

ENCHANTMENT OF ARTIFICIAL INTELLIGENCE: EMERGING ADVANCES IN LANGUAGE DEVELOPMENT

Nandini Banerjee & Susmita Rakshit

Dept. of Education
Kazi Nazrul University
West Bengal, INDIA

nandinibanerjee11@gmail.com

Abstract. The way people learn and acquire new languages has changed significantly as a result of the incorporation of artificial intelligence (AI) in language development. In order to investigate the “enchantment” of AI, this article looks at new developments in technology and trends that are changing language instruction. Artificial intelligence-powered solutions provide learners with tailored experiences, flexible lesson plans and instantaneous feedback based on their individual requirements and inclinations. Artificial intelligence-driven chatbots, speech recognition software and virtual tutors have made learning settings more dynamic and immersive while providing ongoing assistance and engagement. Furthermore, AI makes language learning more accessible, providing students from a variety of socioeconomic and geographic backgrounds with access to high-quality instruction. This paper discusses these advancements and their potential to revolutionise language learning, as well as the future scope of AI in creating more inclusive, efficient and immersive language education, and also sketches a contrary picture of positive dimensions and problematic aspects of artificial intelligence-constructed language equipment.

Keywords: artificial intelligence, language development, technology, assistance

INTRODUCTION

The arena of technology has moved forward significantly since the Industrial Revolution. Plenty of individuals initially began creating intelligent machines after World War II; Alan Turing may have been the first to give a lecture on the topic in 1947. He thought that the best way to study artificial intelligence would be through computer programming and by the late 1950s, a lot of researchers were

concentrating on this subject of discussion. Technology has progressively taken the place of many labour-intensive manual tasks, greatly benefiting humanity. One technological advancement that has replaced human labour in many industries with manual labour is artificial intelligence (PK 1984, 65). Undoubtedly, the aspect of artificial intelligence that is considered “artificial” stems from its development as a result of human creativity and invention, rather than a natural (particularly biological or evolutionary) effect. From another perspective, artificially intelligent things are distinct from naturally intelligent ones because they are artifacts with unique qualities that are typically possessed by non-artifacts (Fetzer 1990, 1). These are objects that, by virtue of a particular method (*i.e.*, because they were made, designed, or produced in this manner), possess a particular attribute. In the present time, AI has become an inseparable part of everyday life (Mintz *et al.* 2023, 326). As AI becomes more widely accepted as a technology with enormous implications for people, society and the environment, rather than just a digital technology with the potential to revolutionise key business processes, its disciplinary foci continue to shift (Dwivedi *et al.* 2022, 17; Kopka and Grashof 2022, 175C). The influence of artificial intelligence on language learning is complex, offering both benefits and obstacles for teachers, students and businesses. AI’s focus on language learning has its roots in the efforts of Intelligent Tutoring Systems (ITS) during the 1980s and their commitment to personalised education. In the early days of ITS, computer-based learning systems made an effort to adjust to the needs of students (Noh *et al.* 2012, 455). As a result, these systems were perceived as making an effort to take care of students.

Since the tutoring component offered unlimited practice and repetitions, it was seen to be important for tailored learning and had numerous benefits beyond a traditional teacher (Woolf 2010, 298). After nearly forty years, the latest advancements in AI are renewing the possibilities for personalised learning (Reiland 2017). In 2016, Stanford University circulated a report labelled “100-year report on AI.” (Stone *et al.* 2016, 1). This research aims to explore eight

aspects of artificial intelligence, including education, by presenting historical data and projecting future paths. The study's conclusions about language acquisition are as follows: Although AI held a lot of potential for language learning, its early research suffered from its inability to support deep learning in systems like the ITS. AI is now present in many facets of daily life, from self-driving automobiles to intelligent mobile applications. Within the subject of AI modelling, Natural Language Processing (NLP) has played an important role as a catalyst in the development of Computer Assisted Language Learning. One example is the E-Tutor, which employed NLP methods to teach German as a second language (Heift 2010, 443). Heift has conducted research on the advantages of employing these AI-based tools in second-language instruction. NLP makes it possible to use mobile phones for voice recognition (Pahwa et al. 2020, 2547). This has led to broader applications as a result of AI's contribution to language processing. Numerous other fields, such as online search and healthcare informatics, are utilising the speech-understanding algorithms that are included in our phones (Stone *et al.* 2016, 29-32). According to the Stanford paper, NLP research has involved reasoning, but scaling it up has been difficult because it is often created for specialised tasks. Pattern recognition is used in a wide range of AI applications. These pattern recognitions were too limited for early AI systems to extend to complicated settings appropriate for language acquisition.

