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Research Article

INTEGRATION OF ARTIFICIAL INTELLIGENCE INTO EDUCATIONAL PLATFORMS FOR EFFECTIVE LANGUAGE LEARNING

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Abstract
The use of artificial intelligence (AI) technologies in language teaching is one of the most promising and dynamically developing areas at the intersection of computer science, linguistics, and pedagogy. Purpose. The study aimed to identify key factors and prospects for the use of AI technologies in the field of language education in Uzbekistan, addressing the unique linguistic and cultural characteristics of the country. Methods. The study analysed existing approaches to integrating AI into language teaching, explored the technical and pedagogical aspects of introducing artificial intelligence technologies into educational platforms in Uzbekistan, and assessed the potential for extending this experience to language education in the country. Results. The study results demonstrate that Uzbekistan has a sufficiently developed technological infrastructure for implementing artificial intelligence projects in education. Conclusions. Research findings also highlighted artificial intelligence's valuable potential for advancing multilingual education initiatives, simultaneously supporting the teaching of Uzbek as the official language while preserving and developing minority languages. The results of the study can be used to create a comprehensive strategy for introducing artificial intelligence into the educational system of Uzbekistan.

Keywords Educational Technologies, Linguistics, Neural Networks, Natural Language Processing, Personalisation, Virtual assistants.

INTRODUCTION

The application of artificial intelligence (AI) technology in language education is a highly promising and rapidly evolving domain at the convergence of computer science, linguistics, and pedagogy. In the context of globalisation and the growing need for multilingual specialists who can effectively interact in an international environment, the issue of optimising language education is of particular importance for Uzbekistan, which is striving to strengthen its position on the global stage.

Traditional methods of language teaching in Uzbekistan often do not meet modern requirements for the speed and efficiency of foreign language learning. A notable disparity exists between theoretical advancements in AI applications in education and their actual integration into the nation's educational programs. In addition, no comprehensive interdisciplinary analysis of the potential

consequences of the large-scale introduction of AI technologies in language education in Uzbekistan, considering the specifics of the national education system and cultural characteristics of the country, is available.

The processes of AI implementation in education during the last two decades have been analysed (Chen et al, 2022; Antwi et al., 2025; Anugradia et al., 2025; Ikhsan et al., 2025). The reviewed technological innovations and pedagogical approaches created the basis for more specialised studies, such as the study by M. Syahnaz and R. Fithriani (2023) who investigated the use of AI tools for paraphrasing in written English teaching practice. A. Alam (2021) explored how game-based learning could be applied to AI and machine learning education, providing insights valuable for the development of interactive language platforms. In a complementary study, M. Tedre et al. (2021) examined both pedagogical and technological dimensions of AI education in secondary schools, offering findings potentially applicable across various language education levels. Alam's additional research highlighted the specific risks and opportunities associated with integrating AI into educational settings. Y. Chen et al. (2022) investigated how AI assistants might enhance student performance. The authors highlighted how chatbots can address challenges like low teacher-student ratios and deliver responsive, confidential, and engaging content to students. Similarly, this study focuses on how AI technologies can improve language education in Uzbekistan by addressing linguistic and cultural challenges.

Completing this picture, S.B. Dodda et al. (2021) analysed the architecture and evaluation methods of conversational artificial intelligence systems, providing a framework for assessing the effectiveness of these technologies in the context of language learning. F. Ouyang and P. Jiao (2021) explored AI in education through three key paradigms, which are AI-directed, AI-supported, and AI-empowered. This provided a framework for language learning integration. B. Cope et al. (2020) introduced “AI-enabled learning ecologies” as a concept applicable to adaptive language learning systems for knowledge assessment. C. Zhang and Y. Lu (2021) offered a thorough analysis of AI development status and prospects, forecasting trends in AI's role in language education.

By 2024, more than 50 major language schools in different countries started to actively use AI technologies in their educational programmes. Notwithstanding this advancement, the literature assessment indicated a necessity for additional research, particularly regarding the legal and ethical dimensions of AI in language teaching and the frameworks for influencing pertinent government policies. Considerable geopolitical factors to be considered included international cooperation in the field of AI technologies, protection of personal data in a cross-border context, and the impact of AI on cultural diversity and national identity in a globalised world.

