021. In particular, the last three years have witnessed a rapid increase in research publications related to deploying technology in education as a result of the global lockdowns imposed in response to the COVID-19 pandemic. On top of that, research studies have mentioned the need to sum up the results of research to obtain a complete picture of AI in teaching and learning (Zawacki-Richter et al., 2019).

## METHOD

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This study is a systematic review that uses the qualitative research method with the goal of collecting all articles relevant to AI used in ELT that were published between 2015 and 2021. The objective is to delineate the current research focus and progress in the field and to further understand the challenges. Keywords and search strings were used to search different databases, including Web of Science (WoS), Scopus, and Google scholar as sources of peer-reviewed articles. After selecting the articles, basic parameters were considered in the analysis of the situation of AI-based ELT such as article title, adopted technology, research method, instruments and/or tools, journal name, publication year and index, educational level, language skill and others, and the effect AI seemed to have on ELT.

Five phases were taken to conduct this systematic review: (1) planning and performing the search strategy; (2) carrying out initial screening by removing duplicates, non-English articles, non-journal articles, non-conference proceedings, and articles outside the study scope and then identifying inclusion and exclusion criteria; (3) determining inter-rater reliability and examining the articles as per the inclusion and exclusion conditions; (4) data extraction; and (5) data synthesis (Figure 1).

### ***PHASE 1: IDENTIFYING SEARCH KEYWORDS AND PERFORMING THE SEARCH STRATEGY***

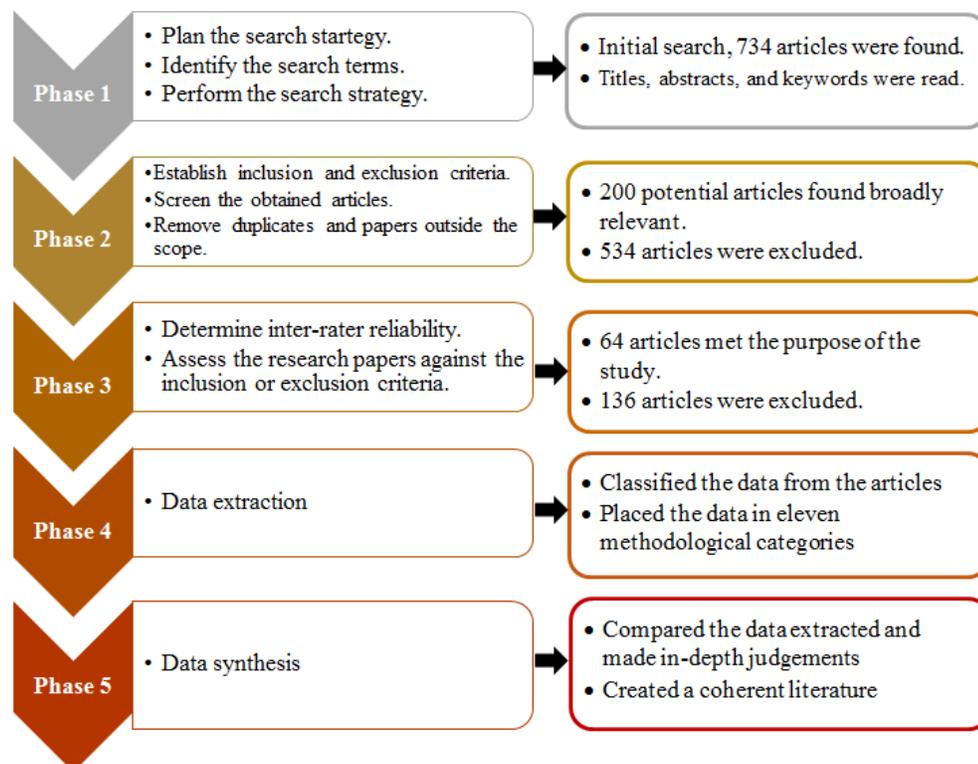
The first phase in the study was to choose a rational search strategy with the purpose of identifying articles from different journals that have focused on the application of AI in ELT. This demanded probing three common academic databases: WoS, Scopus, and Google Scholar. To sieve results, the authors set the search to return articles published between 2015 and 2021. The databases were searched using the search term “Artificial Intelligence” in every search, while one of the following keywords was joined with the term: “English,” “second language,” “foreign language,” “ESL,” “EFL,” “language.” This process yielded 734 published documents as the basis for the next step.

### ***PHASE 2: CARRYING OUT INITIAL SCREENING AND ESTABLISHING INCLUSION/EXCLUSION CRITERIA***

Titles, abstracts, and keywords of the 734 papers were screened by the two researchers and an experienced volunteer colleague, in order to arrive at decisions as to whether to include or exclude papers. At this stage, the focus was on removing duplicates, non-English articles, non-journal articles, non-conference proceedings, and articles outside the study scope. To avoid selection bias, the inclusion and exclusion criteria were agreed upon by the authors before data extraction (Table 1). The researchers filtered out 534 papers, leaving 200 relevant papers.

### ***PHASE 3: DETERMINING INTER-RATER RELIABILITY AND EVALUATING THE PAPERS AGAINST THE INCLUSION AND EXCLUSION CRITERIA***

Prior to fully screening the texts of the 200 papers, the authors randomly picked four papers and reviewed them jointly with an experienced volunteer colleague to ensure inter-rater reliability for inclusion and exclusion decisions. The full text of each paper was read independently by the two authors and the experienced colleague. Later, when the results were compared, the inter-rater reliability was ascertained by comparing similarities or differences among the extracted data. Differences required re-evaluation by the raters to elicit unambiguous research results. 64 articles met the study criteria and were included. The selected articles include both theoretical and experimental studies.



**Figure 1: Phases of the systematic review**

**Table 1: Inclusion and exclusion conditions**

| <b>Inclusion</b>   | <b>Exclusion</b>  |
|--|---|
| 1. Should have “Artificial Intelligence”, as a primary component in the title. | 1. Not use a vigorous methodology or written in an ambiguous way. |
| 2. Be mainly about ELT.  | 2. Outside the study scope.                                       |
| 3. Publications written in English.  | 3. Non-English articles.  |
| 4. Be in a peer-reviewed journal or peer-reviewed conference proceedings.      | 4. Non-journal articles.  |
| 5. Must be published between 2015 and 2021.                                    | 5. Non-conference proceedings.                                    |
|  | 6. Not published between 2015 and 2021.                           |

### ***PHASE 4: DATA EXTRACTION***

In order to obtain data from the articles, all the authors discussed the thematic concepts and established a coding and extraction system which then turned into categories. The recorded information from the 64 papers was classified into nine categories: article title, adopted technology, research

method, instruments and/or tools, journal name, publication year and index, educational level, language skill and other skills, and the effect of the systems used on ELT.

### ***PHASE 5: DATA SYNTHESIS***

The authors and the experienced colleague examined the data; they synthesized the findings across the articles by comparing the subjects retrieved under the categories, which would enable them to compile a logical literature review. This gave the authors the opportunity to reflect on the differences in the elicited data between them. The authors and the expert colleague spent two months reading, interpreting, discussing, and modifying the results to finally produce an overarching summary of the data as shown in the Appendix.

## **FINDINGS**

The main purpose of the current study was to conduct a systematic review with the goal of collecting articles relevant to AI in ELT published between 2015 and 2021. The objective was to delineate the current research focus and progress in the field and to further understand the challenging issues. Through searching databases for topics, the primary quest generated 734 documents on the subject that were later reduced to 200 prospective articles based on their titles and abstracts when the inclusion and exclusion criteria were applied. In the end, after a rigorous selection process, 64 articles remained for blinded review (Table 2).

**Table 2: Number of articles in the primary quest, prospective articles, and articles included for analyses**

| Search terms                          | Primary quest | Prospective articles | Articles included for analyses |
|---------------------------------------|---------------|----------------------|--------------------------------|
| <b>“Artificial Intelligence” AND:</b> |               |                      |                                |
| “English”                             | 260           | 132                  | 54                             |
| “Second Language”                     | 10            | 7                    | 2                              |
| “Foreign”                             | 80            | 18                   | 1                              |
| “ESL”                                 | 5             | 4                    | 1                              |
| “EFL”                                 | 11            | 6                    | 3                              |
| “Language”                            | 368           | 33                   | 3                              |
| Total                                 | 734           | 200                  | 64                             |

It was deemed prudent to examine all work done in all disciplines where the term AI occurs in the title of the papers from 2015 to 2021. The search was conducted in Google Scholar. A total of 1,640 documents contained the term AI in the title in 2015, and 17,600 documents in 2021. Compared with the initial search related to AI in ELT over the period, the search for documents that contained the term AI in all disciplines yielded only 22 relevant documents in 2015, and 228 documents in 2021. The result is as shown in Figures 2 and 3.

Figure 4 presents the total number of documents that contained the term AI in the title in all disciplines (57,260 articles) compared with AI related to ELT (734 articles in the primary quest and only 64 articles included for analyses). Figure 5 presents the articles published from 2015 onwards. The number of articles included for analyses jumped from 1 in 2015 to 30 in 2021.

Using the databases in which the 64 articles are indexed, Figure 6 shows that 45 articles appeared in both WoS and Scopus databases, 49 articles were indexed in WoS only, 51 in Scopus only, and 9 articles in other databases. Figure 7 exemplifies the distribution of articles according to the skill to be developed. The integrated skills category (26 articles) is the most targeted skill in the reviewed arti-

cles, followed by oral skills (12 articles), writing (8), translation (6), evaluation (3), recognition of bodily expressions (3), reading (2), attitude/satisfaction (2), grammar (1) and others such as anxiety and teaching resources (5).

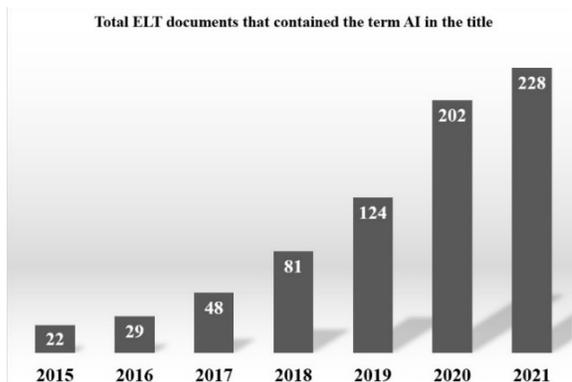


Figure 2: Total ELT documents that contained the term AI in the title

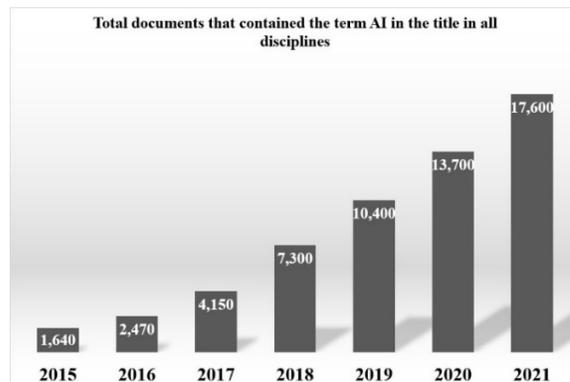


Figure 3: Total documents that contained the term AI in the title in all disciplines

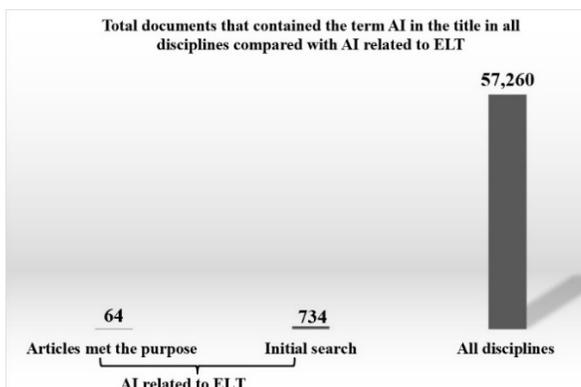


Figure 4: Total documents that contained the term AI in the title in all disciplines compared with AI related to ELT