This article investigates the magic of artificial intelligence in language development in reference to natural language processing and language learning, multilingual AI systems and cross-lingual transfer learning, translation and cross-language communication, the crossover of AI, OpenAI, ChatGPT and language instructions, conversational AI and Chatbots, including an example of a conversation between a human being and ChatGPT along with its implications in language learning and AI-powered assistive technology, emphasising on speech recognition technology, writing tool, grammar-correcting apparatus, and personalised teaching assistant for growth of language. The paper ends on a note of

comparison of positive dynamics and problematic aspects of AI-powered language development, privacy and security issues in the context of language development tools and future scope for research in this arena.

LINGUISTIC DEVELOPMENT AND ARTIFICIAL INTELLIGENCE

Artificial intelligence offers cutting-edge resources and tools that improve and customise the learning process, which has a revolutionary impact on language development. Artificial intelligence enables more accessible and customised language learning through adaptive algorithms, real-time feedback and interactive platforms. AI gives students the chance to practice and advance their language abilities in ways that were previously unachievable by taking out obstacles pertaining to time, place and learning speed. A few towers of linguistics are identified in the era of AI (McShane & Nirenburg 2021, 9). 1) A converged intermediary designing develops language processing capabilities; 2) Within the framework of the explanatory paradigm, AI simulation is human-inspired; 3) From linguistic ontology, insights are accumulated, and so on. They have stated in a chapter that natural language processing systems initially focused on interpreting textual aspects that the target reasoning engine could digest, rather than interpreting natural language semantics (Nirenburg & McShane 2017, 340). Natural Language Processing aims to create software systems that analyse, understand and generate natural human languages, enabling computer communication. As an ancient machine learning research area, it's used in AI speech recognition and text processing (Ali & Shandilya 2021, 135). This involved producing machine-tractable knowledge in various forms, including grammar formalisms, dictionaries, rule sets and world models. This led to the emergence of the empiricist, knowledge-lean paradigm in NLP research and development, moving the field away from rationalist approaches. The translation sector has been steadily revolutionised by AI,

especially NLP. In the field of artificial intelligence, which comprises the act of giving computer systems instructions to perform tasks without explicit programming, Machine Learning and Deep Learning are intricately correlated concepts (Mohamed et al. 2024, 25555). The framework provides a basis for designing multilingual deliberations in a resilient and scientifically trustworthy manner. This includes factors like participant selection techniques, timing, facilitation, format and structure, translation, scoping, processes, methods, settings, expert involvement and communication channels (online and in-person). In the case of hybrid approaches, these channels should also have effective connection points (Kalampokis et al. 2024,6).

When artificial intelligence technology is applied to English translation, along with the Internet and intelligent knowledge bases, translation systems can be developed to partially address the challenges (Bi 2020, 5057). In contrast to handling nuances of syllables, words, phrases, or even sentences, machine translation (MT) is now better suited to handle the subtleties of actual speech. The meaning of each given word, phrase, sentence, or paragraph in a language is contingent upon a broader context that could be referred to as culture. Intentions and speaker mood, in addition to the context in which they are used, all influence meaning. Idioms, satire, humour, irony and other literary devices are some more elements that machine translation finds problematic to understand (Das 2018, 2).

The development of increasingly sophisticated chatbots has been made feasible by the most recent developments in machine learning, particularly in artificial neural networks. When it comes to generating responses, chatbots built on artificial neural networks have the option of using either generative or retrieval techniques (Hussain et al. 2019, 950). Due to their accuracy, lack of reliance on human resources and accessibility throughout the day and night, chatbots can be employed anywhere (Meshram *et al.* 2021, 1). As chatbots advance, they are being incorporated into a wide range of applications and platforms, such as customer service, virtual

assistants and social media messaging (Casheekar 2024, 100632). Several projects have attempted to create an emotive human-computer dialogue production approach using Sequential Generative Adversarial Networks (SeqGANs), in addition to Microsoft. Researchers in artificial intelligence foresee that machines capable of thinking will eventually handle our cognitive tasks (Jain & Jain 2013, 584). And, at present, Microsoft's model may nevertheless produce replies that are human-like in both content and emotion, even though its performance is not as good as anticipated (Lin et al. 2023, 3). Developed by Microsoft-backed startup OpenAI, ChatGPT (generative pre-trained transformer) is one of the most advanced AI-powered chatbots on the market today. It was introduced in November 2022. Natural language processing, automatic speech recognition and limited artificial intelligence are supported by this technology, as demonstrated by digital assistants such as Siri and Alexa. However, according to some researchers, ChatGPT lacks interaction between students and instructors, leading to isolation and hindering psychological development, well-being and social skills development among students (Al-Obaydi *et al.* 2023, 44; Rane 2023, 5). Chatbots, particularly ChatGPT, can significantly improve education by providing personalised learning, virtual tutoring, interactive language learning, examination preparation, catering to learning disabilities and supporting remote education. They analyse learning styles and preferences, tailor content and offer detailed explanations for homework and assignments. ChatGPT actively involves learners in interactive dialogues, provides pronunciation corrections and recommends vocabulary (Kostka & Toncelli 2023, 3). By creating practice questions as well as providing explanations, it further assists with studying for the test (Javaid *et al.* 2023, 9). Professionals may benefit from ChatGPT by having access to expert perspectives, research papers and carefully selected information, which enhances decision-making and problem-solving abilities. But the scholarly papers published in academic journals cannot identify ChatGPT as an author (Rahman *et al.* 2023, 3). Meanwhile, it assists

