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The Application of AI Technologies in English Education in Industry 4.0

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Abstract: *This article will briefly present the great changes that took place in English education in the background of industry 4.0, focusing especially on how modern Artificial Intelligence (AI) technologies in industry 4.0 has influenced the way of English teaching and learning. First, the general changes in English education and the features of traditional way of English teaching will be concluded, followed by a brief introduction of the circle of English learning. Based on the circle, four technologies (intelligent tutoring system, chatbot, virtual reality, and automatic evaluation system) will be introduced to illustrate how Artificial Intelligence technologies can help English learners facilitate their learning in different learning stages, so that they can learn English in a personalized, immersive, flexible and smart way. Finally, there will be a conclusion about the application of the AI technologies in English education.*

Keywords: *AI Technologies, Application, English Education, Industry 4.0*

1. Introduction

In the era of Industry 4.0, rapid advancements in technology have revolutionized various sectors, and education is no exception. One notable development is the integration of Artificial Intelligence (AI) technologies into English education. AI, with its ability to analyze vast amounts of data, recognize patterns, and simulate human intelligence, offers tremendous potential for enhancing language learning and teaching processes.

English education has undergone great changes. One prominent feature of the past English education is the reliance on face-to-face instruction in a physical classroom setting. In traditional English classrooms, teachers play a central role as the primary source of knowledge and guidance, delivering lectures, providing explanations, and leading group activities. The teaching tools are mainly chalks and blackboard. Students, in turn, assume a relatively passive role as recipients of information, often engaging in rote memorization and repetitive exercises to reinforce language skills. The curriculum typically follows a structured progression, focusing on grammar rules, vocabulary lists, and prescribed texts. The paper textbooks are the only source of learning materials. Assessments primarily involve written tests and examinations, measuring students' understanding of grammar concepts, reading comprehension, and writing proficiency. Overall, traditional English teaching and learning emphasize the transmission of knowledge from teacher to student, with a strong emphasis on accuracy, standardized assessments, and adherence to established curricular frameworks.

Compared with that, in the industry 4.0, English education is more interactive, personalized, automatic, and flexible.

Generally, the English learning process involves several stages, which constitute a circle: (1) Assessment: The first step in learning English is to assess your current level of proficiency. (2) Setting Goals: Once you have assessed your level, you can set goals for what you want to achieve in your English learning journey. (3) Learning: The next step is to start learning English. (4) Practice: Practice is crucial for improving your English skills. This can include practicing speaking, listening, reading, and writing. It's important to practice regularly and to seek feedback from others. Once you have practiced, you should assess your progress and adjust your goals if necessary. This will help you stay motivated and continue to improve. That is to say, you come to the assessment stage again. See the figure 1 below.

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Figure 1: The Circle of English Learning Process

Based on the circle of English learning process, English learners can benefit a lot from AI technologies in different learning stages. For example, they can assess their current language proficiency with intelligent tutoring systems or automatic evaluation systems. Then, they can set their learning goals. Chatbots and virtual reality can help them practice their different language skills, such as speaking, listening, reading and writing. During the learning process, they can assess their levels and outcomes with automatic evaluation systems at any time. With these technologies they can have personalized, adaptive, and immersive learning experiences that cater to the their individual needs and preferences.

2. AI Technologies in English Education

Some researchers make a comprehensive study about the effect of AI technologies on English education by systematically reviewing the previous researches. Klimova, et al. made a systematic review in order to identify and analyze all of the technologies that are currently efficiently employed in foreign language teaching and learning. They concluded that new technologies are perceived as being useful complementary tools for language acquisition[1]. Rusmiyanto, et al. conducted a literature review in order to investigate the function of AI in the development of communication skills in English language learners[2]. The findings of this literature review suggest that AI has the potential to significantly enhance English language learners' communication skills by providing personalized and interactive learning experiences. Huang, et al. focused on how AI was integrated into language education by using bibliometric analysis[3]. They analyzed 516 papers published between 2000 and 2019, and concluded 10 most popular topics. The findings additionally indicated that AI was extensively employed to support students in various English language skills, including writing, reading, vocabulary, grammar, speaking, and listening. Key AI technologies such as natural language processing, automated speech recognition, and learner profiling were commonly utilized to create automated writing evaluation systems, personalized learning platforms, and intelligent tutoring systems.