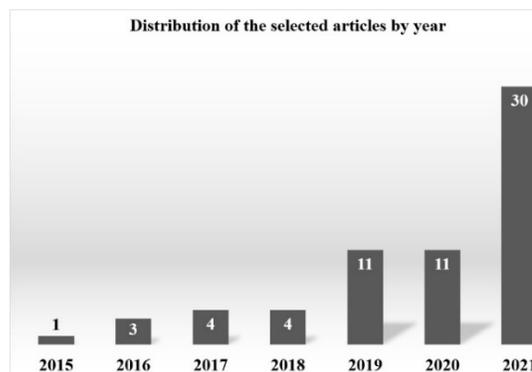


Figure 5: Distribution of the selected articles by year

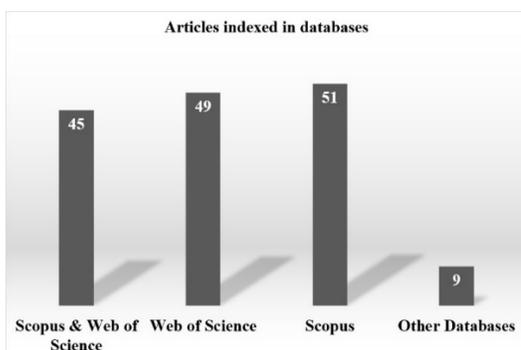


Figure 6: Articles indexed in databases

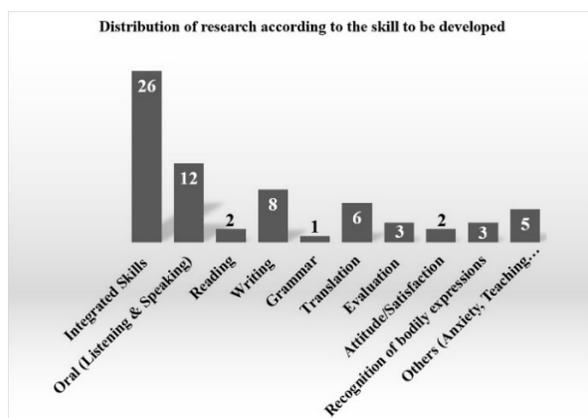


Figure 7: Distribution of research according to the skill to be developed

In addition, AI in ELT research generally adopted three research methods. Figure 8 shows that the mixed research (26 articles) was the greatly utilized in AI in ELT research from 2015 to 2021, next the quantitative method (22), and qualitative (16) was the least used. Furthermore, Figure 9 shows the educational level of those who participated in the 2015-2021 articles. The higher education level (35 articles) had the most participants, followed by school students from elementary to high school level (12 articles), and unspecified (16 article).

Figure 10 shows that the articles that were included in the current study followed three patterns in the use of technology based on AI in ELT. 32 articles developed novel AI-based systems that were developed by the researchers for the purpose of their article, 21 articles used existing AI-based systems, while 7 articles implemented a theoretical framework. Figure 11 displays the distribution of the analyzed articles according to the sampled participants. Most articles sampled students as participants (36 articles), only 3 articles sampled educators, 18 articles did not specify the sample type, and 7 articles were theoretical or conceptual studies.

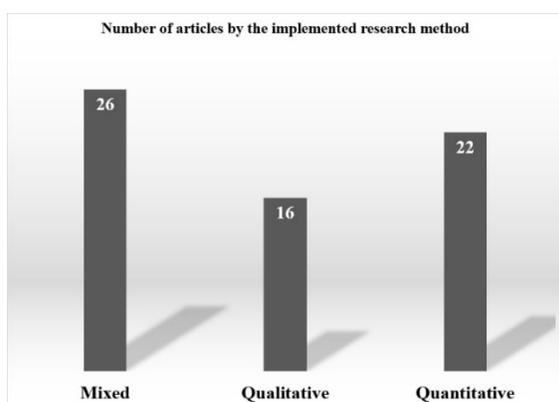


Figure 8: Number of articles by the implemented research method

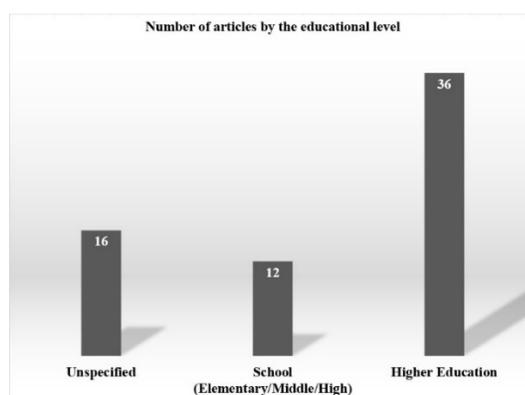


Figure 9: Number of articles by the educational level

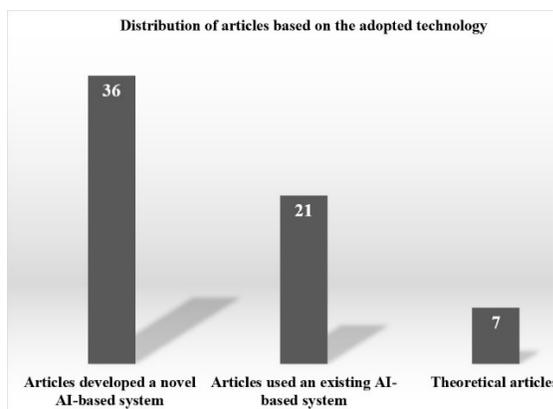


Figure 10: Distribution of articles based on the adopted technology

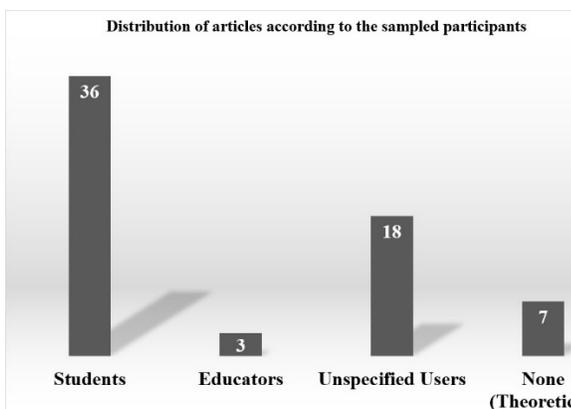


Figure 11: Distribution of articles according to the sampled participants

The Appendix reveals the data extracted from the selected 64 articles for the current study. Data were classified into nine categories: article title, adopted technology, research method, instruments and/or tools, journal name, publication year and index, educational level, language skill and others, and the effect.

## DISCUSSION

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### *STATE OF CURRENT RESEARCH ON AI IN ELT*

This study conducted a systematic review of the literature on AI in ELT by analyzing selected articles between 2015 and 2021, aiming to understand the current research progress in the field and to further understand the challenging issues. The findings revealed that the number of papers on the subject has significantly increased over the said period, whether in all disciplines in general or in ELT in particular (Figures 2 & 3). Almost all the studies reported positive effects of AI on ELT. This suggests that AI is an active field of research over the period between 2015 and 2021, with progressively constant developments and a highly promising future for ELT. This finding is compatible with previous research (Das et al., 2015; Tang et al., 2021).

There is relatively little relevant research on AI in ELT. Only 64 articles were found relevant among the large corpus in all disciplines that was yielded by the Google Scholar search conducted for this study, which includes 57,260 documents (Figure 4). It is likely that AI is a discipline that involves a fusion of “computer science, cybernetics, information theory, neurophysiology, psychology, linguistics, and other disciplines” (Bin & Mandal, 2019, p. 1), which truly requires team effort. Therefore, it is noticeable that the majority of the articles were produced by authors from outside the ELT domain; this resulted in a greater focus on providing theoretical information and almost neglecting the experimental aspect in the learning environment. This finding is in line with Singh et al. (2021), who state that few studies have focused on the teaching and learning through AI technology, while it contrasts with Kim (2019), who believes that there have been a few studies on the use of AI in ELT.

It is also worth bearing in mind that the articles reviewed in this study, except for 9 articles in other databases, were published in journals indexed in the WoS or Scopus databases or both (Figure 6). This indicates that the included articles are of good quality, which makes their results more reliable. According to Tang et al. (2021), it is necessary to distinguish studies of high quality “from an academic database which provides detailed meta-data as well as the content of the studies” (p. 4).

The analysis of the extracted articles reveals that most of the articles have been conducted from 2019 onwards (Figure 5). It is evident that the COVID-19 pandemic, which started to emerge in late December 2019, has accelerated the pace of research relevant to AI in order to find effective teaching practices with technology. However, the research in the field is not yet satisfactory and is still far from sufficient. Undoubtedly, the scarcity of research on AI in ELT negatively impacts our understanding of progress in the field, resulting in improper assessment of the situation. The problem lies in the fact that the English language is not a single skill, but a collection of skills; thus, when these articles are distributed across the skills, one can sense the real dearth of studies (Figure 7).

It was also found out that most of the selected articles used the mixed research method for their research design, comprising both the qualitative and quantitative research method (Figure 8). The qualitative method involved analyzing the literature, analyzing the users' record, creating the system database, theoretically describing the system, and providing discussions in light of relevant theories. The quantitative research method attempts to evaluate the usability of the system, using questionnaire, pretest–posttest, and special exams. The mixed research approach is arguably the best method to utilize since it allows qualitative data to complement quantitative data, hence increase the study's validity (Dornyei, 2007).

This systematic review shows that higher education level is the most common group used as a sample (Figure 9). Perhaps this is due to the higher English proficiency of higher education students compared to students at high school level or lower. Personalized learning might also be a main cause; with young students the focus is on delivering the fundamental knowledge of the language rather than personalization. Also, some AI systems are not suitable for younger students such as examining a translation system or evaluating an automated essay scoring system. For example, Chen and Warden

(2019) conducted a study to improve the abstract writing skills of graduate learners applying SMOOC and Quick Research Papers technologies (see Appendix).

According to the analysis of the selected articles, most articles sampled students as participants (Figure 11), while there is a dearth of studies on educators. Certainly, at this early stage of research, it would be significant to study the role of the educators in integrating AI into ELT. We are in a dire need to know the impact of AI on the educators and the difficulties they may face.

Most previous studies developed novel AI-based systems; some studies used existing AI-based systems, while a few articles presented AI in ELT in a theoretical framework (Figure 10). Articles that introduced novel systems adopted technologies namely neural networks, expert systems, cloud computing, self-learning system, data mining, deep learning, machine learning (Pikhart, 2020), speech recognition, image recognition, natural language processing, expert systems (Wanwu, 2015), edge computing (Xu, 2021), etc. On the other side, studies that used existing AI-based technology used applications such as “Apple Siri”, “Amazon Alexa”, “Google Assistant”, “Microsoft Cortana”, web chatbots like Audrey, Charles, Cristal, Mike, Mondly, MiABot, Mitsuku, and Lyra, and robots such as Pepper and Erica. It is noted that most articles focused on designing an ELT assistant system and then examined its effect on a selected sample.

Based on the data reported in the Appendix, various AI approaches have been incorporated into ELT. For example, machine learning has been used to program a robot that talks to students and produces different sentence forms (Thin et al., 2020), recognizes the optimal feature set of pedagogical factors distinguishing high-achievers from low-achievers in reading (Xiao & Hu, 2019), “analyze[s] the key competences assessment of English teaching disciplines and build[s] an evaluation model” (T. Zhao & Cai, 2021, p. 1), builds an intelligent online English education classroom management system (Y. Wang, 2021), and assesses students' knowledge of grammar (Srikanthan et al., 2020). Another approach that has been used is neural network, which is used to construct a machine translation system utilizing a large corpus (Binh & Phap, 2018), to figure which knowledge element needs to be comprehended, recalled, or reinforced based on the former level of mastery of knowledge (Li, 2017), to set up “autonomous learning system module, which is used to analyze the student test situation and perform self-diagnosis” (X. Zhu, 2018, p. 18), to process images to secure a facial profile (Na, 2021), to identify the courses that students want to take the most (Cai, 2020), to build a chatbot that is trained for a conversation class (Srikanthan et al., 2020).