researchers with data analysis and literature reviews, alongside group discussions (Vargas-Murillo *et al.* 2023, 122).

Artificial intelligence-assisted language learning technology is streamlining, personalising and increasing efficiency in the process. Learners at every level of language proficiency can benefit greatly from AI-driven solutions, which range from immersive learning experiences and individualised lesson plans to pronunciation feedback. AI-assisted language learning technology has developed into a potent instrument for improving language learning through the manifestation of machine translation, speech technology, Chatbots and AI-generated content (Patty 2024, 650). By using artificial intelligence to personalise learning experiences (Vorst & Jelicic 2019, 11; Maghsudi *et al.* 2021, 7; Kaswan *et al.* 2024, 108), these tools increase the effectiveness, appeal and accessibility of language acquisition for users of all ability levels. AI systems evaluate the performance and preferences of students to generate personalised language learning programs (Tapalova & Zhiyenbayeva 2022, 644). These programs focus on vocabulary, grammar and pronunciation problems and modify them according to the student's development (Shevchenko & Ogurtsova 2023, 12). Using artificial intelligence, programs such as Duolingo and Babbel dynamically modify their lessons to keep students engaged but not overwhelmed (Arvanitis 2019, 123-125). Through speech pattern analysis, AI can offer real-time pronunciation feedback. AI-powered speech recognition is used by apps such as Elsa Speak (Vall *et al.* 2023, 7573) and Rosetta Stone (Rogerson-Revell 2021, 193) to identify accents, make correction suggestions and teach pronunciation in real time to learners. Learners can practice language skills in an engaging manner by using AI chatbots such as ChatGPT, which can mimic real-life discussions (Gill *et al.* 2024, 20; Limna *et al.* 2023, 2). Through interaction, immediate feedback and the ability to fix grammatical and word use errors, this offers an immersive learning environment. Learners can improve their writing by using AI-powered programs such as Grammarly and LanguageTool, which can detect and fix grammatical errors,

sentence structure and style (Schmidt & Strasser 2022, 169). AI-Generated Content (AIGC) is a flexible approach to content creation, which parallels human writing and thought processes.

With Quizizz, an AI-driven personalised teaching assistant, quizzes can be crafted in under a minute, effectively enhancing language learning (Degirmenci 2021, 5). Students trying to get better at writing in a new language will find this real-time feedback to be quite helpful. AI systems can assess language proficiency through adaptive testing, where the difficulty level of questions adjusts based on the learner's responses (Colchester et al. 2017, 53). This provides a more accurate assessment of language skills than traditional testing methods.

Lingvist and Quizlet are examples of platforms that use adaptive testing to evaluate users' language knowledge. AI-powered platforms are being developed to detect learners' emotional states through facial recognition or voice analysis, adjusting teaching strategies accordingly (Ahmad *et al.* 2023, 15). These AI-driven systems aim to keep learners motivated by identifying frustration or boredom and altering lessons to suit the learner's mood. When communicating with voice-activated AI assistants in their target languages, such as Siri, Amazon Alexa and Google Assistant, language learners can improve their communication abilities. They can provide fast translations, schedule daily practice sessions and start basic dialogues with students. Tools for students with disabilities, such as dyslexia (Barua *et al.* 2022, 4) or hearing loss (Garg & Sharma 2020, 524), are also being developed. AI-driven text-to-speech and speech-to-text technologies facilitate language acquisition by translating spoken words into text and vice versa, giving students the flexibility to interact with language in ways that best meet their requirements. Language learning is made more enjoyable and interesting by gamified AI-based platforms (Tsvilodub *et al.* 2022, 557). Through interactive stories, songs and games, apps like Lingokids use artificial intelligence to lead kids through language-learning activities that hold their interest longer than traditional approaches.

