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ADAPTIVE LEARNING SYSTEMS AND ARTIFICIAL INTELLIGENCE IN LANGUAGE LEARNING

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Abstract
The integration of adaptive learning systems with the continuously developing applications supported by artificial intelligence (AI) introduces new solutions in language education. This study examines AI-powered solutions that facilitate language learning, highlighting key areas where AI-driven applications can effectively support both learners and educators. AI-based platforms, such as natural language processing applications, automatic speech recognition systems or virtual teachers provide interactive and engaging learning experiences while developing key language skills. The continuous development and spread of AI-based applications can lead to significant changes in language learning as well as language teaching methodology.

1. Introduction

The integration and development of adaptive learning systems and artificial intelligence have revolutionized the method of language learning by providing learners with efficient and engaging opportunities for language acquisition. These systems offer personalized learning experiences tailored to individual learning preferences and goals, along with automated assessments, real-time feedback and, in general, a renewed approach to language learning. The traditional methods of language education are less likely to meet the diversified needs, preferences and learning paces of individual students in comparison to the various adaptive learning systems leveraging AI-based solutions, which can contribute to the development of language skills by tailoring learning paths based on the learner's individual progress, skills and needs. [1] As a consequence of the customization of language learning, the engaging learning environment and the numerous gamification elements – just to mention a few advantages –, the use of artificial intelligence in language learning enhances student engagement and attention that results in knowledge development. These language learning tools are constantly available and provide instant feedback on all aspects of language skills, such as grammar, pronunciation or vocabulary, while machine learning algorithms analyse learner data to recommend targeted exercises and individual learning paths. In addition to the advantages, adaptive learning systems also help educators by providing real-time insights into students' performance enabling teachers to focus on areas that require further clarification and to identify at-risk students. On the other hand, tailored lesson plans and automated grading can also be generated by these systems, saving time for teachers. Furthermore, the use of virtual tutors as assistants can be of great help in the teaching progress in group management. As a result of this new learning possibility, the four essential language skills – reading and listening comprehension, writing and speaking – that comprise basic language competency can be efficiently developed. These technologies continuously evolve, therefore, the potential to transform language learning is constantly expanding. [2] [3] This paper explores the intersection of adaptive learning systems and artificial intelligence in language acquisition, focusing on their operation, benefits and implications for learners and educators.

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2. Methodology

This research was written using a qualitative research method, examining relevant academic sources on foreign language education, adaptive learning systems and artificial intelligence. The sources were selected based on recency, diversity and credibility apart from relevance to provide current information regarding how AI-driven adaptive learning systems can contribute to language acquisition. The literature review was analysed and the information was systematically collected to explore the key areas where AI-powered applications can enhance language learning efficiency and the support that educators can be provided with by introducing artificial intelligence into their teaching process. As a result of the study, two figures were created, Figure 1 and Figure 2, to demonstrate the findings of the exploration based on the review of the literature. Focusing on the advantages and identifying key trends of AI tools in language education, the challenges related to the introduction of such systems have also been discussed in the study.

3. The Effectiveness of Various AI-Based Learning Platforms in Developing Language Skills

With the growing availability of AI-based digital tools and platforms, language learners can experience a more immersive, flexible and basically, a constantly available approach to language acquisition regardless to time and place. These platforms leverage advanced technologies such as machine learning, natural language processing (NLP) and adaptive learning algorithms to provide tailored learning experiences to students. Language learners can practice speaking, writing, and listening with immediate corrections and suggestions that can foster confidence, quick progress and the acquisition of appropriate language skills. Virtual teachers and conversational AI tools also help simulate real-world language use, thanks to which theoretical knowledge can be transformed into practical use of the learnt language, facilitating native language skills. [4] [5] The key areas where AI-powered applications can enhance the development of language learning can be seen in Figure 1 and are detailed below:

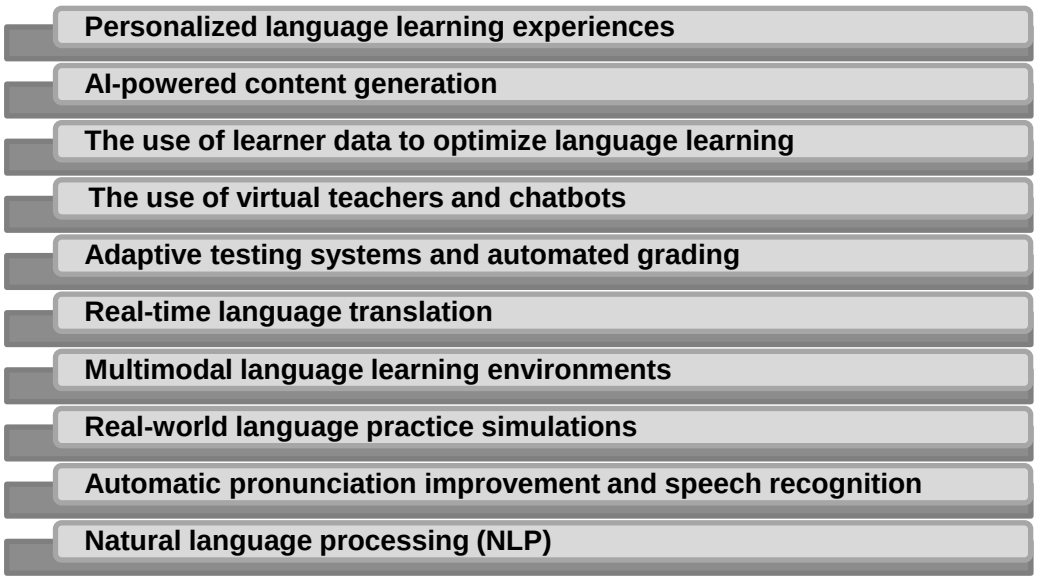

Figure 1.: The key areas of AI-powered applications to enhance the development of language learning. (Source: Author's own work)

3.1. Personalized Language Learning Experiences

AI-driven language learning applications offer personalized learning exercises to students that are tailored to the individual user's level and learning pace through interactive tasks, real-time feedback and gamification elements that both make learning effective and fun. Student performance is continuously monitored and analysed by these systems so that they can automatically adapt to

students' strengths, weaknesses and learning abilities ensuring faster progress and deeper understanding. [1] Such AI-driven language learning platforms are *Duolingo, Babbel, Rosetta Stone, Memrise* and *Lingoda* without claiming completeness that can help learners successfully in language learning in a self-study and efficient way.

3.2. AI-powered Content Generation

The learning content generated by artificial intelligence systems refers to educational resources specifically compiled to provide personalized and adaptive learning experiences by machine learning algorithms. This includes engaging learning platforms and virtual teachers that adapt to the individual needs of each learner. On the other hand, various learning aids can be generated by AI tailored to the level of the language learner to support their learning progress, for example, flashcards, presentations, study guides, memorization pieces, targeted exercises, texts and dialogues to improve all language skills. This possibility also supports teachers in providing diverse and interesting materials for students in accordance with individual needs and ensures materials are easily adaptable to students' language proficiency levels. [6]

3.3. The Use of Learner Data to Optimize Language Learning

AI can analyse large volumes of learner data to track user performance and progress to identify strengths and areas for improvement. Real-time feedback on students' language skills and performance can be provided by learning analytics to educators for informed and fast decision-making. Besides allowing teachers to provide students with personalized learning recommendations, data-driven insights can also help students maintain motivation by tracking their own progress and setting newer learning goals.

3.4. The Use of Virtual Teachers and Chatbots

With the use of AI-powered virtual teachers and chatbots as a complement to human educators, language learning can become highly effective. These tools provide real-time language practice for learners with constant accessibility. They can engage learners in conversations covering all topics on any level in ways of speaking or chatting. [7] [8] Thanks to them, students can improve their language skills basically anytime and anywhere without the presence of a human teacher, therefore, language frequency can easily be improved. Besides the widely known and used *ChatGPT*, *Talkpal*, a GPT-powered AI language teacher, *Elsa AI, Loora, Gliglish, Character.AI,* and *Replika* can also effectively be used to support language learning. Machine dependency, however, should be considered when using these tools, as virtual tutors provide instant human-like answers on any topic in an engaging environment, learners can easily become isolated from peers and addicted to these computer programs.

3.5. Adaptive Testing Systems and Automated Grading

Language tests and assessments can become automated by AI tools offering both students and teachers quick and accurate feedback. Adaptive tests adjust to individual performance levels, providing test items of appropriate difficulty that help students develop at their own learning pace. For example, in *Computerized Adaptive Testing (CAT),* tests are personalized as they adapt to the level of the examinee in accordance with their ability and present performance. In case of good results, the test items become more difficult, and in case of poor performance, the items become easier. [9] Automated grading with AI provides immediate feedback both for students and teachers, ensuring consistency, scalability and time-saving. Besides the present limitations of this type of grading, such as context understanding, complex subjectivity or biases in training data, AI-based automated grading tools have the potential to transform the standard testing of language skills.