The study aims to identify opportunities to integrate artificial intelligence into educational platforms for effective language learning in the context of the Uzbek education system. To achieve the set goal, the following tasks were formulated and solved: 1) The current methodologies for using AI in language teaching are examined, taking into account the linguistic characteristics of the Uzbek language and the cultural setting of the nation; 2) The study analysed the technical and pedagogical aspects of introducing AI technologies into educational platforms for language learning in Uzbekistan, including infrastructure analysis, teacher readiness, adaptation of AI to the peculiarities of the Uzbek language, and the need for retraining; 3) The prospective outcomes of the extensive implementation of AI in language education in Uzbekistan and its effects on the quality and accessibility of language learning in the nation have been evaluated.

RESEARCH METHOD

An important stage of the research was the study of Uzbekistan's regulatory framework in the field of education and the use of AI technologies. Key documents were analysed: Law of the Republic of Uzbekistan No. ZRU-637 “On Education” (2020), Resolution of the President of the Republic of Uzbekistan No. PP-4851 “On Measures to Further Improve the System of Education in the Field of Information Technologies, Development and Integration of Scientific Research with IT-industry” (2020).

Data from the Digital 2024: Uzbekistan (Kemp, 2024) was used to assess the current state of Uzbekistan's digital infrastructure. The indicators of Internet penetration, and mobile and fixed Internet speeds were analysed, which were used to assess the technical capabilities of introducing AI systems into the educational process.

The survey was conducted from 1 March to 30 April 2024 and covered 10 schools in different regions of Uzbekistan, including urban and rural educational institutions. 150 respondents took part in the survey: 50 foreign language teachers (age 25-60 years, average age 42 years; 70% women, 30% men) and 100 students (age 14-17 years, average age 15.5 years; 55% girls, 45% boys).

Purposive and stratified sampling was used in this study to guarantee that both urban and rural educational institutions from various Uzbek areas were included. This method made it possible to get a wide-ranging and representative viewpoint on the level of preparedness for incorporating AI into language instruction. The inclusion criteria for teachers required them to have taught foreign languages for at least three years and have used digital teaching resources before. Students had to be in grades 9-11, have at least two years of foreign language study experience, and use digital devices for learning on a regular basis. Every participant has to fill out the online survey and give their informed consent. Those who refused to fill out the online consent-based questionnaire or who had never used digital technologies in an educational setting were excluded. In order to properly assess AI integration, it was necessary that all respondents possess at least a basic understanding of technology-mediated learning, which was ensured by this selective method.

Two questionnaires were developed: one for teachers and one for learners. Each questionnaire contained 6 key questions aimed at assessing different aspects of readiness to integrate AI into language education. The survey for educators comprised the subsequent inquiries: 1) How aware are you of the use of AI technologies in education? (Answer options: Very well aware / Well aware / Partially aware / Poorly aware / Not at all aware); 2) How do you feel about the introduction of AI in language teaching? (Answer options: Very positive / Positive / Neutral / Negative / Extremely negative); 3) How ready are you to use AI technologies in language teaching? (Answer options: Completely ready / Rather ready / Not sure / Rather not ready / Not at all ready); 4) How confident are you in your AI skills? (Answer options: Very confident / Confident / Moderately confident / Not very confident / Not at all confident); 5) Do you think that the use of AI will increase the effectiveness of language teaching? (Answer options: Definitely yes / Rather yes / Difficult to answer / Rather no / Definitely no); 6) How concerned are you about the possible negative consequences of the introduction of AI in education? (Answer options: Highly concerned / Concerned / Partially concerned / Little concerned / Not at all concerned)

The questionnaire for students contained similar questions adapted to their perceptions: 1) Do you know what AI technologies in education are? (Answer options: Very well aware / Well aware / A little aware / Poorly aware / Not at all aware); 2) How do you feel about the use of AI in language learning? (Answer options: Very much like it / Like it / Indifferently / Don't like it / Don't like it at all); 3) Would you like to use AI technologies in language learning? (Answer options: Very much so / Want to / Not sure / Not really so / Not at all); 4) How confident are you that you can use AI technologies to learn languages? (Answer options: Very confident / Confident / Not so confident / Doubtful / Not at all confident); 5) Do you think AI will help you learn languages better? (Answer options: Definitely helps / Somewhat helps / Don't know / Mostly doesn't help / Definitely doesn't help); 6) Are you worried about anything about using AI to learn languages? (Answer options: Very worried / worried / A little worried / Almost not worried / Not worried at all).