ILLUSTRATION OF A CONVERSATION WITH CHATGPT, MAY 2024

As ChatGPT is recognised as the most popularly applied communicative AI-constructed tool, the author likes to give an illustration of a communication between an individual learning English and ChatGPT (OpenAI, 2023) that focuses on strengthening language skills and analyse the output it conveys:

Human: Hi, I'm trying to improve my English. I'm having trouble with using articles like "a", "an", and "the". Can you help?

ChatGPT: Absolutely! Articles in English can be a bit tricky. Here's a quick guide:

- "A" is used before words that begin with a consonant sound (e.g., "a cat", "a dog").
- "An" is used before words that begin with a vowel sound (e.g., "an apple", "an hour").
- "The" is used to refer to specific or known items (e.g., "the book on the table", "the car we saw yesterday").

Would you like to try using these articles in some sentences?

Human: Sure, let me try. How about "I saw a cat in the garden" and "I met an interesting person"?

ChatGPT: Great job! Your sentences are correct. In the first sentence, "a cat" is used because it's not specific; any cat could be in the garden. In the second sentence, "an interesting person" is correct because "interesting" starts with a vowel sound.

Would you like to practice more sentences or is there another area you're curious about?

Human: Could you explain when to use "the" versus no article at all?

ChatGPT: Sure! You use "the" when referring to a specific item that both the speaker and listener know about. For example, "I put the keys on the table" implies there's a specific table in mind. When no article is used, it usually refers to something general or abstract. For example, "I love music" talks about music in general, not a specific piece. Would you like to make some sentences to practice this?

Human: Okay, how about "She is the best student" and "Dogs are friendly animals"?

ChatGPT: Nice work! In "She is the best student", "the" is used because

you're referring to a specific student known to both speaker and listener. In "Dogs are friendly animals", no article is used because you're talking about dogs in general.

Is there anything else you'd like to review or practice?

Human: Not right now, but thanks for your help!

ChatGPT: You're welcome! Feel free to return anytime if you have more questions. Happy learning!

INTERPRETATION

ChatGPT, the interactive program, helps users practice using English articles with explanations that are easy to understand. It gives precise descriptions of what constitutes an appropriate or improper statement and promotes positive reinforcement. To clear up any misunderstandings and give further practice, the dialogue changes based on the learner's comments and inquiries. It is simpler for the student to comprehend article utilisation in real-life scenarios because of the pertinent and useful examples that are given. Though there is room for improvement, some examples that should be included are those that are context-specific, vary and handle exceptions. Enhancing continuous learning could be achieved by offering thorough feedback on mistakes and making recommendations for new resources. For the most part, ChatGPT is a useful tool for teaching students how to comprehend and use English articles, thus contributing to language development.

COMPARISON OF POSITIVE DIMENSIONS AND PROBLEMATIC LANDMARKS OF AI-TOOLS OF LANGUAGE

AI-powered personalised learning provides individualised instruction by modifying the information to match each student's learning style, strengths and areas for development. This flexibility improves learning effectiveness by enabling users to concentrate on the vocabulary, grammar and pronunciation that best suit their needs. AI creates a personalised learning experience that is available

at any time by monitoring progress and giving immediate feedback (Kaur *et al.* 2020, 95). However, learners lose out on the rich, nuanced communication that comes with real-life conversations due to the lack of human contact in AI-based learning. Deeper cultural context, emotional connection and spontaneous feedback are all provided by human teachers and these are essential for the development of social and conversational language abilities (Kudryashova *et al.* 2015, 461). Though AI can mimic speech, it is unable to perfectly capture the erratic and diverse character of human interaction. While the lack of human connection in AI-powered learning platforms restricts the development of social and cultural language competencies (Khanzode & Sarode 2020, 34), individualised AI learning is, by contrast, quite effective and convenient in self-paced learning. Learners are able to participate in language development at any time and from any location because of AI's accessibility to the digital world. Geographical, financial and temporal obstacles are eliminated by AI-driven platforms, which offer flexible learning options. Learners can use resources like virtual instructors and language applications from the comfort of their homes, with continuous availability and personalised content, to practice at their own speed. Conversely, when learners use only AI, they are deprived of the advantages of in-person contact, peer learning and real-time human feedback because AI is not accessible in real-world classrooms. Additionally, practical language use and deeper social involvement are fostered by hands-on learning activities found in real-world contexts. Comparatively, AI provides more digital ease of use and accessibility. Learners may swiftly identify and correct faults by receiving immediate feedback from AI in the form of suggestions and corrections regarding their language use. With this real-time response, learning efficiency is increased and learners may rapidly modify their practice, encouraging ongoing development and reinforcing proper usage. But if AI is used excessively, it may result in a loss of the capacity to evaluate and self-correct language use. Learners may become less adept at solving problems and less capable of using language in an organic, nuanced

way without the assistance of technology if they rely too much on AI for responses and feedback. This reliance may impede the growth of self-directed learning techniques and the acquisition of practical communication abilities. By contrast, although artificial intelligence offers useful instant feedback, too much reliance on it may hinder language learners' capacity for critical thought and independence (Creely 2024, 159).