Apart from these comprehensive studies, some researchers also pay their attention to a certain technology. This article will focus on four technologies as the following: intelligent tutoring system, chatbot, virtual reality and automatic evaluation system.

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2.1. Intelligent Tutoring System

Cognitive psychology, artificial intelligence, and computer technology have advanced to the point where it is feasible to build computer systems that are as effective as intelligent human tutors[4]. An intelligent tutoring system (ITS) refers to a computer-based educational tool or software that provides personalized and adaptive instruction to learners. It leverages artificial intelligence techniques to simulate a human tutor's role by assessing the student's knowledge and skills, delivering tailored instruction, and providing feedback and guidance throughout the learning process[5]. Up to now, there are plenty of such platforms or applications that can be used to learn English as a useful complement to the human teachers or just for self learning. By adapting to individual needs, AI-enabled platforms can offer personalized content, adaptive exercises, and immediate feedback, enabling students to learn at their own pace and address specific areas for improvement. A lot of researchers have studied the effectiveness of it in different fields. In English education, there are also lots of research outcomes.

Abu Ghali, et al. designed an intelligent tutoring system for English grammar and studied the effect of the application[6], and found that the evaluation by teachers and students are pleasing. Through a systematic literature review method, Wang, et al. examined the effectiveness of the application of intelligent tutoring systems in real educational contexts from a social experiment perspective[7]. Their findings confirmed that ITS can be very powerful to support teaching and learning. Simultaneously, they also highlighted that, when viewed from a social experiment perspective, technology alone cannot ensure the success of Intelligent Tutoring Systems implementation. The intricate interplay of contextual and social factors within actual educational settings can significantly influence the observed effectiveness of ITSs.

Bakeer and Abu-Naser presented an example and evaluation of their development of an intelligent tutoring system for teaching TOEFL using the ITSB (Intelligent Tutoring System Builder) tool[8].

In a word, ITSs have the potential to significantly enhance English education by offering personalized instruction, real-time feedback, and individualized support. They promote active and interactive learning experiences, fostering student engagement and language acquisition. When combined with the guidance of human educators, they can create a comprehensive and effective English learning environment that caters to the individual needs of learners.

2.2. Chatbot

The integration of AI technologies in English education also extends beyond the classroom. Mobile language learning applications equipped with AI-driven chatbots enable learners to practice language skills anytime and anywhere. Chatbots have found various applications in the field of English education. They offer interactive, engaging and personalized learning experiences, providing learners with the opportunity to practice and improve their English language skills in a conversational manner, ultimately enhancing their English language skills in a convenient and accessible manner.

Some researchers have studied different aspects of the application of chatbots. Kasneci, et al. discuss the opportunities and challenges of several large language models including ChatGPT for education[9]. They highlight how these models can be used to create educational content, improve student engagement and interaction, and personalize learning experiences. At the same time, some challenges are also concluded. Ali, et al. investigated how ChatGPT impacts learning motivation in English with a quantitative research[10]. The findings suggest that ChatGPT-based teaching is motivational. Some researchers also develop a certain chatbot and examine its effect of application in learning English. Yang, et al. developed a task-based voice chatbot called "Ellie" and examined the appropriateness of its task design and performance as an English conversation partner and students' perceptions on using it in EFL class in Korea[11]. The findings support the appropriateness of the design and a positive potential of the chatbot. Sarosa, et al.[12] developed an application in the form of a chatbot inside Facebook as an English learning media to help students learn English more efficiently. Through this application, students have the opportunity to engage in self-directed English learning and access a diverse range of information and well-structured exercise materials. They can seek assistance or explore additional challenges whenever required, thus avoiding the risk of learning monotony.

Chatbots can be used in many aspects of English learning, such as the practice of speaking, writing, grammar, vocabulary, etc. They offer valuable opportunities in English education by providing instant feedback, personalized support, and engaging interactions. They enhance language learning, cater to individual needs, and promote student engagement. While chatbots have their limitations, when

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integrated thoughtfully with human instruction, they can contribute to a comprehensive and effective English learning environment.