3.6. Real-Time Language Translation

With the use of AI-based translation tools, such as *Google Translate* or *DeepL*, the real-time translation of texts and speech becomes possible, which can be useful in language learning, too. As these tools allow students to understand written or spoken contents in other languages, language learners can learn new vocabulary, native expressions or grammar structures easily and quickly in context. [10]

3.7. Multimodal Language Learning Environments

Multimodal language learning environments, where learners use multiple senses simultaneously – for example, reading a text, listening to audio or working with different visual aids – are integrated with AI technologies in various applications, transforming traditional language acquisition methods into an interactive, personalized way of learning. By engaging visual, auditory or kinaesthetic senses during learning, a more immersive understanding and better retention of the learning material can be achieved. Integrating different communication modes with AI-powered platforms increases the effectiveness of multimodal language learning. [11] For instance, speech recognition technologies enable students to practice pronunciation and improve fluency by providing real-time feedback on accent, clarity and intonation. Different speech-to-text systems and voice assistants allow language learners to develop speaking skills in an interactive environment. What is more, various AI-driven applications can provide contextualised language input – for example, by labelling objects in photos or describing scenes in videos – enabling a more engaging way of connecting words with their meanings.

3.8. Real-World Language Practice Simulations

Simulation itself in language learning is an effective way of improving communicational skills, as it enables real-world language practice by allowing students to retain their own personas and practice real-life situations in realistic and interactive scenarios in pairs or small groups. With AI-driven simulations, for instance, communicating with AI chatbots or virtual assistants, this kind of language acquisition method can be effective in improving communicational skills and could be used as a supplement tool to language classes. [12] Using immersive Virtual Reality (VR) environments and AI in simulation practice ensures real-life situations for language learners, where they can immediately connect their classroom experiences with their lives outside of school and feel that what they are learning is relevant.

3.9. Automatic Pronunciation Improvement and Speech Recognition

AI-based speech recognition systems, like *Google Read Along, Pronounce* or *Speechmatics* are effective language learning tools that can be used as supplementary tools in the classroom and for self-study. These systems analyse spoken language and help learners correct pronunciation errors. The instant feedback on pronunciation fosters the development of adequate speaking skills and enables pronunciation that is closest to that of a native speaker. Pronunciation practice incorporating Automatic Speech Recognition (ASR) technology, besides the improvement of foreign language pronunciation, can provide instant personalized feedback for learners. [13]

3.10. Natural Language Processing (NLP)

Natural Language Processing (NLP), the foundation of many AI-driven systems, enables computers to interact with humans more naturally and effectively focusing on the interaction between computers and human language by enabling machines to interpret, understand and generate human language. The application of NLP technology is present for example, in virtual assistants and tutors, chatbots, search engines, translation services, grammar and spelling checking tools, content recommendations or sentiment analysis. [4] Despite the present challenges of NLP, such as natural

language ambiguity or full context understanding, tools like *Grammarly* or *QuilBot* can help students improve spelling, grammar and style in writing with real-time and continuous support.

4. Artificial Intelligence to Support Teachers

Based on the above, it can be stated that AI not only supports language learners in developing their skills but can also be of great help to teachers. With the wide range of AI-powered adaptive tools, AI can assist in adaptive curriculum development by analysing individual student needs, levels and learning styles, allowing teachers to create personalized learning resources and ensure real-world simulation practice to improve all language skills. Additionally, AI-powered analytics provide teachers with real-time results of student performance, reflecting strengths, weaknesses and learning patterns. This data enables teachers to offer targeted support regarding the areas that need further practice. Automated assessments and feedback, as well as the possibility of generating various types of learning materials, reduce the time spent on evaluating, grading and lesson preparation, which allows teachers more time on other educational tasks. The interactive, dynamic and gamification elements of AI-based tools, as well as the use of virtual tutors, enhance engagement both in the classroom and in independent learning while sustaining student motivation. The aspects of AI support for teachers can be seen in Figure 2 below:

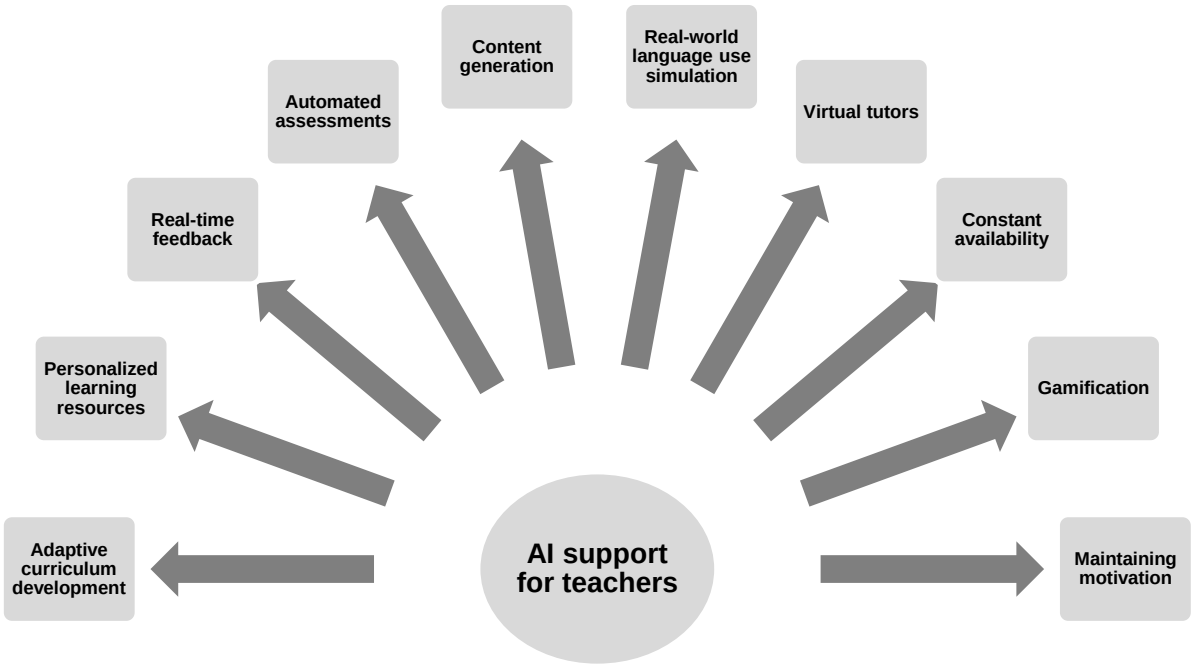

Figure 2.: AI support for teachers. (Source: Author's own work)

5. The Challenges of AI-powered Adaptive Systems

Introducing AI-powered adaptive learning systems in the teaching process also raises some challenges that need to be considered despite the benefits discussed above. First, AI-based adaptive learning systems require adequate technological infrastructure, such as high-speed internet, modern hardware and sufficient learning devices for students, which can be a significant financial investment even for well-equipped institutions. Additionally, teacher training and willingness to change is another significant challenge. The AI-driven teaching method does not reduce the role of the teacher in the learning process, it renews and complements teaching roles. With comprehensive training, the necessary technical skills can be developed, and the complexities of adaptive learning can be addressed. [14] By reinforcing the complementary role of adaptive systems, a further challenge of these systems, the reduced human interaction, can also be avoided. Balancing the use of AI-powered adaptive systems with traditional teaching methods can ensure students' self-discipline to

maintain motivation and engagement in the self-study phase, on the other hand, the balance of teaching methods can facilitate the fulfillment of the national curriculum requirements. Another significant challenge lies in data privacy and ethical concerns. To personalize the learning material, a large amount of student data is collected, therefore, data protection regulations must be adequately handled by institutions. Furthermore, as language learning also involves understanding cultural and regional differences, linguistic and cultural awareness could present a challenge when AI-based adaptive tools are applied, since in some adaptive systems cultural and dialectal variations in language may not be considered. [15] [16]

6. Conclusion

In conclusion, the integration of artificial intelligence and adaptive learning systems represents a transformative change in language education. These technologies provide personalized, flexible, and efficient learning experiences that support the diverse needs and learning styles of students. By providing real-time feedback, tailored exercises and continuous assessments, AI not only enhances foundational language skills but also fosters engagement, motivation and confidence among learners. Furthermore, AI supports educators by simplifying routine tasks, ensuring data-driven insights and offering innovative tools to make the teaching process more effective and engaging. Although these platforms are highly efficient in supporting many aspects of language learning, their full potential is realised when supplemented by human instruction. As AI technologies continue to evolve, their capacity to innovate and reform language acquisition will unquestionably expand, offering novel opportunities for students and educators alike.

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