Moreover, the support vector machine approach is utilized to provide categorization accuracy to differentiate between the high- and low-achieving readers (Xiao & Hu, 2019), to produce pronunciation feedback, perform functions, and score predictions (Srikanthan et al., 2020). A further method that is closely related is genetic algorithms, which is applied to search for continuous improvement until a test paper that meets the specified conditions is reached (Tan, 2020), to refine the rules for an intelligent test paper, and thus lay out an optimized English test system (H. Wang, 2016). Studies also used the deep learning approach to achieve the optimization of the “automated essay evaluation system” and realize effective feedback (Z. Wang, 2022), to set up “a business English speech translation model” (Xu, 2021), to design a new tool platform to assist learners improve their ELT efficiency conforming to their comprehension of knowledge and personality (Z. Sun et al., 2021), and to devise ingredients to train learners and produce pronunciation feedback (Srikanthan et al., 2020).

Additionally, the decision tree approach is assumed to generate an English teaching assessment implementation model (Z. Sun et al., 2021), to handle the ordered classification “problem to the comprehensive evaluation system of students” (T. Zhao & Cai, 2021, p.8). Expert system was also adopted by the reviewed studies to assist English teaching based on special knowledge and experiences provided by experts (Bin & Mandal, 2019; Cuiye, 2016; Li, 2017; X. Zhu, 2018). Besides, natural language processing is used to make robots smarter, with the ability to talk and ask and answer questions of students (Thin et al., 2020). Moreover, studies reviewed indicate that data mining is utilized to create a thorough assessment of the learners' English test scores and nominates recommendations for reference teaching

(Wu, 2021), to “analyze the association rules of question types to find some unknown information in an ordered data” (Shen, 2021). An additional approach is cloud computing, which is used to store the complete learning process of each knowledge point for every student (Huiying & Qiang, 2021; Zou, 2017). Finally, edge computing is adopted to set up English translation system architecture to handle the differences between the source and target languages, and thus increase the readability of the translation (Xu, 2021).

From the perspective of current research, AI improves ELT. All studies reported positive effects of AI in general (see Appendix). Specifically, studies found (1) comprehensive improvement of student's English level (e.g., Bin & Mandal, 2019; L. Ma, 2021), (2) proven usability and suitability of the platform/interface (e.g., Li, 2017; Yuan, 2021), (3) improvement in autonomous learning (e.g., Han, 2019; Zou, 2017), (4) increase in interaction/performance (e.g., Z. Sun et al., 2021; Zhou, 2019), (5) increase in engagement (e.g., M. H. Shin, 2021), (6) inclusion in teaching resources (e.g., M. Gao et al., 2021), (7) positive attitudes towards AI (e.g., Haryanto & Ali, 2018; Sindermann et al., 2021), (8) reduced anxiety (e.g., Bao, 2019; Su et al., 2019), (9) active and interesting learning environment (e.g., Chong, 2021; Keerthiwansa, 2018; X. Sun, 2021), (10) improved translation accuracy/quality (e.g., Binh & Phap, 2018; Wei, 2020; Xu, 2021), (11) improved satisfaction with the teaching model (e.g., An & Zhao, 2021; Zhang & Chen, 2021), (12) improved English teachers' teaching efficiency/ability (e.g., Cai, 2020; Cuiye, 2016), (13) effective learning feedback (e.g., Han, 2019; Z. Wang, 2022), (14) automatic analysis and error correction by the systems (e.g., Chen & Warden, 2019; D. Zhao & Sun, 2016), (15) intelligent locating/positioning of students by the system (e.g., Aiyuan & Hui, 2021; Y. Wang, 2021), (16) improvement in accuracy of facial recognition (e.g., Y. Gao et al., 2021; Na, 2021).

However, studies mentioned shortcomings too (see Appendix). Bin and Mandal (2019) state that their proposed system only supports objective questions. Li (2017) points out that the online learning system interface is usable but that it requires some improvements. Kim (2019) sheds light on the lack of research on the use of chatbots to improve grammar skills. M. H. Shin (2021) acknowledges that the developed learning model was just a start with further research needed, including the need for a more controlled experiment using AI speakers. El Shazly (2021) mentions deficiencies such as learners' anxieties not being assuaged, potential bias, no “control group, small sample size, and [no] substantial descriptive data” (p. 12). Xu (2021) affirms that the design was not up to achieving sizeable accuracy in “complex speech” environments, and that the training period was long. According to Zhou (2019), the proposed platform lacks recording and monitoring functions, lacks the capability to control students' learning habits, lacks a sufficient scoring mechanism, and “scattered teaching materials come from the Internet rather than from an in-class book” (p. 3). Cai (2020) highlights that the model assumes that educators are familiar with the latest teaching methods, and the model is not verified in the actual environment. Chong (2021) argues that students with insufficient English foundation still need teacher intervention. Wu (2021) mentions “overreliance on multimedia, lack of innovation in multimedia content, and no change in teaching thinking mode” (p. 6). Aljohani (2021) posits that the effect of the used technique was not tested on participants. Binh and Phap (2018) admit that the quality of machine translation is modest because of the insufficient amount of used corpus. Rulin (2020) reports shortages in the application such as the absence of “tolerance of errors, innovative space, individualized content and highly collaborative learning processes” (p. 88). D. Shin et al. (2021) illustrate that Mitsuku generated excessive quantities of information that hindered the students' understanding and caused communication breakdowns. Therefore, it can be asserted that research on AI in ELT is in its infancy. So far, there is no article without shortcomings or insufficient data. It is difficult to have a system that can be fully used as a perfect role model.

## ***CHALLENGES***

Some articles have used commercially available mobile phone applications. This leads to the question of whether these Apps actually apply the AI technology, whether they are consistent with students' learning, and whether their impact on learning has been measured. Pikhart (2020) tested a number of

applications and, surprisingly, states that the largest part of the applications do not use any AI, except in speech recognition. In the same context, Zhou (2019) questions the ability of these applications to contribute to the achievement of guaranteed learning outcomes, bearing in mind the student does not receive proper guidance and instruction from an English teacher. Therefore, the selection of such applications must be carefully thought out so that the students' learning is not driven by expectations of commercial actors but, instead, by specific learning goals and real students' needs.

Most articles lacked the instructional content and the method that were used to optimize students' learning based on AI. There was not enough description given about the systems that were employed in the articles. This entangles the reader in important questions about how the content was being linked to AI, how it was delivered, and how the impact was measured. Definitely, the shortcomings are largely related to the weak instructional design and lack of pedagogical knowledge. D. Shin et al. (2021) point out that no studies tracked the effectiveness of the AI-based instructional design or the suitability of the learning context. Today, rigorous AI research is needed that seriously includes more detailed description of the method, so that researchers can utilize the data for further research.

A few studies that claim to have utilized AI systems have actually used traditional technology tools. Some of the reviewed articles clearly misunderstood AI in ELT. For example, using audio or video files to train students on listening and speaking has nothing to do with AI. It is, in fact, critical to distinguish between AI-based systems and traditional technology approaches under the view that AI-based systems are capable of simulating human thinking and behavior. The fundamental difference between AI and traditional systems is manifested in the AI-based system's ability to draw from big data having different formats and time spans and to draw conclusions from that data (Zuboff, 2019 as cited in Leyer et al., 2020). In practice, there is a need to establish clear evaluation criteria by journals to assess whether or not AI is actually used in research.

AI can be enormously beneficial if used to enhance listening and speaking skills by incorporating speech recognition technology; however, inherent issues are inevitably present. That is because human languages are complicated and include multiple elements that are still far from machine-controlled; these include the paralinguistic cues such as body language, gestures, facial expressions, and emotions accompanying speech. Mukherjee (2020) confirms that AI lacks the sophistication to understand "complex human speech" like "humor, pun, irony and sarcasm" (p. 91). Similarly, Zhou (2019) believes that the efficiency and the suitability of intelligent oral English systems are still uncertain.

Though AI-based systems are reliable overall and assist learners in developing their writing skills, they may give inaccurate feedback. For example, Z. Wang (2022) identified wrongly detected proper nouns by the AI-based system such as "iPhone" as a capital letter error; the system was also unable to differentiate "a long" from "along" and failed to identify the subject fragment and predicate in a sentence like "When Robby got up early, which was a routine for twenty years." Some authors believe that the current AI-based writing systems "only provide vocabulary and grammar improvement suggestions in information feedback" (Su et al., 2019, p. 3). This indicates that human capabilities remain irreplaceable during this time period.

AI technology in translation is still difficult to replace humans during this time period as well. This can be simply proved by translating back to the source text; more often than not, the result will not match the original text. If we take the Arabic language as an example, Khalatia and Al-Romanyb (2020) introduced challenges that face AI-based translation into Arabic including: equivalency, synonymy, antonymy, metonymy, polysemy, as well as rules and symbols of multiple meanings that differ according to tone, character, or punctuation marks. Another interesting example of the incompetence of machine translation was provided by Stewart (2016), who confirms that machines need to grasp the meanings of words and sentences. The author asserts that a computer cannot understand a sentence like "It will rain tomorrow" may mean belief "I believe that it will rain tomorrow", hope "I hope that it will rain tomorrow", or fear "I'm afraid that it will rain tomorrow".

## ***GAPS IN AI RESEARCH***

Various gaps have been identified in the literature regarding AI in ELT. The current study highlights the main gaps in the literature review, in order to propose some relevant future research areas.

Most studies that have researched AI in ELT did not elaborate on what teaching material for learning driven by AI they used. A detailed description of the method, teaching material, design, and procedures should be provided to allow stakeholders to fully benefit from good practices and understand conditions under which AI is being carried out to optimize learning. This scarcity of useful teaching material needs to be urgently corrected in future work endeavors.

There is a misunderstanding of what can be considered under the realm of AI and what traditional technology is that could not simulate intelligence. The scope of AI is limited to the ability of machines to think like humans and perform their intellectual tasks. Therefore, journals must ensure that any future research submitted for publication includes real use of AI. It was shocking that many of the studies that were excluded had little to do with AI.

The majority of the articles reviewed in this study were conducted by authors from outside the ELT domain who did not have a clear understanding of how to develop effective learning material that could meet the needs of ELT learners. AI is interdisciplinary in nature that involves multiple sciences such as computer science and linguistics. This necessitates the cooperation among professionals across a range of disciplines, and that may be the reason why the construction of AI-based learning is somehow complicated. Considering the experience of the researchers in the current study, this was a major reason for our decision on the weaknesses of a number of studies that were excluded from review.

The validity and reliability of the assessment instruments, the cornerstone of the measurement, were absent from most studies. Based on the Appendix, the effectiveness of the systems applied in this area was evaluated by the use of pre-tests and post-tests, analysis of users' records, questionnaires, interviews, etc. Absence of details about the validity and reliability of the measurement instrument is a great weakness that affects the study accuracy, consistency, and feasibility. This emphasizes the critical need for future studies to fill this gap.

To some extent, studies are active in delineating oral skills, but, in contrast, reading and grammar are the least covered in current research. As mentioned earlier, Kim (2019) talks about the lack of research on the use of chatbots to improve grammar skills. This may indicate that reading and grammar can be better developed through integrated skills rather than as separate skills. This gap calls for further research with greater attention to these skills to attest the effect of using AI-based learning in optimizing reading and grammar learning.

## **CONCLUSIONS**

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This study presented a systematic review of the current state of AI in ELT over the period between 2015 and 2021. Overall, data from the reviewed articles indicate that there is a promising future for AI in ELT. AI in the field generally has a positive impact in terms of optimizing the English skills, translation, assessment, recognition of paralinguistic cues, attitude, satisfaction, etc. This is evident by the increase in the number of papers published over the said period. However, most of the articles have been conducted from 2019 onwards, suggesting that the COVID-19 pandemic has accelerated the pace of research relevant to AI. Higher education level is the most common group used as a sample, implying that perhaps this is the right level to meet the requirements of personalized learning.

However, AI in ELT is still in its preliminary stages and is still far from sufficient, and more research is needed. There is relatively little relevant research conducted on AI in ELT, and the majority of the articles were produced by authors from outside the ELT domain. Additionally, there is not enough description given about the instructional content and the systems, indicating that AI research needs to seriously include more detailed descriptions of the method in further research. There are inherent

issues related to teaching listening and speaking because languages include elements that are still far from machine control such as paralinguistic cues like body language, gestures, expressions, and emotions. The same also applies to automated writing evaluation systems, where most of them tend to correct only vocabulary and grammar and fail to give enough feedback on content, structure, style, and coherence. Similarly, human translation is still irreplaceable since the quality of machine translation is still far from complete.