2.3. Virtual Reality

Virtual Reality (VR) has gained significant attention and recognition for its potential to revolutionize various industries, and education is no exception. In the field of English education, VR offers a range of immersive and interactive experiences that can enhance language learning and provide students with unique opportunities for practice and engagement, where students can practice conversational skills, navigate virtual scenarios, and explore cultural contexts. Such immersive experiences facilitate language acquisition by promoting active engagement and contextual understanding.

Pinto, et al. conducted a systematic review of empirical research in order to investigate whether the use of gaming strategies in virtual reality is beneficial for the learning of a second/foreign language or not[13]. Results show that more than half of the articles proved that virtual reality technologies with gaming strategies can be used to learn a foreign language. Due to the absence of focused inquiry, it is advisable to utilize these technologies as a means of supporting second language acquisition rather than completely substituting traditional methods. Bendeck Soto, et al. evaluated the impact of the application of the virtual reality platform ImmerseMe as an empowering and innovative tool for learning English in a private university, and also evaluated its possible future implementation in a private university in Medellín[14]. The findings show that it is ideal to enhance the different skills of English as a foreign language from an immersive focus considering different contexts and thinking of the development of communicative skills and interaction with native speakers in higher education.

There are lots of researches about the application of VR in English education. They may be different in the specific names of the platforms or the devices, or the research focuses, but most of them confirm the value of VR in English education.

To conclude, virtual reality holds immense potential in English education by providing immersive and interactive learning experiences. It enhances language acquisition, cultural understanding, and communication skills while fostering creativity and collaboration. Despite the challenges, the thoughtful integration of VR can revolutionize English education, enabling students to engage with the language in meaningful and memorable ways.

2.4. Automatic Evaluation System

Moreover, AI-powered language assessment tools have emerged as valuable resources for evaluating language proficiency. Automated evaluation systems can assess students' speaking and writing abilities, providing objective feedback on grammar, vocabulary, pronunciation, and coherence. This allows teachers to focus on individualized instruction and provide targeted guidance based on the specific needs of each learner.

Some researchers compared the influence of automatic evaluation system and human teacher grading on students' English writing. A comparative study conducted by Wang[15] indicated that the feedback given by the automatic evaluation system Writing RoadmapTM 2.0 (WRM) helped student A benefit significantly from the system, which effectively enhanced their writing proficiency, particularly in areas like word choice, syntax, spelling, and grammar. However, the system lacked the ability to offer sufficient feedback and revision suggestions regarding ideas, content, and organization for Student A. Conversely, the teacher's adoption of global scoring only provided limited feedback to Student B, resulting in minimal improvement in their writing quality.

Some researchers even develop systems by themselves and examine the effect. Hwang, et al. developed Smart RoamLingo app and made experimental research to find out its application in facilitating English as foreign language writing, by supporting personalization and contextualization in authentic contexts[16]. The findings strongly suggested to use Smart RoamLingo with AI-SS and AI-WF for EFL writing in authentic contexts.

There are also some researches concerning the effect of the systems on speaking. Wang, et al.[17] See the Table 1 below.

Proposed an automatic evaluation system for spontaneous speech of English language learners and confirmed the value of automatic evaluation systems in improving the performance of English speaking

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of the candidates.

In conclusion, automatic evaluation systems offer valuable tools for assessing and providing feedback on language proficiency in English education. They provide quick and objective assessments, promote self-directed learning, and support data-driven instruction. However, their limitations should be acknowledged, and they should be used in conjunction with human interaction to provide a comprehensive and balanced approach to English language education.