The survey was administered online via Google Forms, a dedicated platform that guarantees respondent anonymity. The survey results were analysed using statistical data processing methods. Percentages for each parameter were calculated for groups of teachers and students and used for a comparative analysis of the readiness of various participants in the educational process to implement AI. The analysis of the linguistic features of the Uzbek language, such as the agglutinative nature of morphology, the law of vowel harmony and free word order, was emphasised. For this purpose, the works of linguists specialising in Turkic languages were studied, in particular, the research of L. Johanson (2021). The study also analysed the socio-cultural aspects of introducing AI into language education in Uzbekistan, including the preservation of cultural identity and the development of multilingualism in the country.

RESULTS AND DISCUSSION

Analysing approaches to integrating AI into language education in Uzbekistan

The Uzbek language is part of the Turkic language family and possesses distinct features that must be considered in the creation and execution of AI systems for language instruction. The agglutinative nature of morphology expressed in the rich system of affixes attached to the root of a word to express grammatical meanings creates certain difficulties for AI systems, requiring the development

of algorithms capable of efficiently analysing and generating long chains of morphemes (Johanson, 2021; Beltran, 2025; Candia et al., 2025; Jalmasco et al., 2025). This feature is further compounded by the operation of the law of vowel harmony, which requires vowels in a word to be homogeneous in a row and voicing, requiring the development of specialised machine learning models that accommodate the phonological rules of the language (Mamasodikovich, 2023; Intharit et al., 2025; Jarnawi et al., 2025). Additional difficulties for natural language processing systems are created by free word order: despite the basic SOV (subject-object-verb) order, the Uzbek language allows considerable variability, which requires the development of more flexible algorithms for analysing syntactic structures (Jumanazar gizi and Komiljon o'g'li, 2024). The situation is further complicated by the presence of several dialects of the Uzbek language, which makes it difficult to create universal AI systems for language learning and requires taking this diversity into account when developing educational platforms.

X. Chen et al. (2022) show that the integration of AI into teaching languages with rich morphology, such as Uzbek, requires the development of specialised neural networks capable of processing complex morphological structures. The authors propose the use of recurrent neural networks with an attention mechanism, which have shown high efficiency in processing agglutinative languages. Furthermore, M. Syahnaz and R. Fithriani (2023) demonstrated that the use of AI tools for paraphrasing in English language teaching can be adapted to Uzbek. However, the authors emphasise the need to account for cultural and linguistic peculiarities in such adaptation.

The cultural context of Uzbekistan is significant in the process of adaptation of AI technologies for language education. Traditions of respect for the teacher and personal interaction in the learning process may create certain barriers to the adoption of AI, which requires the development of approaches that harmonise traditional methods with innovative AI technologies (Davydiuk et al., 2024; Jumaera et al., 2024; Onipko and Yaprynets, 2024; Kheang et al., 2025; Mabeza, 2025). The multilingualism and cultural diversity of Uzbekistan, where, in addition to Uzbek, Russian, Tajik and other languages are widely used, necessitate the creation of AI systems capable of working in a multilingual context. When developing educational materials and AI algorithms, it is critical to address local cultural values and ethical norms to prevent potential conflicts and ensure social acceptance of the technology (Khrystych, 2023). Favourable conditions for the integration of AI in language education are created by the state policy, which is confirmed by the Resolution (2020), which emphasises the introduction of modern technologies in the educational process. A. Alam (2022) further emphasises the importance of considering the cultural context when developing game-based approaches to AI-enhanced learning. In particular, the study suggests that game elements such as storylines, characters and visual design should be adapted to the local cultural realities and traditions of Uzbekistan. For instance, using national Uzbek holidays (such as Navruz) as a thematic basis for language tasks, incorporating elements of traditional Uzbek art into the interface design, and considering the peculiarities of non-verbal communication characteristic of Uzbek culture when designing dialogue systems.