ETHICAL CONCERNS IN AI-SPONSORED LANGUAGE EQUIPMENT

Plagiarism and privacy ethics pose significant complications in the context of AI-driven language development. It should be confirmed that privacy pattern has to be secured in any apparatus interconnected to digital applications (Schurig & Thomas 2017, S3809). It is crucial to properly credit ChatGPT as an AI tool and acknowledge its contribution to the writing process. There is a worry that authors can unintentionally pass off the AI-generated writing as their own if they only use ChatGPT's generated content without giving credit to the platform (Jarrah *et al.* 2023, 14). This can be framed as a new arena of plagiarism and it may present issues in creative and educational environments that respect originality and intellectual property. Implementing policies that guarantee AI tools generate original work and adhere to copyright rules is crucial in order to address this. Some examples of these policies include plagiarism detection algorithms and enforcing appropriate citation guidelines. On the flip side, privacy ethics pertain to the protection of users' personal information that is gathered during language learning exchanges. AI systems frequently collect large volumes of sensitive data, which must be safeguarded against abuse and illegal access (Ghosh *et al.* 2018, 216). This entails implementing robust data protection techniques, such as anonymisation and encryption and guaranteeing openness regarding data utilisation. Sustaining ethical standards and preserving confidence in AI applications for language development also requires obtaining user agreement and

following privacy laws. By weighing these moral considerations, we can make sure that AI tools are applied ethically and sensibly to the language learning industry.

AI AND LANGUAGE DEVELOPMENT: FUTURE RESEARCH PERSPECTIVES

Research on AI's function in language development has a wide and potential future ahead of it, with many areas still needing to be explored and developed. Improving AI systems to comprehend and handle complex linguistic subtleties, such as idioms, cultural contexts and emotional tone is an important field of future study. As a result, language learning would be even more realistic and engaging because of AI's increased ability to mimic human-like dialogues.

Using AI to develop extremely immersive language learning environments through the use of upcoming technologies like Augmented Reality and Virtual Reality is another possible field of study. With greater involvement and more useful applications for language development, these cutting-edge technologies may be able to replicate real-world settings where students may practice language abilities in context.

Furthermore, a crucial area of research continues to be how AI might help students with disabilities like dyslexia or speech problems. Making language acquisition genuinely inclusive, AI's capacity to personalise learning experiences might be increased to offer even more focused and efficient support for a variety of learners.

Besides, multiple research projects are necessary to address ethical concerns including protecting privacy and avoiding an excessive dependence on artificial intelligence. Responsible and efficient use of AI in language instruction will be ensured by research into striking a balance between the convenience of AI and the requirement for critical thinking and real-world engagement. Long-term research on how AI-based technologies affect language

retention, learner motivation and competency would shed important light on the advantages and disadvantages of AI in language development.

CONCLUSION

Artificial intelligence is playing a revolutionary and more important role in language development with its innovative technologies that improve geared learning, supply real-time feedback and make language acquisition more accessible to a worldwide audience, Artificial Intelligence facilitates more effective and captivating language learning experiences by adjusting to individual learning styles, mimicking real-life interactions and providing ongoing assistance. Even if artificial intelligence has numerous benefits, it needs human involvement to handle cultural subtleties and the difficulties of communicating in the real world. Artificial Intelligence has the ability to completely transform language learning and mastery when applied ethically and responsibly. To widespread AI-driven language technology, integration of AI into language apps should be promoted as rapidly as possible. It should be implemented in the simplest form possible to save time and money. It should also be improved over time so that language apps eliminate expensive solutions (Pikhart 2020, 1417).