Almost all researchers seem to agree that AI systems are incapable of simulating human body language, gestures, expressions, and emotions in a reasonable way. Thus, they acknowledge that these are still deep-rooted challenges that demand further interdisciplinary research and collaboration among experts in the relevant fields. The authors of the reviewed studies hope in the future, as technology advances, to find ways to overcome these challenges and increase the capabilities of AI-based systems in simulating human traits.

Thus, developing novel systems that can be integrated with AI and ELT remains an active field of research. Findings in this emerging area of research could be particularly important for other researchers, educators, and AI specialists who are involved in the study of the applications of AI in ELT. Researchers may then better grasp how the literature is progressing or what areas of AI are being covered. It is also recommended that researchers review the efficiency of AI-based systems used in previous research and ensure their relevance and functionality. Educators can use such novel systems as a guide to design English activities based on AI. Finally, AI specialists and experts can use the findings of this research to evaluate the efficiency of their proposed algorithms and make improvements.

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## APPENDIX

### *The data extracted from the 64 articles and their classification into nine categories*

| Article Title   | Adopted Technology  | Research Method | Instrument & Tool  | Journal  | Year + Index          | Language Skill & Others | Level & Country           | Effect Description  |
|---|---|-----------------|--|--|-----------------------|-------------------------|---------------------------|---|
| 1. "English teaching practice based on artificial intelligence technology" (Bin and Mandal, 2019)               | This paper used English assisted instruction software called SAJET that utilized AI technology. SAJET is software development that enables automation programs. It is adopted by the study to provide personalized teaching environment. Teaching strategies were chosen by pinpointing the predictions of the learners. Expert system was adopted to assist English teaching based on special knowledge provided by experts. Some features of the software were enhanced and made more human-like. The system model of intelligent teaching that utilized Web and "data mining used data mining technology" to study the massive bulk of data on the Web to pinpoint rules and specific patterns favored by the users. | Mixed           | <ul style="list-style-type: none"> <li>• Relevant theories of curriculum theory</li> <li>• Literature analysis</li> <li>• Field investigation</li> </ul> | Journal of Intelligent & Fuzzy Systems                     | 2019<br>Scopus<br>WoS | Integrated Skills       | Middle school<br>China    | <ul style="list-style-type: none"> <li>• The system provides convenience for teachers.</li> <li>• Provides teachers with data about students' learning.</li> <li>• Provides personalized education environment.</li> <li>• Comprehensive improvement of students' learning.</li> <li>• Shortcomings: The system only supports objective questions.</li> </ul> |
| 2. "The construction of intelligent English teaching model based on artificial intelligence" (Li, 2017)         | This study developed an e-learning system using Java software and Prolog language systems with expert system. Prolog is a programming language associated with AI. This system comprises two systems: one that pertains self-learning and one that is conducive to experts. The system mined and collected student data via three means: indirect, direct, and background data. The expert system calculated the kinds of knowledge to be attained, recollected, or improved in keeping with the previous level of knowledge.   | Qualitative     | <ul style="list-style-type: none"> <li>• The browser of the online learning system</li> <li>• Dreamweaver web development tool</li> </ul>                | International Journal of Emerging Technologies in Learning | 2017<br>Scopus<br>WoS | Integrated Skills       | Unspecified<br>China      | <ul style="list-style-type: none"> <li>• The "model mines and collects knowledge levels."</li> <li>• The neural network can calculate knowledge points that should be gained or reinforced.</li> <li>• Shortcomings: The interface is usable, but there should be some improvements.</li> </ul>   |
| 3. "Designing and practice of a college English teaching platform based on artificial intelligence" (Zou, 2017) | The study established a platform for teaching English that utilized cloud computing. Cloud computing enables the provision of various services online. The cloud computing platform stored the complete learning process for every student. Through AI analysis, student learning records were analyzed.  | Qualitative     | Students' learning record, knowledge feedback, test data and teaching resources stored in the platform   | Journal of Computational and Theoretical Nanoscience       | 2017<br>Scopus<br>WoS | Integrated Skills       | Higher Education<br>China | <ul style="list-style-type: none"> <li>• Improved autonomous learning and English abilities</li> <li>• The platform can classify students into categories according to their abilities.</li> <li>• Learning log and exam data can be stored.</li> </ul>   |

| Article Title  | Adopted Technology  | Research Method | Instrument & Tool   | Journal                                  | Year + Index          | Language Skill & Others                    | Level & Country               | Effect Description  |
|--|---|-----------------|---|--|-----------------------|--|-------------------------------|---|
| 4. "Design of online intelligent English teaching platform based on artificial intelligence techniques" (Sun et al., 2021) | The study proposed deep learning-assisted online intelligent ELT (DL-OIET) system to assist learners improve their ELT efficiency conforming to how much knowledge they have grasped and to their character. The system was based on the algorithm called decision tree and also on neural systems. The study used this kind of algorithm and neural systems to generate a model for implementing assessment. It provided useful data from large chunks of data, summarized guidelines and data, examined past data, detected possible similarities between previous data, carried out investigation, and helped teachers make decisions to improve students' learning. | Qualitative     | Analysis of the use of learning services in the platform to forecast student performance              | Computational Intelligence               | 2021<br>Scopus<br>WoS | Integrated Skills                          | Unspecified<br><br>China      | <ul style="list-style-type: none"> <li>The system can assist learners lavish their learning efficiency.</li> <li>It has "better performance for evaluating interaction quality, level, and the learning activity compared to IA, CNTS, SSA, and CALL."</li> </ul> |
| 5. "A Study on the use of artificial intelligence chatbots for improving English grammar skills" (Kim, 2019)               | Participants in the study engaged in chat activities with the chatbot named Replika to improve English grammar. Replika was made with the idea to create a personal AI that can present a subject and lead a conversation. Through students' interactions, its personality becomes more similar to its users. Users were able to connect their social media like Instagram or Facebook to allow Replika to understand them better.  | Quantitative    | <ul style="list-style-type: none"> <li>Text message chats</li> <li>Pre-test and post-tests</li> </ul> | Journal of Digital Convergence           | 2019                  | Grammar                                    | Higher Education<br><br>Korea | <ul style="list-style-type: none"> <li>Replika significantly improved the participants' English grammar skills.</li> <li>Shortcomings: Dearth of research on the use of chatbots to improve grammar skills.</li> </ul>  |
| 6. "An English network teaching method supported by artificial intelligence technology and WBIETS system" (Du, 2021)       | The study constructed an AI English network teaching system through a Web-based intelligent English teaching system (WBIETS) that utilized neural networks. This study availed itself of the system for network intelligent teaching of English; this was intended to improve the algorithm for machine learning and render it an essential algorithm ready to be utilized by AI systems.   | Qualitative     | Perform mathematical analysis of the user's access patterns   | Scientific Programming                   | 2021<br>Scopus<br>WoS | English online teaching- Integrated Skills | Unspecified<br><br>China      | The constructed English teaching system can play a marked effect in modern English teaching.  |
| 7. "Analysis of the application of artificial intelligence in college English teaching" (D. Zhu, 2017)                     | The study introduced the essence of AI, like the concept, improvements in and merits of AI, suggest the AI-based "English teaching system in colleges and analyzed the overall realization scheme of college English assistant teaching system based on AI with a view to reducing the burden on teachers".   | Qualitative     | Introduce the concept, its development, advantages, application, and its significance                 | Advances in Intelligent Systems Research | 2017<br>Scopus<br>WoS | English teaching- Integrated Skills        | Higher Education<br><br>China | The proposed scheme includes four modules: auxiliary teaching, knowledge explanation, exercise training and environment simulation. The system will facilitate the English learning.  |

| Article Title  | Adopted Technology   | Research Method | Instrument & Tool  | Journal   | Year + Index          | Language Skill & Others | Level & Country                     | Effect Description  |
|--|--|-----------------|--|---|-----------------------|-------------------------|-------------------------------------|---|
| 8. "Artificial intelligence translation under the influence of multimedia teaching to study English learning mode" (P. Li et al., 2021)    | The paper designed a platform for online translation that utilized AI using Google API, Gzip compression software, and speech recognition technology. Google APIs are application programming interfaces (APIs) that were created by Google and that enable communication between Google and humans. The speech recognition feature was used to allow Google to comprehend human voice, and alter the voice input into written data. The translated text is displayed by the software in two forms: audio text and written text. | Mixed           | <ul style="list-style-type: none"> <li>• SQLite software as text data source</li> <li>• Analyze users' records.</li> <li>• Word2vec</li> <li>• LSTM</li> <li>• The Internet of Things</li> </ul> | International Journal of Electrical Engineering & Education | 2021<br>Scopus<br>WoS | Translation             | Unspecified<br><br>China            | The platform can "improve query efficiency, and increase users' enthusiasm for learning English".   |
| 9. "Improving the English skills of native Japanese using artificial intelligence in a blended learning program" (Obari & Lambacher, 2019) | The focus of the paper was the assessment of utilizing the AI speakers Google Home Mini (a smart speaking device powered by Google Assistant) and Amazon Alexa (a voice-controlled virtual assistant developed by Amazon), a kind of an environment for blended learning that ameliorates language skills.   | Quantitative    | <ul style="list-style-type: none"> <li>• Pretest and posttest using TOEIC test.</li> <li>• Post-training survey.</li> </ul>  | CALL and complexity-short papers from EURO-CALL             | 2019                  | Integrated Skills       | Higher Education<br><br>Japan       | <ul style="list-style-type: none"> <li>• Developed the learners' comprehensive English skills, in particular listening comprehension.</li> </ul>  |
| 10. "Development of English teaching model applying artificial intelligence through maker education" (Shin, 2021)                          | The study developed a learning model that utilizes a maker education program via speech recognition. Utilizing AI provided an opportunity for the students to carry out speaking activities and overcome the limitations of classroom instruction. The makeup of the AI using the maker education program comprised three phases: before learning, during learning, and after learning. A questionnaire was used to assess the self-learning capability through this teaching and learning model.                                | Quantitative    | <ul style="list-style-type: none"> <li>• Pre- and post-results</li> <li>• Experimental group questionnaire</li> </ul>  | Journal of the Korea Convergence Society                    | 2021                  | English speaking        | Higher Education<br><br>South Korea | <ul style="list-style-type: none"> <li>• Increased self-direction, engagement, problem-solving, and participation</li> <li>• Shortcomings: This study was merely a start with further research required.</li> </ul> |
| 11. "Research on English teaching system based on artificial intelligence and WBIETS wireless network system" (Tan, 2020)                  | The study established a test paper model based on the genetic algorithm and WBIETS wireless network system. The study used the algorithm to search for the optimization until a test paper near the set condition is produced. Genetic algorithm is a method used for searching the optimal solution by simulating the natural evolution process.  | Mixed           | <ul style="list-style-type: none"> <li>• Mathematical model of the examination paper.</li> <li>• Test paper model</li> </ul>   | EURASIP Journal on Wireless Communications and Networking   | 2020<br>Scopus<br>WoS | English online test     | Unspecified<br><br>China            | The test paper made by this method satisfies users' requests for questions, content, and scores.  |