The integration of AI in language education in Uzbekistan presents both promising opportunities and significant challenges (Shcherbiak et al., 2024). Adapting AI algorithms to the linguistic nuances of the Uzbek language remains a primary hurdle, requiring specialized development efforts. The digital divide between urban and rural regions further complicates implementation, as access to necessary technological infrastructure varies considerably across the country. Ensuring AI systems reflect Uzbek cultural contexts and values is essential for their effectiveness and acceptance. Perhaps most critically, the successful deployment of AI in language education necessitates comprehensive retraining programs for educators, many of whom have limited experience with advanced digital tools. The programs should focus on improving digital literacy, using AI tools for personalised instruction, managing AI-based assessments, and addressing ethical concerns (Avtalion et al., 2024; Iklassova et al., 2024; Nou et al., 2025; Obenza et al., 2025). These challenges must be addressed systematically for AI integration to meaningfully enhance language education throughout Uzbekistan's diverse educational landscape. B. Cope et al. (2020) demonstrated the effectiveness of adaptive learning systems that use AI to create personalised pathways, which is particularly relevant for Uzbekistan with its diverse linguistic landscape and can help to address individual learner characteristics.

Adaptation of these technologies to the Uzbek language can significantly increase the accessibility of language education in the country, especially in remote regions, by facilitating learning in the mother tongue. Incorporating the cultural context into the design of the content and interfaces of

these systems contributes to their relevance and attractiveness to local users, which in turn can increase student engagement and learning efficiency, especially in areas with limited access to qualified language teachers (Chen et al., 2022; Rachmatika & Salighehdar, 2024; Putri et al., 2025; Rubio et al., 2025).

The application of artificial intelligence in Uzbek language education presents transformative opportunities for addressing regional challenges (Diachuk, 2024). According to M. Tedre et al. (2021), AI-powered automated assessment systems can evaluate written assignments and provide immediate feedback, helping mitigate the shortage of qualified language instructors in Uzbekistan's remote areas. Intelligent speech recognition technologies tailored to Uzbek phonetics create new pathways for enhancing pronunciation training and listening comprehension – fundamental components of effective language acquisition. Furthermore, adapting advanced natural language processing algorithms like those found in Generative Pre-trained Transformer (GPT) models specifically for Uzbek could fundamentally reshape the learning experience. These technological innovations offer learners unprecedented access to authentic materials and interactive exercises. By generating Uzbek content and analyzing student responses in real-time, AI systems facilitate a richer educational environment. The technology enables the creation of customized learning materials and adaptive assignments that respond to individual students' proficiency levels and specific needs, ultimately delivering a more personalized and effective language learning journey.

The successful integration of AI into language education in Uzbekistan hinges on several critical factors requiring thorough analysis to ensure effective implementation of these innovative technologies in the country's educational system. The legal and regulatory environment plays a fundamental role in this integration process. Law of the Republic of Uzbekistan No. ZRU-637 (2020) established an essential legal foundation for incorporating innovative technologies into educational practices, reflecting the government's strategic commitment to modernizing education and creating pathways for advanced technologies, including AI, in teaching and learning environments. Nevertheless, considering the unique challenges and potential risks associated with AI applications in education, more comprehensive and specific regulations are necessary. These additional regulatory frameworks should address multiple dimensions of AI utilization in educational settings, including data protection protocols, ethical considerations, quality standards for educational AI systems, and implementation oversight mechanisms.

Furthermore, it is necessary to consider the demographic context when developing strategies for introducing AI in language education. According to the Digital 2024 Report for Uzbekistan (Kemp, 2024), the median age of the population of Uzbekistan is 27.1 years, indicating a predominantly young population. This may be a favourable factor for the introduction of innovative technologies, as young people are usually more receptive to new technological solutions. At the same time, the gender gap in the use of social media should be noted: 63% of users are men and only 37% are women. This may signify a broader gender disparity in access to digital technology, which must be taken into account when creating and implementing AI systems for language instruction to provide equitable chances for all learners.

Thus, the existing infrastructure and legislative framework create favourable conditions for the introduction of AI technologies, further measures are needed to develop the legal and regulatory framework, to ensure equal access to the technologies and to accommodate the demographic characteristics of the country for the effective integration of AI into the language education system of Uzbekistan.