REFERENCES

- Ahmad, K., Iqbal, W., El-Hassan, A., Qadir, J., Benhaddou, D., Ayyash, M., & Al-Fuqaha, A. 2023. Data-driven artificial intelligence in education: A comprehensive review. *IEEE Transactions on Learning Technologies*, 17, 12-31. <https://doi.org/10.1109/TLT.2023.3314610>
- Al-Obaydi, L. H., Pikhart, M., & Klimova, B. 2023. ChatGPT and the General Concepts of Education: Can Artificial Intelligence-Driven Chatbots Support the Process of Language Learning? *International Journal of Emerging Technologies in Learning (IJET)*, 18(21), 39-50. <https://doi.org/10.3991/ijet.v18i21.42593>

- Ali, A. A. S., & Shandilya, V. K. 2021. AI-Natural Language Processing (NLP). *International Journal for Research in Applied Science and Engineering Technology*, 9, 135-140. <https://doi.org/10.22214/ijraset.2021.37293>
- Arvanitis, P. 2019. Self-paced language learning using online platforms. *The handbook of informal language learning*, 117-138. <https://doi.org/10.1002/9781119472384.ch8>
- Barua, P. D., Vicnesh, J., Gururajan, R., Oh, S. L., Palmer, E., Azizan, M. M., ... & Acharya, U. R. 2022. Artificial intelligence enabled personalised assistive tools to enhance education of children with neurodevelopmental disorders—a review. *International Journal of Environmental Research and Public Health*, 19(3), 1192. <https://doi.org/10.3390/ijerph19031192>
- Bi, S. 2020. Intelligent system for English translation using automated knowledge base. *Journal of Intelligent & Fuzzy Systems*, 39(4), 5057-5066. <https://doi.org/10.3233/JIFS-179991>
- Casheekar, A., Lahiri, A., Rath, K., Prabhakar, K. S., & Srinivasan, K. 2024. A contemporary review on chatbots, AI-powered virtual conversational agents, ChatGPT: Applications, open challenges and future research directions. *Computer Science Review*, 52, 100632. <https://doi.org/10.1016/j.cosrev.2024.100632>
- Colchester, K., Hagraas, H., Alghazzawi, D., & Aldabbagh, G. 2017. A survey of artificial intelligence techniques employed for adaptive educational systems within e-learning platforms. *Journal of Artificial Intelligence and Soft Computing Research*, 7(1), 47-64. <https://doi.org/10.1515/jaiscr-2017-0004>
- Creely, E. 2024. Exploring the Role of Generative AI in Enhancing Language Learning: Opportunities and Challenges. *International Journal of Changes in Education*, 1(3), 158-167. <https://doi.org/10.47852/bonviewIJCE42022495>
- Das, A. K. 2018. Translation and Artificial Intelligence: Where are we heading? *International Journal of Translation*, 30(1), 72-101.
- De la Vall, R. R. F., & Araya, F. G. 2023. Exploring the benefits and challenges of AI-language learning tools. *International Journal of Social Sciences and Humanities Invention*, 10(01), 7569-7576. <https://doi.org/10.18535/ijsshi/v10i01.02>
- Degirmenci, R. 2021. The Use of Quizizz in Language Learning and Teaching from the Teachers' and Students' Perspectives: A Literature Review. *Language Education and Technology*, 1(1), 1–11. <https://langedutech.com/letjournal/index.php/let/article/view/12>
- Dwivedi, Y. K., Hughes, L., Baabdullah, A. M., Ribeiro-Navarrete, S., Giannakis, M., Al-Debei, M. M., ... & Wamba, S. F. 2022. Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International journal of information management*, 66, 102542. <https://doi.org/10.1016/j.jinfomgt.2022.102542>