| Article Title  | Adopted Technology  | Research Method         | Instrument & Tool   | Journal  | Year + Index          | Language Skill & Others    | Level & Country                                    | Effect Description   |
|--|---|-------------------------|---|--|-----------------------|----------------------------|--|--|
| 12. "Personalized recommendation method for English teaching resources based on artificial intelligence technology" (M. Gao et al., 2021)                        | The study used web mining technology that gathered personalized data about the users and mined teaching resource rules and patterns which represented behavior of the learners. AI is utilized to resemble the intelligent conduct of learners looking for information and to pinpoint the more frequently occurring lexical items. Those lexical items were chosen "as keywords, thus calculating the resemblance between keywords" and learner characteristics. After that, the researchers used as a recommendation goal the teaching resources that had high similarity, and the suggested formula is chosen to establish resource recommendations. | Mixed                   | In-depth analysis of the user's Web log and page content  | Journal of Physics: Conference Series                    | 2021<br>Scopus<br>WoS | English teaching resources | Unspecified<br><br>China                           | This method improves the accuracy of recommended content and provides teaching resources that meet each student needs. Shortcomings: insufficient sharing of English teaching resources.           |
| 13. "Assessing the attitude towards artificial intelligence: Introduction of a short measure in German, Chinese, and English Language" (Sindermann et al., 2021) | The study used Siri, Pepper, and Erica technologies as representatives of popular AI products. The purpose was to assess attitudes towards AI products. Siri is a virtual assistant that is part of Apple Inc. Pepper is a social humanoid robot able to recognize faces and basic human emotions. Humanoid female robot Erica can engage in more human-like conversations.   | Quantitative            | Self-report measures  | KI-Künstliche Intelligenz                                | 2021<br>Scopus<br>WoS | Attitude                   | Higher Education<br><br>Germany, China, and the UK | <ul style="list-style-type: none"> <li>• Positive attitudes towards AI</li> <li>• The study introduced a concise measure with high reliability, and validity on the attitude toward AI.</li> </ul> |
| 14. "Artificial intelligence promotes the evolution of English writing evaluation model" (Su et al., 2019)   | An AI writing review system was used to control the learners' way of learning, learning preferences, and learning techniques, reduce the writing anxiety, stimulate interest and motivation. To ascertain the efficiency of AI assessment system, the article, guided by the "data-driven theory, adopted the stratified cluster random sampling" way to choose college students.   | Quantitative            | <ul style="list-style-type: none"> <li>• 10 writing exercises</li> <li>• Pretest/posttest</li> <li>• Data analysis</li> </ul> | IOP Conference Series: Materials Science and Engineering | 2019<br>Scopus<br>WoS | Writing                    | Higher Education<br><br>China                      | Use of the AI writing review system improves English writing achievement, ability, and reduces writing anxiety.  |
| 15. "Artificial intelligence education (AIEd) in English as a second language (ESL) classroom in Sri Lanka" (Keerthiwansha, 2018)                                | This study investigated the various likelihoods of having AI in the ESL classroom to improve the students' knowledge, effectiveness of the teaching style, and produce a theoretical concept regarding the way how the ESL classroom can benefit from AI. Students accessed personalized lessons, so they viewed their improvement records and their frequent mistakes, communicated with their educator and their peers whenever they had enquiries, and learned lessons on their own when they missed class.  | Qualitative Theoretical | Questionnaire   | Artificial Intelligence                                  | 2018<br>Scopus<br>WoS | Integrated Skills          | Higher Education<br><br>Sri Lanka                  | The AIEd would produce a live and motivating personalized learning environment.  |

| Article Title   | Adopted Technology  | Research Method | Instrument & Tool  | Journal   | Year + Index          | Language Skill & Others                        | Level & Country                | Effect Description  |
|---|---|-----------------|--|---|-----------------------|--|--------------------------------|---|
| 16. "Artificial intelligence speech recognition model for correcting spoken English teaching" (Ran et al., 2021)              | The study used the Hidden Markov Model (HMM)-based algorithm to create a system on MATLAB that recognizes English speech. The students used the AI model for correcting speech that was constructed by this study to correct pronunciation.   | Quantitative    | <ul style="list-style-type: none"> <li>• GUI interface.</li> <li>• Speech recorder</li> <li>• 40 speakers; each reads 10 words; total 400 words</li> <li>• Pretest-posttest</li> </ul> | Journal of Intelligent & Fuzzy Systems                              | 2021<br>Scopus<br>WoS | Speaking                                       | Elementary school<br><br>China | The proposed AI model can help students correct their pronunciation in a timely and effective manner.   |
| 17. "College English assisted teaching based on artificial intelligence" (X. Zhu, 2018)                                       | The study designed an assisted instruction system for college English that utilized expert system. The expert system module for teacher-assisted teaching utilizes the expert system theory. The system represents domain knowledge by joining in production and framework. In view of uncertain fuzzy inference analysis, students' command of knowledge points was identified by the educators. In this education process, the neural network was adopted to create learner autonomy module that was taken advantage of to scrutinize the student test condition and execute independent diagnosis of themselves. | Mixed           | <ul style="list-style-type: none"> <li>• Analysis of recorded data</li> <li>• Evaluation criteria</li> </ul>   | International Conference on Virtual Reality and Intelligent Systems | 2018<br>Scopus        | Integrated Skills                              | Higher Education<br><br>China  | The system can help teachers grasp the learning situation of learners through "reasoning analysis and enables students to learn autonomously with good application value".  |
| 18. "Effects of artificial intelligence on English speaking anxiety and speaking performance: A case study" (El Shazly, 2021) | Students encountered various unsophisticated AI-driven systems, with "web chatbots" (such as Charles and Cristal) and Mondly, which were their printed and verbal e-partners for communication. The learners used Mondly's ability to recognize voice and practiced their pronunciation to help them make correct English pronunciations accurately on various topics of their choice. The web chatbots made possible largescale text chats on a variety of topics.   | Mixed           | <ul style="list-style-type: none"> <li>• Pretest-posttest</li> <li>• A 33-item FLA questionnaire</li> </ul>  | Expert Systems  | 2021<br>Scopus<br>WoS | Speaking                                       | Higher Education<br><br>Egypt  | <ul style="list-style-type: none"> <li>• Chatbots are beneficial in advancing learning, improving interaction, and oral communication.</li> <li>• Shortcomings: Learners' anxieties were not assuaged, potential bias, no control group, small sample, and substantial descriptive data.</li> </ul> |
| 19. "Simulation of English feature recognition based on machine learning and artificial intelligence technology" (Na, 2021)   | An e-learning system was created and applied to better understand behavior, to identify students through their facial features, to examine learning situations through the eyes, to investigate the acquisition of knowledge, to appreciate learning content, and to scrutinize new learning conduct via observation. The system used neural network to process images to obtain a facial profile for students.   | Mixed           | <ul style="list-style-type: none"> <li>• Collect face data</li> <li>• Classroom attendance</li> <li>• Classroom expression score</li> </ul>  | Journal of Ambient Intelligence and Humanized Computing             | 2021<br>Scopus<br>WoS | Facial recognition<br><br>Behavior recognition | Unspecified<br><br>China       | Students' performance in classroom is identified through facial features and eye recognition. The system was able to process images to obtain a facial profile for students.  |

| Article Title   | Adopted Technology  | Research Method | Instrument & Tool   | Journal                                      | Year + Index    | Language Skill & Others       | Level & Country           | Effect Description   |
|---|---|-----------------|---|--|-----------------|-------------------------------|---------------------------|--|
| 20. "5G Joint Artificial Intelligence Technology in the Innovation and Reform of University English Education" (Sun, 2021)                          | The paper built an AI teaching system carried by a 5G transmission network. The paired used edge computing to connect webcams that would record behavior, gestures, and physical messages of educators and learners during class. Utilizing AI, the data is scrutinized in the background to determine how much the learners have actually learnt. During independent learning, the results from the system and the intelligent assessment were shown on the monitor in real time to help students to make corrections.   | Quantitative    | <ul style="list-style-type: none"> <li>12 sets of wired VR devices and 6 sets of wireless VR devices</li> <li>Pretest and posttest</li> <li>Survey</li> </ul> | Wireless Communications and Mobile Computing | 2021 Scopus WoS | Listening and speaking skills | Higher Education<br>China | Using this system is influential and assists promote users' interest in learning and their involvement ability.  |
| 21. "Research on business English translation architecture based on artificial intelligence speech recognition and edge computing" (Xu, 2021)       | The study developed a translation system for business English utilizing AI's ability to recognize speech, and also utilizing deep learning as well as edge computing. In order to achieve speech recognition, the study used the deep neural network fusion method and integrated the elicited mono-modal characteristics. The study also adopted the edge computing method for the purpose of creating the architecture of the business English translation system to enhance the readability of the translation. Simulation test analysis was used to find out to what extent the established translation system was efficient.       | qualitative     | Simulation test analysis to verify the efficiency of the established business English translation framework   | Wireless Communications and Mobile Computing | 2021 Scopus WoS | Translation                   | Higher Education<br>China | <ul style="list-style-type: none"> <li>Compared to the existing methods, the proposal improved the readability of the translation by 10%.</li> <li>Shortcomings: The method is not able to attain sizeable accuracy in "complex speech environments", and the "training time" is lengthy.</li> </ul> |
| 22. "College English smart classroom teaching model based on artificial intelligence technology in mobile information systems" (Zhang & Chen, 2021) | The article designed a teaching model based on AI mobile information system. The system provided students with personalized learning and collected learner's voice, emotions, and other physical data to support subsequent personalized learning. With the application of pattern recognition, spoken language of students was compared with the standard oral language to direct the students' learning and to ascertain through AI the students' learning status. The teachers as well as the learners were shown the analysis of the results of the learning that the software provided so they would give evaluation and feedback. | Mixed           | Questionnaire Survey  | Mobile Information Systems                   | 2021 Scopus WoS | Integrated Skills             | Higher Education<br>China | <ul style="list-style-type: none"> <li>The model can improve students' learning abilities.</li> <li>High satisfaction with this teaching model</li> </ul>  |

| Article Title   | Adopted Technology   | Research Method | Instrument & Tool   | Journal   | Year + Index          | Language Skill & Others | Level & Country           | Effect Description  |
|---|--|-----------------|---|---|-----------------------|-------------------------|---------------------------|---|
| 23. "Application of artificial intelligence to higher vocational English teaching in the information environment" (Yong, 2020)                                | The study adopted IT teaching mode and implemented it in English teaching at institutions of vocational training. Recognizing the characteristics of students, AI selected appropriate content for learning and set learning goals, made learning plans tailored to the students' needs, identified challenges, and provided various learning styles. Educators were able to adapt their teaching styles and teach students according to their aptitude in light of the test results of learners.  | Quantitative    | <ul style="list-style-type: none"> <li>• Pretest and posttest</li> <li>• Questionnaire</li> </ul>                                     | Journal of Physics: Conference Series                   | 2020<br>Scopus<br>WoS | Writing composition     | Higher Education<br>China | <ul style="list-style-type: none"> <li>• The AI mode is able to analyze the students' characteristics and establish "personalized learning".</li> <li>• The essay writing marks of the experimental group have improved comprehensively.</li> </ul>   |
| 24. "An immersive context teaching method for college English based on artificial intelligence and machine learning in virtual reality technology" (Ma, 2021) | The article proposed "the virtual reality (VR) technology college English immersive context teaching method" utilizing AI as well as machine's ability to learn. Virtual situations that included all language skills were created by the VR technology. Teachers made remarks as the discussions were in progress to promote understanding and to foster improvement in learning.   | Quantitative    | <ul style="list-style-type: none"> <li>• Pretest and posttest</li> <li>• Questionnaire</li> </ul>                                     | Mobile Information Systems                              | 2021<br>Scopus<br>WoS | Integrated Skills       | Higher Education<br>China | The "virtual reality technology" can foster improvement in "students' English level."   |
| 25. "The Construction of English Teachers' classroom teaching ability system based on artificial intelligence" (Cuiye, 2016)                                  | The study designed an AI system based on "expert system and natural language recognition technology" for the purpose of creating a new system of English teaching lesson. The expert system was used to store knowledge of experts. These experiences and knowledge were continuously augmented and modified. The system automatically generated the corresponding characteristics of the teacher knowledge tree; this is a process that defines the strategies and the planning of the teaching, and it enabled the students continued to learn the knowledge points and create a student knowledge tree accordingly. | Quantitative    | <ul style="list-style-type: none"> <li>• Pretest and posttest</li> <li>• Mid-term test</li> <li>• Platform final test</li> </ul>      | Revista Ibérica de Sistemas e Tecnologias de Informação | 2016<br>Scopus        | Integrated Skills       | Middle school<br>China    | <ul style="list-style-type: none"> <li>• The system "can improve English teachers' teaching ability, mobilize the students' learning enthusiasm and help improve their ability to learn English".</li> <li>• Shortcomings: Because of the little experience of the researchers, there were problems in the paper, which still require to be made better in the future.</li> </ul> |
| 26. "English listening teaching model in flipped classroom based on artificial intelligence fusion control algorithm" (Hu, 2021)                              | The article proposed the application of the particle swarm optimization (PSO) computing technology based on intelligent control algorithms in English listening flipped lesson to enable the learners to acquire skills in ways that are more intelligent and expedient. Intelligent control algorithm is capable of autonomously making intelligent machines work on their own and attain control goals with no intervention from humans.   | Quantitative    | <ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Pretest and posttest</li> <li>• Interviews with teachers</li> </ul> | Mathematical Problems in Engineering                    | 2021<br>Scopus<br>WoS | Listening               | Primary school<br>China   | The students' overall performance has improved significantly.   |