Table 1: Overview of the researches presented in this article

No.	Title	Author	Year
1	A systematic review on the use of emerging technologies in teaching English as an applied language at the university level	B. Klimova, M. Pikhart, P. Polakova, M. Cerna, S.Y. Yayilgan, and S. Shaikh.	2023
2	The role of Artificial Intelligence (AI) in developing English language learner's communication skills	R. Rusmiyanto, N. Huriati, N. Fitriani, N. Tyas, A. Rofi'i, and M. Sari	2023
3	Trends, Research Issues and Applications of Artificial Intelligence in Language Education	X. Huang, D. Zou, G. Chen, X. Chen and H. Xie	2023
4	Intelligent tutoring systems	J. R. Anderson, C. F. Boyle and B. J. Reiser	1985
5	The defining characteristics of intelligent tutoring systems research: ITSs care, precisely	J. Self	1998
6	An intelligent tutoring system for teaching English grammar	M. J. Abu Ghali, A. Abu Ayyad, S. S. Abu-Naser and M. Abu Laban	2018
7	Examining the applications of intelligent tutoring systems in real educational contexts: A systematic literature review from the social experiment perspective	H. Wang, A. Tlili, R. Huang, et al.	2023
8	An intelligent tutoring system for learning TOEFL	H. M. S. Bakeer and S. S. Abu-Naser	2019
9	ChatGPT for good? On opportunities and challenges of large language models for education	E. Kasneci, K. Seßler, S. Küchemann, et al.	2023
10	Impact of ChatGPT on Learning Motivation: Teachers and Students' Voices	J. K. M. Ali, M. A. A. . . Shamsan, T. A. Hezam, and A. A. Q. Mohammed	2023
11	Implementation of an AI chatbot as an English conversation partner in EFL speaking classes	H. Yang, H. Kim, J. Lee and D. Shin	2022
12	Developing a social media-based Chatbot for English learning	M. Sarosa, M. Kusumawardani, A. Suyono and M. H. Wijaya	2020
13	Foreign Language Learning Gamification Using Virtual Reality—A Systematic Review of Empirical Research	R. D. Pinto, B. Peixoto, M. Melo, L. Cabral, and M. Bessa	2021
14	Perceptions of ImmerseMe Virtual Reality Platform to Improve English Communicative Skills in Higher Education	J. Bendeck Soto, D. Toro Ocampo, L. Beltrán Colon and A. Valencia Oropesa	2020
15	A comparative study on the influence of automated evaluation system and teacher grading on students' English writing	F. Wang and S. Wang	2012
16	AI and Recognition Technologies to Facilitate English as Foreign Language Writing for Supporting Personalization and Contextualization in Authentic Contexts	W. Y. Hwang, R. Nurtantyana, S. W. D. Purba, U. Hariyanti, Y. Indrihapsari and H. D. Surjono	2023
17	Towards automatic assessment of spontaneous spoken English	Y. Wang, M. J. F. Gales, K. M. Knill, K. Kyriakopoulos, A. Malinin, R. C. van Dalen and M. Rashid	2018

3. Conclusion

A lot of modern technologies have been employed in English education nowadays. The four technologies mentioned above (intelligent tutoring system, chatbot, virtual reality, and automatic evaluation system) are just part of them. English learners have benefited a lot from them. However, technologies run faster than applications. The findings of some research papers also indicate that although the latest technological devices might be known well to some English teachers, they are still not properly or timely used in the teaching process.

In the future, AI technologies in English education holds immense potential for transforming the way students learn, practice, and master the English language. AI is poised to play a central role in providing personalized, adaptive, and immersive learning experiences that cater to the individual needs and preferences of students.

While AI technologies in English education present exciting opportunities, it is important to address potential challenges and ethical considerations. Issues such as data privacy, algorithmic bias, and the need for human interaction in language learning should be carefully addressed to ensure the responsible

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and effective integration of AI in the education landscape.

As we move forward in the digital age, AI technologies continue to shape the future of English education, offering innovative tools for personalized and immersive language learning experiences. Embracing these advancements can empower learners, educators, and institutions to navigate the evolving demands of Industry 4.0 and foster a new era of effective language education.

At the same time, it's important to note that while AI technologies can enhance English education, the role of human educators remains crucial in providing guidance, motivation, and emotional support to students. AI should be seen as a tool to complement and assist educators, rather than replace them.

In conclusion, the future of AI technologies in English education is promising. AI will enable personalized learning experiences, advanced language analysis and feedback, immersive virtual environments, and increased support for educators. By embracing AI technologies responsibly, English education can become more engaging, effective, and accessible for learners, empowering them to become proficient communicators in the English language.

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