Technical and pedagogical aspects of introducing AI technologies into educational platforms in Uzbekistan

The integration of AI into educational platforms in Uzbekistan is a complex process that requires careful consideration of both technical and pedagogical aspects. This process is characterised by a dynamic interaction between technological innovations and educational methodologies, which creates unique challenges and opportunities for the national education system.

An examination of Uzbekistan's technological infrastructure and its preparedness for the incorporation of AI in education identifies numerous critical factors that must be considered when formulating and executing strategies for the integration of AI into the educational framework. According to the Digital 2024 Report for Uzbekistan (Kemp, 2024), the internet distribution rate has reached 83.3%, which corresponds to 29.52 million internet users. This creates a solid foundation for

the introduction of online platforms with AI components. The median mobile internet speed is 24.70 Mbps, while the fixed internet speed is 55.45 Mbps, indicating substantial advancement in the nation's digital infrastructure (Kemp, 2024).

Although there are favorable developments in Uzbekistan's digital infrastructure, the incorporation of AI into the educational system encounters numerous substantial hurdles that necessitate a holistic approach for resolution. Firstly, the problem of uneven access to the Internet remains relevant: 16.7% of the national population is still unconnected, which creates a risk of digital inequality in education and limits the access of a significant part of the population to innovative AI learning technologies. This situation is worsened by a second problem: poor quality of connectivity. Although there has been an increase in internet speeds, further improvements in the quality and stability of internet connections are necessary for the effective functioning of complex AI systems, especially in remote regions of the country. The above two factors directly affect the third problem – the technical equipment of educational institutions. To fully integrate AI into the educational process, it is critical to provide schools and universities with modern equipment capable of supporting the operation of AI platforms. This requires not only significant financial investment but also strategic planning, considering rapidly evolving technologies.

The Government of Uzbekistan is taking active steps in this direction. According to the Resolution (2020), a comprehensive programme is being implemented to modernize the IT infrastructure of educational institutions and improve the digital literacy of teachers. The program includes the creation of IT parks in the regions, the provision of educational institutions with high-speed Internet, large-scale professional development for teachers in digital technologies and the introduction of courses on programming and artificial intelligence into the curricula of higher education institutions.

The introduction of AI into language education in Uzbekistan is a complex process that requires not only technological readiness but also a deep adaptation of pedagogical methods to the innovative opportunities provided by AI technologies. This transformation process is characterised by several key trends and challenges that are shaping the new landscape of the country's education system. Personalisation of learning is becoming one of the central aspects of integrating AI into the educational process (Rexhepi et al., 2024; Salim et al., 2025; Siddique et al., 2025). AI systems may generate personalized learning pathways that cater to the distinct attributes, requirements, and pace of each student (Tkachenko et al., 2024; Griban et al., 2020). M. Murtaza et al. (2022) demonstrated the effectiveness of this approach in education, emphasising its particular relevance to Uzbekistan with its rich linguistic diversity. Personalised learning allows not only to increase the efficiency of learning but also to consider the cultural and linguistic specificities of students, which is critical in the multinational context of the country.

The second key aspect is the implementation of adaptive assessment using AI technologies. AI applications for automatic evaluation of written work and immediate feedback delivery, as thoroughly explored by V. González-Calatayud et al. (2021), open new frontiers in educational assessment. This approach enhances assessment efficiency and objectivity while substantially decreasing teacher workload, enabling educators to concentrate on more creative and intellectual aspects of teaching. In Uzbekistan's context, where demand for quality language education continues to grow, these innovations may prove essential for improving both the quality and accessibility of educational services.

The third important direction is the integration of interactive teaching methods based on AI technologies, for example, AI-powered chatbots for real-time Q&A, adaptive learning platforms that adjust content to student progress, and virtual tutors for personalized language practice. These technologies create new opportunities for interactive language learning, significantly increasing student engagement and learning efficiency. In Uzbekistan, where there is a need for large-scale and effective language education, such innovations can become a key factor in overcoming language barriers and increasing the international competitiveness of the country (Chen et al., 2022; Shagembe et al., 2025).

All these trends are interconnected and reinforce each other, creating a synergistic effect in the transformation of the educational process. The personalization of learning, facilitated by adaptive assessment and interactive methodologies, creates a whole ecosystem of language instruction that can readily adjust to the unique requirements of learners and the evolving demands of contemporary society (Krokhmalnyi et al., 2021; Khilya et al., 2024; Somantri, 2024; Syahrul et al., 2025).