| Article Title   | Adopted Technology  | Research Method | Instrument & Tool   | Journal   | Year + Index          | Language Skill & Others                           | Level & Country           | Effect Description  |
|---|---|-----------------|---|---|-----------------------|---|---------------------------|---|
| 27. "Application of artificial intelligence in autonomous English learning among college students" (Han, 2019)  | The study used the back propagation (BP) neural network for the purpose of creating the modules of the self-directed English learning system. In machine learning, back propagation, a typical AI technique, is algorithm for training feedforward neural networks. Using Visual Studio programming technology, the system conducted the software makeup of the autonomous learning system. The system provided learners with various benefits such as assessing oneself, e-learning, and historical exercise.  | Qualitative     | English test  | International Journal of Emerging Technologies in Learning      | 2019<br>Scopus<br>WoS | Autonomous English Learning.<br>Integrated Skills | Higher Education<br>China | The proposed system provides college students with intelligent and "open self-evaluation tests and effective learning" feedback.  |
| 28. "Research on the automatic error correction model combined with artificial intelligence for college English essays" (Zhao & Sun, 2016)                                | The study proposed a model for automatic correction of mistakes utilizing AI based on training texts/ training corpus to improve the students' writing skills. The system selected two-hundred writing samples of CET-6 and used them as model essays; they were among those referred to in statistics on lexeme frequency of the ordinary dictionary of morphology.  | Mixed           | <ul style="list-style-type: none"> <li>• Input the words of writing and reading of CET-6.</li> <li>• Select three kinds of training text with different degrees of difficulty.</li> </ul> | First International Conference on Real Time Intelligent Systems | 2016                  | English Essays                                    | Higher Education<br>China | The model is able to "analyze the spelling errors" and the grammatical errors and to "correct them automatically".  |
| 29. "Construction of artificial intelligence-based interactive oral English teaching platform based on application problems of present intelligent products" (Zhou, 2019) | The study suggested an AI-based interactive system for teaching spoken English. The system included a comprehensive spoken corpus which the teachers, the students, and the AI technology can update. The purpose of the teaching assistant system was for it to observe, control and interact with the learners as they learn. The scoring system that was used alongside this system was an improved one that offered instant evaluation of the students' oral performance, which helped improve their speaking skills. This paper analyzed the intelligent oral English learning systems currently available, summed up the most favorable ones used by English learners in colleges and analyzed their salient features, merits and challenges. | Mixed           | <ul style="list-style-type: none"> <li>• Survey</li> <li>• NYSE : LAIX</li> <li>• Kouyu100.com</li> <li>• Acadsoc.com.cn</li> <li>• Casually Speak</li> <li>• 51 talks</li> </ul>         | IOP Conference Series: Materials Science and Engineering        | 2019<br>Scopus<br>WoS | Oral English teaching                             | Higher Education<br>China | <ul style="list-style-type: none"> <li>• Interactive system is efficient for oral conversions and a "real-time scoring system for speaking performance" assessment.</li> <li>• Shortcomings: Platforms lack recording and monitoring function, capability to control students' learning habits, insufficient scoring mechanism, and "scattered teaching materials coming from the internet".</li> </ul> |

| Article Title  | Adopted Technology  | Research Method | Instrument & Tool  | Journal                               | Year + Index          | Language Skill & Others | Level & Country               | Effect Description   |
|--|---|-----------------|--|---------------------------------------|-----------------------|-------------------------|-------------------------------|--|
| 30. "Design of college English teaching information platform based on artificial intelligence technology" (Yuan, 2021) | The study analyzed the makeup of ET IP technology in aiding English learning utilizing AI technology, and analyzed the potential of AI technology. The study designed the model, guided by learning theory and modern education theory, along with the information environment and actual teaching, utilizing AI as well as information technology. Novel media in IT and AI are implemented in teaching, and the entire process of teaching practice was traced and scrutinized.   | Mixed           | <ul style="list-style-type: none"> <li>Analyze the literature</li> <li>Questionnaire</li> </ul>  | Journal of Physics: Conference Series | 2021<br>Scopus<br>WoS | Integrated Skills       | Higher Education<br><br>China | The platform improves students' learning ability and greatly improves their English learning achievements.   |
| 31. "Practice of hybrid teaching mode of English writing based on artificial intelligence" (Cai, 2020)                 | The study designed a model of English writing teaching that is hybrid and utilizes AI multi-layer network and neural network. By means of the neural network training, the lessons that learners were mostly interested in were identified. Later, the study used the algorithm for collaborative filtering for the purpose of making recommendations.  | Mixed           | <ul style="list-style-type: none"> <li>Questionnaire</li> <li>Teachers prepare content before class, in class, and after class.</li> </ul>             | Journal of Physics: Conference Series | 2020<br>Scopus<br>WoS | English writing         | High school<br><br>China      | <ul style="list-style-type: none"> <li>Students' writing level increased by 40%, and the teaching efficiency increased by 35%.</li> <li>Shortcomings: The teaching model needs educators to be familiar with recent teaching methods. The article is not verified in the actual teaching.</li> </ul> |
| 32. "Research on artificial intelligence-based English writing blended teaching mode" (Chong, 2021)                    | The study established a teaching model of English writing that was blended and that utilized AI. Intelligent tools were used to help the learners integrate both virtual and traditional learning. By analyzing the problems generated and in view of the data observed by the system, the educator gave various learning ideas to different learners. Machine translation helped scrutinize model essays. The essay guided learners to construct a mind map when reading. This helped students realize the syntax and linguistic characteristics of the selected essays and imitate the sentential patterns in those essays. | Quantitative    | <ul style="list-style-type: none"> <li>Writing skills before and after teaching</li> <li>The length of article words</li> <li>questionnaire</li> </ul> | Journal of Physics: Conference Series | 2021<br>Scopus<br>WoS | English writing         | Higher Education<br><br>China | <ul style="list-style-type: none"> <li>This model can improve students' composition writing and increase their interest.</li> <li>Shortcomings: Learners with inadequate English skills and no interest still require intervention by instructor.</li> </ul>   |

| Article Title  | Adopted Technology  | Research Method | Instrument & Tool  | Journal                                | Year + Index          | Language Skill & Others             | Level & Country               | Effect Description  |
|--|---|-----------------|--|--|-----------------------|-------------------------------------|-------------------------------|---|
| 33. "Improvement of English key competences based on machine learning and artificial intelligence" (Zhao & Cai, 2021)  | The research applied the technology machine learning for the purpose of investigating the main skills evaluation of various aspects of English teaching and built an assessment model. Based on orderly mutual information, the article combined the minimum redundancy and the maximum correlation theory to determine the attribute algorithm and to achieve the best possible main skills evaluation of various disciplines in English learning. The performance of the model was scrutinized by means of a comparative test; then the results were examined by comparing actual numbers as well as error differences.   | Quantitative    | <ul style="list-style-type: none"> <li>• A comparative test</li> <li>• Online teaching evaluation questionnaire</li> <li>• 290 data records</li> </ul> | Journal of Intelligent & Fuzzy Systems | 2021<br>Scopus<br>WoS | Key competences of English subjects | Unspecified<br><br>China      | The "recognition accuracy of this assessment model is higher and has certain practical effects."  |
| 34. "Role of 5G network technology and artificial intelligence for research and reform of English situational teaching in higher vocational colleges" (X. Gao, 2021) | Supported by 5G technology and AI, the study constructed an English situation teaching model for examining data that utilized the system architecture sketch that showed cache placement, used computing properties as well as storage capacity for the purpose of giving room to a larger bandwidth for the backhaul link, adopted the "many to many" algorithm, which is an extension to the "one to many" algorithm, and used the on-demand approach for the purpose of eliciting from the cloud scenario teaching information. The study also constructed the data processing intermediate link and used 5G technology to eliminate the slowness in the movement of data. | Mixed           | <ul style="list-style-type: none"> <li>• CET-3 test paper</li> <li>• Pretest and posttest</li> </ul>   | Journal of Intelligent & Fuzzy Systems | 2021<br>Scopus<br>WoS | Integrated Skills                   | Higher Education<br><br>China | The constructed English situation teaching method "based on 5G network technology and AI" can successfully promote the English language scores. |
| 35. "Exploring the results of college English learning under the perspective of artificial intelligence" (Cao, 2019)   | Students used the lab to improve their English language, which was made to simulate a VR lesson based on AI. Students practiced by themselves. Educators made set up a report timestamp for the purpose of assessing the students' speaking ability and provided some comments when needed. Various topics were integrated into the system, and with their VR glasses on, the learners felt like it was a real setting according to the topics.   | Quantitative    | <ul style="list-style-type: none"> <li>• Lab designed as a Virtual Reality classroom</li> <li>• A report time of students' oral practice</li> </ul>    | Journal of Physics: Conference Series  | 2019<br>Scopus<br>WoS | Integrated Skills                   | Higher Education<br><br>China | Applying VR method brings positive results for college English learning,  |

| Article Title   | Adopted Technology  | Research Method | Instrument & Tool   | Journal                                | Year + Index          | Language Skill & Others                              | Level & Country           | Effect Description   |
|---|---|-----------------|---|--|-----------------------|--|---------------------------|--|
| 36. "Application of artificial intelligence in higher vocational English teaching mode" (Y ong, 2020)                                     | The study established an AI education platform based on the technology of data mining that gathered and examined student data, assessed the status of the students' learning and their performance, and created a multifarious assessment system. By examining large chunks of data, the study summarized the inactivity and behavior of each learner's learning, for the purpose of helping educators tailor their teaching styles to the learners' needs and provide teaching that addressed their specific needs.  | Qualitative     | Questionnaires to teachers and students of four HVC   | Journal of Physics: Conference Series  | 2021<br>Scopus<br>WoS | Integrated Skills                                    | Higher Education<br>China | <ul style="list-style-type: none"> <li>English teaching in HVC became much easier, and the students' interest greatly improved.</li> <li>Shortcomings: Overreliance" on multimedia, lack of innovation in multimedia content, and no change in teaching thinking mode".</li> </ul> |
| 37. "An artificial intelligence recognition model for English online teaching" (Aiyuan & Hui, 2021)                                       | The paper proposed an e-model for teaching English that utilized AI, and adopted a positioning method that hinged on an ameliorated deep belief network that performed position control in real time and recognized students' status in e-learning. The study combined intelligent algorithms for the purpose of creating the model structure and ascertaining the model's performance.   | Mixed           | <ul style="list-style-type: none"> <li>Performance test</li> <li>Sample data set collected in the offline stage</li> </ul>                                    | Journal of Intelligent & Fuzzy Systems | 2021<br>Scopus<br>WoS | Actual time position control and status recognition  | Unspecified<br>China      | <ul style="list-style-type: none"> <li>The model has an assured impact and meets the requirements of intelligent education.</li> <li>The model can intelligently locate students.</li> </ul>   |
| 38. "College English cross-cultural teaching based on cloud computing MOOC platform and artificial intelligence" (Huiying, & Qiang, 2021) | Using AI and cloud computing, the article ameliorated traditional MOOC, improved traditional algorithms in keeping with the demands of teaching using MOOC, and proposed an enhanced model. First, the cloud system used virtualization technology to extract into the resource pool the diverse physical resources. If different learners submitted their work to the cloud, the submissions were stored in the waiting queue; following that step the scheduler in the system assigned the submissions to the suitable virtual machine that would execute the implementation. | Mixed           | <ul style="list-style-type: none"> <li>Complete homework</li> <li>The collected raw data</li> <li>Characteristics of the topic post and reply post</li> </ul> | Journal of Intelligent & Fuzzy Systems | 2020<br>Scopus<br>WoS | English cross-cultural teaching<br>Integrated Skills | Higher Education<br>China | The model has good performance and can effectively improve the efficiency of English cross-cultural teaching.  |