- Fetzer, J. H. 1990. *What is artificial intelligence?* (pp. 3-27). Springer Netherlands.
https://doi.org/10.1007/978-94-009-1900-6_1
- Garg, S., & Sharma, S. 2020. "Impact of artificial intelligence in special need education to promote inclusive pedagogy." *International Journal of Information and Education Technology*, 10(7), 523-527.
<https://doi.org/10.18178/ijiet.2020.10.7.1418>
- Ghosh, A., Chakraborty, D., & Law, A. 2018. Artificial intelligence in Internet of things. *CAA Transactions on Intelligence Technology*, 3(4), 208-218.
<https://doi.org/10.1049/trit.2018.1008>
- Gill, S. S., Xu, M., Patros, P., Wu, H., Kaur, R., Kaur, K., & Buyya, R. 2024. Transformative effects of ChatGPT on modern education: Emerging Era of AI Chatbots. *Internet of Things and Cyber-Physical Systems*, 4, 19-23.
<https://doi.org/10.1016/j.iotcps.2023.06.002>
- Heift, T. 2010. Developing an intelligent language tutor. *CALICO Journal*, 27(3), 443-459. <http://www.jstor.org/stable/calicojournal.27.3.443>
- Hussain, S., Ameri Sianaki, O., & Ababneh, N. 2019. A survey on conversational agents/chatbots classification and design techniques. In *Web, Artificial Intelligence and Network Applications: Proceedings of the Workshops of the 33rd International Conference on Advanced Information Networking and Applications (WAINA-2019) 33* (pp. 946-956). Springer International Publishing.
- Jain, N. K., & Jain, S. 2013. Live multilingual thinking machine. *Journal of Experimental & Theoretical Artificial Intelligence*, 25(4), 575–587.
<https://doi.org/10.1080/0952813X.2013.813975>
- Jarrah, A. M., Wardat, Y., & Fidalgo, P. 2023. Using ChatGPT in academic writing is (not) a form of plagiarism: What does the literature say? *Online Journal of Communication and Media Technologies*, 13(4), e202346.
<https://doi.org/10.30935/ojcm/13572>
- Javaid, M., Haleem, A., Singh, R. P., Khan, S., & Khan, I. H. 2023. Unlocking the opportunities through ChatGPT Tool towards ameliorating the education system. *Benchmark Transactions on Benchmarks, Standards and Evaluations*, 3(2), 100115. <https://doi.org/10.1016/j.tbench.2023.100115>
- Kalampokis, E., Karacapilidis, N., Karamanou, A., & Tarabanis, K. 2024. Fostering Multilingual Deliberation through Generative Artificial Intelligence.
- Kaswan, K. S., Dhatteval, J. S., & Ojha, R. P. 2024. AI in personalized learning. In *Advances in Technological Innovations in Higher Education* (pp. 103-117). CRC Press.
- Kaur, S., Tandon, N., & Matharou, G. S. 2020. Contemporary trends in education transformation using artificial intelligence. In *Transforming Management Using Artificial Intelligence Techniques* (pp. 89-103). CRC Press.

- Khanzode, K. C. A., & Sarode, R. D. 2020. Advantages and Disadvantages of Artificial Intelligence and Machine Learning: A Literature Review. *International Journal of Library & Information Science (IJLIS)*, 9(1), 30-36.
- Kopka, A., & Grashof, N. 2022. Artificial intelligence: Catalyst or barrier on the path to sustainability? *Technological Forecasting and Social Change*, 175, 121318. <https://doi.org/10.1016/j.techfore.2021.121318>
- Kostka, I., & Toncelli, R. 2023. Exploring applications of ChatGPT to English language teaching: Opportunities, challenges, and recommendations. *Tesl-Ej*, 27(3), 1-19. <https://doi.org/10.55593/ej.27107int>
- Kudryashova, A., Gorbatoeva, T., Rybushkina, S., & Ivanova, E. 2015. Teacher's roles to facilitate active learning. *Mediterranean Journal of Social Sciences*, 7(1), 460-466. <https://doi.org/10.5901/mjss.2016.v7n1p460>
- Limna, P., Kraiwani, T., Jangjarat, K., Klayklung, P., & Chocksathaporn, P. 2023. The use of ChatGPT in the digital era: Perspectives on chatbot implementation. *Journal of Applied Learning and Teaching*, 6(1), 64-74. <https://doi.org/10.37074/jalt.2023.6.1.32>
- Lin, C. C., Huang, A. Y., & Yang, S. J. 2023. A review of AI-driven conversational chatbots implementation methodologies and challenges (1999–2022). *Sustainability*, 15(5), 4012. <https://doi.org/10.3390/su15054012>
- Maghsudi, S., Lan, A., Xu, J., & van Der Schaar, M. 2021. Personalized education in the artificial intelligence era: what to expect next. *IEEE Signal Processing Magazine*, 38(3), 37-50. <https://doi.org/10.1109/MSP.2021.3055032>
- McShane, M., & Nirenburg, S. 2021. *Linguistics for the Age of AI*. MIT Press.
- Meshram, S., Naik, N., Megha, V. R., More, T., & Kharche, S. (2021, June). Conversational AI: chatbots. In *2021 International Conference on Intelligent Technologies (CONIT)* (pp. 1-6). IEEE. <https://doi.org/10.1109/CONIT51480.2021.9498508>
- Mintz, J., Holmes, W., Liu, L., & Perez-Ortiz, M. 2023. Artificial Intelligence and K-12 education: Possibilities, pedagogies and risks. *Computers in the Schools*, 40(4), 325-333. <https://doi.org/10.1080/07380569.2023.2279870>
- Mohamed, Y. A., Khanan, A., Bashir, M., Mohamed, A. H. H., Adiel, M. A., & Elsadig, M. A. 2024. The impact of artificial intelligence on language translation: a review. *Ieee Access*, 12, 25553-25579. <https://doi.org/10.1109/ACCESS.2024.3366802>
- Nirenburg, S., & McShane, M. J. 2017. Natural Language Processing 18. *The Oxford handbook of cognitive science*, 337.
- Noh, N. M., Ahmad, A., Halim, S. A., & Ali, A. M. 2012. Intelligent tutoring system using rule-based and case-based: a comparison. *Procedia-Social and Behavioral Sciences*, 67, 454-463. <https://doi.org/10.1016/j.sbspro.2012.11.350>
- OpenAI. 2023. ChatGPT (May 13, 2024 version) [Large Language Model]. <https://chat.openai.com>