The adaptation of pedagogical methods to AI-assisted learning in Uzbekistan faces several interrelated challenges. An essential necessity for the professional development of educators arises, as the effective implementation of AI technology in education demands enhanced capabilities from

teachers. These competencies include skills in working with AI systems, the ability to integrate them into traditional teaching methods, the ability to analyse student progress data generated by AI and to develop appropriate teaching materials. Furthermore, educators must comprehend the ethical dimensions of employing AI in education, encompassing privacy concerns and the potential biases inherent in algorithms. The thorough development of these competencies among educators is essential for the effective integration of AI technology into Uzbekistan's educational system.

In addition, the introduction of AI in education raises several ethical issues, especially in the context of handling students' data. These issues cover protecting the privacy of student's personal information, ensuring the transparency of AI algorithms, preventing discrimination and bias in assessments, maintaining a balance between personalisation and autonomous learning, and developing informed consent mechanisms for data use. To address these ethical challenges, Uzbekistan needs a well-defined regulatory framework and principles for AI in education. This approach will maximize technological benefits while minimizing risks to students and the education system. Creating clear ethical principles for educational AI applications is essential for responsible implementation (Oqlu Kazimi, 2021; Yulianti, S., & Awingan, 2024; Temirbolat et al., 2025). Addressing these interrelated issues requires a comprehensive approach and close cooperation between educators, technology specialists and educational policymakers.

The development and adaptation of AI platforms for language learning in Uzbekistan is a complex process that requires recognition of the unique linguistic and cultural characteristics of the country. This process is characterised by several key aspects that are closely interrelated. Firstly, AI platforms must ensure multilingualism by supporting not only Uzbek, but also other languages widely used in the country, such as Russian and Tajik, which reflects the policy of multilingual education enshrined in Law of the Republic of Uzbekistan No 3561-11 (1989). At the same time, it is necessary to address the linguistic peculiarities of the Uzbek language, in particular its agglutinative nature of morphology and the specificity of the phonetic system, which requires the development of specialised algorithms for natural language processing (Johanson, 2021).

Equally important is the cultural adaptation of the content of the AI platforms, incorporating the values and traditions of Uzbekistan that are directly relevant to language learning. This includes the high value of oral creativity and eloquence, the traditional multilingualism of society, the collectivist approach to learning and the importance of preserving the Uzbek language as the basis of national identity. The integration of cultural elements into AI platforms will establish an educational environment that blends technological innovation with Uzbek society's cultural norms and practices in language education, aligning with Law of the Republic of Uzbekistan No. 3561-11 (2020). For educational continuity and effectiveness, these AI platforms should connect with Uzbekistan's current digital educational resources through compatible interfaces and data exchange protocols.

Successful implementation of all these interrelated aspects requires close cooperation between developers of AI technologies, linguists, educators and representatives of the Uzbek authorities. The public-private partnership supported by the Law No. ZRU-537 (2019) is central to this process. At the time of the study, some AI platforms for language learning already existed in Uzbekistan, such as UzAI Learn and Til.uz, but they did not fully meet the country's unique requirements for cultural adaptation and consideration of the linguistic features of the Uzbek language. These platforms frequently use generalised natural language processing models that are not well-suited to the Uzbek language's agglutinative morphology, vowel harmony, and syntactic flexibility. This results in errors in grammar parsing and semantic interpretation. Furthermore, culturally embedded elements, like national holidays, traditional communicative norms, or regionally specific colloquial expressions, rarely appear in their content and interface design, which restricts user engagement and the contextual relevance of learning materials. An integrated approach, combining the efforts of all stakeholders, will improve the existing platforms and create new, more effective and culturally adapted AI solutions for language learning that will fully meet the unique needs and peculiarities of Uzbekistan's educational system.

An analysis of the technical and pedagogical aspects of introducing AI technologies into educational platforms in Uzbekistan reveals several key factors that determine the success of this process. Refer to the following summary Table 1 for a visual depiction of the primary components and their interconnections with AI integration in language teaching within the country.