| Article Title  | Adopted Technology  | Research Method | Instrument & Tool   | Journal                                   | Year + Index    | Language Skill & Others           | Level & Country               | Effect Description   |
|--|---|-----------------|---|---|-----------------|-----------------------------------|-------------------------------|--|
| 39. "Development of English conversation practice App with artificial intelligence & speech recognition" (Muhammad et al., 2020)     | The study designed an application for learning English that is web-based, empowered by the technology of speech recognition. Users talked to bots that had different roles (bank tellers, vendors, ...). Learners were able to freely select from a number of learning environments. If the response from the user was wrong or not spoken properly, the bot instructed the learner to make a response triggered by the stimulus from the bot. The user's recorded voice was detected during speech recognition, and it was recognized and shown in a text area on the screen.  | Qualitative     | Test all the features of the website using the black-box method.  | International Electronics Symposium (IES) | 2020 Scopus     | Speaking                          | Higher Education<br>Singapore | <ul style="list-style-type: none"> <li>• The web App enables "speech-to-text conversion" and does "speech synthesis on the results of integration" with the Dialog flow bot's response.</li> <li>• Shortcomings: "Mozilla Firefox and Microsoft Edge browsers cannot do speech recognition"; MDN does not support the Web Speech API.</li> </ul> |
| 40. "A study on the diversified college English teaching mode based on artificial intelligence" (Liu & Kong, 2021)                   | The article proposed the integration of a new diversified English teaching model with AI, combining multiple intelligence with teaching strategies. The study attempted to guide students in personalized learning through teaching practice and providing a variety of intelligent exercises for learning English.   | Qualitative     | <ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Multiple intelligence test</li> </ul> | E3S Web of Conferences                    | 2021 Scopus WoS | Integrated Skills and translation | Higher Education<br>China     | <ul style="list-style-type: none"> <li>• Students are more confident.</li> <li>• Educators are more thorough in thinking.</li> <li>• The teaching process was enhanced and the quality of teaching progressed.</li> </ul>  |
| 41. "Data mining artificial intelligence technology for college English test framework and performance analysis system" (Shen, 2021) | The paper first studied and designed a system for analyzing the framework and performance of English testing. This study analyzed a prodigious amount of data elicited by the system via 3 mechanisms: utilizing data mining models that associate titles, utilizing machine learning capable of coalescing models for college English score calculation, and assessing based on the model for gender evaluation. The researcher created and executed an exam sheet algorithm. The needs analysis shows that the researcher used the model for diagnostic evaluation and relevant exam sheet algorithm to create and execute the model for diagnostic evaluation. | Mixed           | <ul style="list-style-type: none"> <li>• Performance test</li> <li>• Questionnaire</li> </ul>           | Journal of Intelligent & Fuzzy Systems    | 2021 Scopus WoS | English test                      | Higher Education<br>China     | The two test assessment algorithms can successfully aim at the "user's question types and knowledge point obstacles" and provide them with more correct test questions.  |

| Article Title  | Adopted Technology  | Research Method | Instrument & Tool  | Journal   | Year + Index    | Language Skill & Others  | Level & Country           | Effect Description  |
|--|---|-----------------|--|---|-----------------|--|---------------------------|---|
| 42. "Research on the satisfaction of hybrid college English teaching based on artificial intelligence rain classroom" (An & Zhao, 2021)      | The paper analyzed students' satisfaction through the rain classroom (TRC). TRC mixed teaching, the study augmented the value and practicability of College English teaching. TRC is a teaching tool that is both intelligent and lightweight, and it is capable of building a channel for communication in real time between educators and learners. By constructing a hybrid College English teaching mode, the study realized the teaching of English before, during, and after class and also realized the evaluation.                                  | Mixed           | <ul style="list-style-type: none"> <li>Analyze the asynchronous teaching of CET</li> <li>Questionnaire</li> </ul>  | Journal of Physics: Conference Series                     | 2021 Scopus WoS | Satisfaction   | Higher Education<br>China | The platform stimulates interest in English learning (76.4%) and enhances classroom learning atmosphere (67.9%).  |
| 43. "An improved machine learning and artificial intelligence algorithm for classroom management of English distance education" (Wang, 2021) | The paper built a management system for a distance learning classroom for learning English that utilized enhanced machine learning AI algorithms using GPS for intelligent positioning. The research constructed the system function module, and applied the positioning algorithm for the purpose of determining where the learners are as they take part in the lesson. The paper analyzed the status of the students' learning via intelligent record processing to assess the learning status of the students.  | Quantitative    | <ul style="list-style-type: none"> <li>Analyzes the students' status through intelligent database processing</li> <li>Pretest and posttest</li> </ul>              | Journal of Intelligent & Fuzzy Systems                    | 2021 Scopus WoS | Locate students on Online English education<br><br>Integrated Skills | Secondary school<br>China | The English distance education "classroom management system", and the intelligent positioning of the learner's location constructed in this paper function in agreement with the needs of various levels. |
| 44. "An artificial intelligence-based construction and application of English multimodal online reading mode" (Qianjing & Lin, 2021)         | The article constructed an online AI platform for English multimodal reading based on speech recognition system. The article established a mathematical model that dealt with the human issue of forgetfulness "of knowledge, and obtained an intelligent memory algorithm that provided personalized help to learners". The system created activities automatically in view of each individual learner's status. Following each learner exercise, this system recorded the grades attained so it would use them in assessment and making future decisions. | Mixed           | <ul style="list-style-type: none"> <li>The system recorded data</li> <li>The comprehensive English scores obtained by the students after the experiment</li> </ul> | Journal of Intelligent & Fuzzy Systems                    | 2021 Scopus WoS | Pronunciation  | Unspecified<br>China      | The platform constructed in this article can effectively improve students' English scores in pronunciation.   |
| 45. "GLIB: Ameliorated English skills development with artificial intelligence" (Srikanthan et al., 2020)                                    | The study used a cross-platform application (GLIB) using machine learning, natural language processing, and deep learning to produce components that teach the student and evaluate grammatical knowledge. The chatbot used neural network to generate responses that were tailored for an oral class. The platform utilized support vector machine that provided feedback on enunciation of sounds, performed functions, and scored predictions.   | Mixed           | <ul style="list-style-type: none"> <li>Audio recorder</li> <li>PocketSphinx speech recognizer</li> <li>Audio files</li> <li>Survey</li> </ul>                      | IEEE Bangalore Humanitarian Technology Conference (B-HTC) | 2020            | Integrated Skills  | High school<br>Sri Lanka  | The application provides facilities to improve all the English language skills.   |

| Article Title   | Adopted Technology  | Research Method | Instrument & Tool  | Journal   | Year + Index          | Language Skill & Others                      | Level & Country                  | Effect Description  |
|---|---|-----------------|--|---|-----------------------|--|----------------------------------|---|
| 46. "A Research on classroom teaching ability system based on AI using neural network and the multiple intelligence theory. The study explored the effect of applying this system by designing a particular teaching case, conducted contrast experiment and proved this system's legitimacy and development by investigating experimental results." (Y. Sun, 2016) | The paper constructed a classroom teaching ability system based on AI using neural network and the multiple intelligence theory. The study explored the effect of applying this system by designing a particular teaching case, conducted contrast experiment and proved this system's legitimacy and development by investigating experimental results.  | Mixed           | <ul style="list-style-type: none"> <li>• Test for the two groups</li> <li>• Questionnaire to the students from the experimental group</li> </ul> | First International Conference on Real Time Intelligent Systems | 2016<br>WoS           | Integrated Skills                            | Middle schools                   | <ul style="list-style-type: none"> <li>• The new constructed system is helpful to improving the teaching efficiency of the teachers and the quality of their teaching.</li> <li>• Shortcomings: The sample was too small, and the experiment duration was not long enough.</li> </ul> |
| 47. "The development prospect of English translation software based on artificial intelligence technology" (Wei, 2020)  | This paper developed English machine translation software that utilized computer-aided translation (CAT) technology. Its essence was to elicit the main lexical items from the English expressions or English phrases provided by the system or the learner, and search the phrases by main lexical items, for the purpose of generating a likely translation of the text that needs to be translated. The research presented the experimental results and assessment of this translation system. | Mixed           | <ul style="list-style-type: none"> <li>• Create the system database</li> <li>• Test</li> <li>• self-reported questionnaire</li> </ul>            | Journal of Physics: Conference Series                           | 2020<br>Scopus<br>WoS | Translation                                  | Higher Education<br>China        | High performance and high accuracy of "computer-assisted translation technology".   |
| 48. "Teacher and student perceptions on the impact of artificial intelligence on English language learning in Saudi Arabia" (Aljohani, 2021)  | The study investigated the perceptions of educators and students of English in Saudi Arabia regarding the use of AI for expediting the learning of the English language. The paper discussed the influence of AI on ameliorating the learning of English. The study also had two videos which demonstrated how using AI could impact language learning.   | Quantitative    | Close-ended questionnaire  | Journal of Applied Linguistics and Language Research            | 2021                  | Integrated Skills                            | Higher Education<br>Saudi Arabia | <ul style="list-style-type: none"> <li>• Teachers and students were in favor of the use of AI in learning English language.</li> <li>• Shortcomings: The impact of this method was not tested on a sample due to the pandemic.</li> </ul>   |
| 49. "Research on English teaching reform based on artificial intelligence matching model" (Yu & Peng, 2021)   | The study constructed an English teaching model that utilized AI face recognition as well as biometric information recognition. Using the multi-target tracking method FISST, the study modeled as RFS the target state and measurement; it subsequently used the "Bayesian filtering method to recursively measure the target posterior PDF", which is capable of calculating the amounts and conditions of targets instantly.   | Mixed           | Examination after the end of the semester  | Journal of Intelligent & Fuzzy Systems                          | 2021<br>Scopus<br>WoS | Online English teaching<br>Integrated Skills | Higher Education<br>China        | Instructors "can realize one-to-one matching" of students, recognize the status of students, and give corresponding ELT methods to diverse students to improve students' English performance.   |

| Article Title   | Adopted Technology  | Research Method | Instrument & Tool   | Journal   | Year + Index          | Language Skill & Others                | Level & Country            | Effect Description  |
|---|---|-----------------|---|---|-----------------------|--|----------------------------|---|
| 50. "Application of artificial intelligence to the small open online English abstract writing course" (Chen & Warden, 2019)                           | This study explored SMOOC ("the small open online course") and the system for AI-assisted composition, assessment and "feedback Quick Research Papers" (QRP) that overcomes the challenges experienced in the conventional teaching method and problems with classroom size, availability of time and space, and amounts of exercises, for the purpose of enhancing postgraduate learners' writing skill in English on abstract topics. The study also applied SMOOC and QRP to keep a record of their writing mistakes to determine the foibles in their writing, which would later help deliver better teaching ideas.  | Quantitative    | <ul style="list-style-type: none"> <li>• Write their abstracts</li> <li>• Online video lectures</li> <li>• Online assignments</li> <li>• Analyze students' error types</li> </ul>     | International Conference on Innovative Technologies and Learning              | 2019                  | English abstract writing skill         | Higher Education<br>Taiwan | Students learned to avoid common writing errors. Teachers can quickly understand the overall weaknesses, prepare teaching material, track individual students' progress, and provide one-to-one counseling.   |
| 51. "An English-Vietnamese translation system using artificial intelligence approach" (Binh & Phap, 2018)   | The study proposed the application of a new model of machine translation that utilizes AI neural network approach alongside a big corpus to enhance the quality of the system for translation between Vietnamese and English. This study implemented a dedicated system for machine translation of legal documents between English and Vietnamese. The study trialed the system by utilizing a corpus of legal documents that had almost half a million pairs of English-Vietnamese phrases.  | Mixed           | <ul style="list-style-type: none"> <li>• Use a large corpus with 460,000 pairs of Vietnamese-English sentences.</li> <li>• Compare the system with two common translators.</li> </ul> | Asian Conference on Intelligent Information and Database Systems              | 2018<br>Scopus<br>WoS | English-Vietnamese translation         | Unspecified<br>Vietnam     | <ul style="list-style-type: none"> <li>• The English-Vietnamese MT system has generated superior translation quality than other systems utilizing different translation models.</li> <li>• Shortcomings: The quality of the system is modest because of the limited volume of corpus used.</li> </ul> |
| 52. "Using artificial intelligence in learning English as a foreign language: An examination of IELTS LIULISHUO as an online platform" (Ruolin, 2020) | The study aimed to investigate the IELTS Liulishuo's characteristics in view of principles from MALL, CALL, and AI. IELTS Liulishuo is a commercial application with an AI platform with speech recognition. The study aimed at ameliorating oral and writing skills, along with immediate detailed commentary on IELTS score in close-ended questions. Users also tested themselves in the mock exam and received a test report with corrections. Learners entered a mock exam with an interactive interface that presented an actual examiner's video. Once the mock exam was completed, students got a thorough descriptive account of their performance with corrections. | Qualitative     | Compare IELTS Liulishuo to those principles of CALL and MALL  | 13th International Conference Innovation in Language Learning Virtual Edition | 2020                  | Productive skills (Speaking & Writing) | Unspecified<br>China       | <ul style="list-style-type: none"> <li>• IELTS Liulishuo has the potential to be utilized as an online platform for EFL learning.</li> <li>• Shortcomings: The application has some shortages such as "possibility of errors, space, individualized content", and not user-friendly.</li> </ul>       |