- Pahwa, R., Tanwar, H., & Sharma, S. 2020. Speech recognition system: A review. *International Journal of Future Generation Communication and Networking*, 13(3), 2547-2559.
- Patty, J. 2024. The use of AI in language learning: what you need to know. *Jurnal Review Pendidikan dan Pengajaran (JRPP)*, 7(1), 642-654. <https://doi.org/10.31004/jrpp.v7i1.24609>
- Pikhart, M. 2020. Intelligent information processing for language education: The use of artificial intelligence in language learning apps. *Procedia Computer Science*, 176, 1412-1419.
- P K, F. A. 1984. What is Artificial Intelligence? *Success is no accident. It is hard work, perseverance, learning, studying, sacrifice and most of all, love of what you are doing or learning to do*, 65.
- Rahman, M. M., Terano, H. J., Rahman, M. N., Salamzadeh, A., & Rahaman, M. S. 2023. ChatGPT and Academic Research: A Review and Recommendations Based on Practical Examples. *Journal of Education, Management and Development Studies*, 3(1), 1-12. <https://doi.org/10.52631/jemds.v3i1.175>
- Rane, N. 2023. Chatbot-enhanced teaching and learning: Implementation strategies, challenges, and the role of ChatGPT in education. *Challenges, and the Role of ChatGPT in Education (July 21, 2023)*. <http://dx.doi.org/10.2139/ssrn.4603204>
- Reiland, R. 2017. "Is Artificial Intelligence the Key to Personalized Education?" *Smithsonian Magazine*. <https://www.smithsonianmag.com/innovation/artificial-intelligencekey-personalized-education-180963172>.
- Rogerson-Revell, P. M. 2021. Computer-assisted pronunciation training (CAPT): Current issues and future directions. *Relc Journal*, 52(1), 189-205. <https://doi.org/10.1177/0033688220977406>
- Schmidt, T., & Strasser, T. 2022. Artificial intelligence in foreign language learning and teaching: a CALL for intelligent practice. *Anglistik: International Journal of English Studies*, 33(1), 165-184.
- Schurig, A., & Thomas, C. G. 2017. Designing the Next Generation of Connected Devices in the Era of Artificial Intelligence. *The Design Journal*, 20(sup1), S3801-S3810. <https://doi.org/10.1080/14606925.2017.1352884>
- Shevchenko, O. M., & Ogurtsova, O. L. 2023. Artificial Intelligence for Language Teaching and Learning. 1-14. <https://doi.org/10.32841/2409-1154.2023.60.2.23>
- Stone, P., Brooks, R., Brynjolfsson, E., Calo, R., Etzioni, O., Hager, G., & Leyton-Brown, K. 2016: "Artificial intelligence and life in 2030. One Hundred Year Study on Artificial Intelligence: Report of the 2015-2016 Study Panel." <https://ai100.stanford.edu/2016-report>

- Tapalova, O., & Zhiyenbayeva, N. 2022. Artificial intelligence in education: AIED for personalised learning pathways. *Electronic Journal of e-Learning*, 20(5), 639-653.
- Tsvilodub, P., Chevalier, E., Klütz, V., Oberbeck, T., Sigetova, K., & Wollatz, F. 2022, June. Improving a Gamified Language Learning Chatbot Through AI and UX Boosting. In *The Learning Ideas Conference* (pp. 557-569). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-21569-8_52
- Van der Vorst, T., & Jelicic, N. 2019. Artificial Intelligence in Education: Can AI bring the full potential of personalized learning to education?, 30th European Conference of the International Telecommunications Society (ITS): “Towards a Connected and Automated Society”, Helsinki, Finland, 16th-19th June 2019, International Telecommunications Society (ITS), Calgary
- Vargas-Murillo, A. R., de la Asuncion, I. N. M., & de Jesús Guevara-Soto, F. 2023. Challenges and opportunities of AI-assisted learning: A systematic literature review on the impact of ChatGPT usage in higher education. *International Journal of Learning, Teaching and Educational Research*, 22(7), 122-135. <https://doi.org/10.26803/ijlter.22.7.7>
- Woolf, B. P. 2010. *Building intelligent interactive tutors: Student-centered strategies for revolutionizing e-learning*. Morgan Kaufmann.