| Article Title  | Adopted Technology  | Research Method | Instrument & Tool   | Journal  | Year + Index    | Language Skill & Others         | Level & Country                        | Effect Description  |
|--|---|-----------------|---|--|-----------------|---------------------------------|--|---|
| 53. "Study of the establishment of a reliable English-Chinese machine translation system based on artificial intelligence" (Fu et al., 2017) | The study built a Chinese-English MT system that utilized AI using automatic control technology and machine dictionary. The study designed a machine dictionary that was more specialized for the purpose of improving the accuracy and naturalness of the Chinese-English MT system utilizing AI. For this system to work best, "the basic entry professional entry" form is applied. The dictionary requires merely basic entry as well as computer professional entry. The dictionary only has to alter the professional items but not the basic ones when a different professional field needs to be tackled. | Mixed           | <ul style="list-style-type: none"> <li>Literature review and dynamic programming</li> <li>Compare ordinary machine translation system and the established system</li> </ul>                   | Advances in Intelligent Systems and Computing              | 2018 Scopus WoS | Translation                     | Unspecified<br>China                   | This is "a reliable English-Chinese machine translation system" that can develop the reliability and "accuracy of machine translation".   |
| 54. "Construction of English learning assistant platform based on artificial intelligence" (Wanwu, 2015)                                     | Combining AI expert systems and using advanced computer technology, the paper established an English learning assistant platform which provided services like English word inquiries, exam practice, and composition revision. The platform helped students learn English after class and revise their compositions, thereby improving their English capability.  | Mixed           | English writing scores before and after using the platform  | Revista Ibérica de Sistemas e Tecnologias de Informação    | 2015 Scopus WoS | English proficiency for writing | Higher Education<br>China              | <ul style="list-style-type: none"> <li>The platform can improve students' English proficiency, specifically writing skills.</li> <li>Shortcomings: The experimental period should be extended and conducted in a wider range.</li> </ul>  |
| 55. "The influential role of robot in second language classes based on artificial intelligence" (Thinh et al., 2020)                         | The study described the application of a robot named MiABot conducting English teaching tutoring. MiABot was pre-programmed based on AI to teach English language content and worked independently of human intervention in the course of the lessons. This robot had the ability to talk and ask and answer students' questions based on natural language processing and machine learning.   | Qualitative     | Pre-programmed MiABot using particular syllabus<br>Facial expressions   | Current and Future Developments in Artificial Intelligence | 2017 WoS        | Oral skills                     | High school<br>Vietnam                 | <ul style="list-style-type: none"> <li>Using a robot as an instructor enhances students' oral skills.</li> <li>Face analysis helps teachers to moderate the class better.</li> </ul>  |
| 56. "Exploring the use of an artificial intelligence chatbot as second language conversation partners" (Shin et al., 2021)                   | The study investigated using AI chatbot Mitsuku as conversation partners for L2 learners. Mitsuku is characterized as an English-speaking woman living in Leeds. Students had a text-based task-oriented conversation with Mitsuku. Chat log data were collected and analyzed in terms of the quantity of utterances and their vocabulary levels, along with the degree of conversation task success between the chatbot and its users.   | Mixed           | <ul style="list-style-type: none"> <li>Quantity of utterances.</li> <li>Students' vocabulary levels</li> <li>Degree of conversation task success between the chatbot and its users</li> </ul> | Korean Journal of English Language and Linguistics         | 2021 Scopus     | Second Language Conversation    | High school and college<br>South Korea | <ul style="list-style-type: none"> <li>The chatbot offers L2 learners' tremendous opportunities as a conversation partner.</li> <li>Shortcomings: Mitsuku generated excessive quantities of information that hindered understanding and caused communication breakdowns.</li> </ul> |

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|--|--|-----------------|---|---|-----------------------|------------------------------|---------------------------------------|--|
| 57. "The Risky influence of artificial intelligence technologies on the foreign language proficiency of Eurasian students in training" (Islamov, 2021)   | The article aimed to identify the idiosyncrasies of AI influence on undergraduates through ICT in EFL classes, especially English. The article attempted to explain why it was possible to regard as AI systems some kinds of ICT; how using them in teaching influences the intellectual attainment at undergraduate level, and the importance of trust in expediting this beneficial effect of AI systems.   | Qualitative     | <ul style="list-style-type: none"> <li>• Analysis, comparison, and classification</li> <li>• Questionnaire</li> <li>• Interviews</li> </ul>                     | E3S Web of Conferences  | 2021<br>Scopus<br>WoS | Degree of trust<br>AI in ICT | Higher Education<br><br>Russia        | "The closer AI of ICT to the human activity working with a foreign language, the lower the activation of the cognitive activity of a student".   |
| 58. "Assessment of optimal pedagogical factors for Canadian ESL learners' reading literacy through artificial intelligence algorithms" (Xiao & Hu, 2019) | The paper delineated the actual parameters in pedagogy that drew a dichotomy between high achievers and low achievers in ESL reading literacy. The study applied an AI using "support vector machine" (SVM) as well as machine learning to recognize the optimal set of features of pedagogical factors and examine forty-one pedagogical features related to reading content, classroom management, reading techniques, reading exercises inside the classroom, and post-reading exercises. | Quantitative    | <ul style="list-style-type: none"> <li>• PIRLS 2016 Database</li> <li>• Analyze 41 factors.</li> <li>• Reading scores</li> <li>• The coded responses</li> </ul> | International Journal of English Linguistics                            | 2019<br>WoS           | Reading                      | Primary school learners<br><br>Canada | Improvements in ESL reading achievement  |
| 59. "Students' attitudes towards the use of artificial intelligence SIRI in EFL learning at one public university" (Haryanto & Ali, 2018)                | The paper attempted to delineate learners' perceptions on utilizing AI-based SIRI for in-class learning of the English language at tertiary level. The paper investigated learners' opinion and perceptions via questionnaire as well as an open discussion.   | Quantitative    | <ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Focus group discussion</li> </ul>   | International Seminar and Annual Meeting BKS-PTN Wilayah Barat          | 2019                  | Integrated Skills            | Higher Education<br><br>Indonesia     | <ul style="list-style-type: none"> <li>• The learners were engaged in the "learning process" and were enthusiastic and motivated.</li> <li>• Siri is a great tool for improving learners' experience in learning a foreign language</li> </ul> |
| 60. "Artificial intelligence in EFL context: Rising students' speaking performance with Lyra virtual assistance" (Junaidi et al., 2020)                  | The study aimed to measure the effectiveness of AI App named Lyra Virtual Assistant (LVA) in EFL classroom environment. LVA was selected "with the line of thinking it can help the students improve their speaking" performance. The students practiced to pronounce words and sentences using Lyra virtual assistant application.  | Quantitative    | Pre-test and post-test.   | International Journal of Advanced Science and Technology Rehabilitation | 2020<br>Scopus        | Speaking                     | Secondary school<br><br>Indonesia     | Lyra is an efficient AI App for EFL learners that helps them develop their speaking ability.   |

| Article Title   | Adopted Technology   | Research Method | Instrument & Tool  | Journal   | Year + Index    | Language Skill & Others                 | Level & Country               | Effect Description  |
|---|--|-----------------|--|---|-----------------|---|-------------------------------|---|
| 61. "Computer-assisted EFL writing and evaluations based on artificial intelligence: a case from a college reading and writing course" (Wang, 2022) | The study aimed to explore the differences between human assessment and automatic assessment, for the purpose of discovering a means to ameliorate the learners' skills in English writing. The study used deep learning to achieve the optimization of the automated essay evaluation system and realized effective feedback. Subjects of the study were required to compose and hand in 4 pieces of writing on 3 online systems that provided auto-evaluation of essay writing. The results from the auto-evaluation and the teacher evaluation were compared. | Quantitative    | <ul style="list-style-type: none"> <li>• Observation</li> <li>• Semi-structured interviews</li> <li>• Questionnaire</li> </ul>                           | Library Hi Tech   | 2020 Scopus     | Writing ability and evaluation feedback | Higher Education<br>China     | <ul style="list-style-type: none"> <li>• The students' English writing significantly improved.</li> <li>• The efficiency of "computer scoring feedback" was higher than that of educators' "scoring feedback".</li> </ul> |
| 62. "Intelligent information processing for language education: The use of artificial intelligence in language learning Apps" (Pikhart, 2020)       | The paper centered on ten most common Apps that are used to learn language and the presence of AI in them. Apps were selected based on "the number of downloads". The testing was conducted from the users' opinion. The author stressed the fact that a good many kinds of AI such as machine learning strategies were available.   | Qualitative     | Test the presence of various kinds of AI that could be used in these mobile language Apps  | Procedia Computer Science                               | 2020 Scopus WoS | Integrated Skills                       | Unspecified<br>Czech Republic | <p>Shortcomings: No one of the analyzed Apps utilizes machine learning, AI, or deep learning.</p> <p>The paper suggests possible solutions on how to implement AI in these Apps.</p>                                      |
| 63. "Artificial intelligence in language education: Introduction of Readizy" (Y. Gao et al., 2021)  | The study proposed AI-based Readizy to provide diagnosis of the reading skill that would help both the learners and the teachers. Readizy is identified as interdisciplinary software utilizing theoretical views and technological advancements in language study, psychology, and affective computing. Through facial expression recognition techniques, the study utilized Readizy for the purpose of recording learners' facial expressions as they read texts and classifying those expressions into 7 types.   | Qualitative     | <ul style="list-style-type: none"> <li>• Compare Readizy with FER2013 and CK+ systems.</li> <li>• Document facial expressions during reading.</li> </ul> | Journal of Ambient Intelligence and Humanized Computing | 2021 Scopus WoS | Reading facial expressions              | Unspecified<br>China          | <p>Improvement in accuracy was detected. In theory, Readizy can perform better than FER2013. CK+ had a high accuracy rate of 95.438%.</p>   |
| 64. "Can home use of speech-enabled artificial intelligence mitigate foreign language anxiety--investigation of a concept" (Bao, 2019)              | The study investigated how AI-based chatbots were able to alleviate anxiety amongst the learners when the learners interacted with them. The methods used to find this out varied: questionnaires about anxiety, opinions regarding the use of chatbots routinely, face-to-face interviews and testing the learners' oral skills. The test group consisted of an English-speaking AI chatbot, offered for free by Google with instructions on how to download to devices.  | Quantitative    | <ul style="list-style-type: none"> <li>• Survey of anxiety</li> <li>• Oral interviews</li> <li>• IELTS testing of English-speaking ability</li> </ul>    | Arab World English Journal (AWEJ)                       | 2019 WoS        | Speech-related anxieties                | Unspecified<br>Thailand       | <p>Con conversationally enhanced AI chatbots can reduce anxiety related to speaking and learning constraints of EFL.</p>  |

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