Table 1. Key aspects of AI implementation in language education in Uzbekistan

Aspect	Current status	Development potential	Key challenges
Technology infrastructure	Internet penetration: 83.3%	High	Uneven access to the market
Pedagogical methods	Initial adaptation stage	Significant	The need to retrain teachers
Multilingualism	Support for major languages	High	Development of Natural Language Processing (NLP) algorithms
Cultural adaptation	In the process of development	Moderate	Preserving traditional values
Legal and regulatory framework	Basic laws adopted	Significant	The need for specific regulations

Source: S. Kemp (2024), Law of the Republic of Uzbekistan No. 3561-11(1989), Law of the Republic of Uzbekistan No. ZRU-637 (2020), L. Johanson (2021), M. Murtaza et al. (2022), V. González-Calatayud et al. (2021), Y. Chen et al. (2022).

The integration of AI technology in language instruction in Uzbekistan is a multifaceted process necessitating a methodical approach and the consideration of numerous interconnected issues. Despite the existing challenges, the country demonstrates significant potential for development in this area. The effective execution of the proposed strategies and the resolution of identified challenges will enable Uzbekistan to emerge as a regional leader in the utilization of AI technologies for language education, thereby enhancing educational quality and the nation's competitiveness on the global stage.

Assessment of the potential outcomes of introducing AI in language education in Uzbekistan

As part of this study, a survey was conducted to assess the readiness of teachers and students to integrate AI into language learning in Uzbekistan (Table 2).

Table 2. Results of the survey on readiness to integrate AI in language education in Uzbekistan

Metric	Teachers	Students
Awareness of AI technologies in education	60%	75%
Positive attitude towards the introduction of AI in language teaching	54%	80%
Willingness to use AI technologies in language teaching/learning	48%	82%
Confidence in AI skills	35%	68%
Expectation of increased learning effectiveness when using AI	58%	72%
Concerns about possible negative consequences of AI implementation	50%	28%

Analysis of the data in Table 2 reveals several noteworthy trends in attitudes towards AI technologies in the educational environment of Uzbekistan. More than half of the surveyed teachers have a positive attitude towards the introduction of AI in language teaching, which indicates the readiness of the teaching staff for innovations. Notably, this indicator is much higher among students. However, the difference in percentages between these teachers and those who are willing to actually use it suggests that while teachers acknowledge the potential benefits of AI in language education, they may feel uncertain or lack confidence in their ability to effectively integrate these technologies into their teaching practices. This suggests that preparedness to embrace new technology is not necessarily correlated with favourable sentiments, perhaps because of a need for additional training or worries about how they will be used in practice.

Students demonstrate greater confidence in their AI skills compared to teachers, indicating the need for additional training for educators. At the same time, seven out of ten students expect the effectiveness of learning to increase when using AI, which emphasises the high level of optimism and readiness for new forms of learning among the younger generation. However, it is worth noting that half of the surveyed teachers express concern about possible negative consequences of the introduction of AI, which indicates the need for information and support for teachers in the process of introducing new technologies. At the same time, only 28% of students voiced the same reservations, which can indicate that students are more positive about adopting AI. This may be as a result of their increased comfort

level and familiarity with digital tools. With fewer concerns about its possible drawbacks, students may also view AI as a practical, dynamic, and captivating method to improve their language learning experience.

The introduction of AI technologies in language education in Uzbekistan can significantly improve the quality of learning while expanding its accessibility. Based on the survey results and analyses of current trends in educational technologies, several key aspects can be identified that interrelatedly affect the efficiency and accessibility of language education. The personalisation of learning enabled by AI systems makes it possible to adapt the learning material and the pace of learning to the individual needs of each student, which can lead to more effective language acquisition and skills development. This personalisation is closely linked to increased interactivity and learner engagement using AI assistants and chatbots, which is particularly important for the development of conversational skills (Belda-Medina and Calvo-Ferrer, 2022; Matviienko, 2023). In addition, AI systems provide opportunities for constant language practice regardless of time and place, which is critical for effective language learning and greatly enhances the accessibility of educational resources. A significant component is also the quick feedback provided by AI-based automated assessment systems, which permits faster correction of errors and reinforcement of proper language structures, making the learning process more efficient and accessible for self-study. All these variables combined not only improve the quality of language education but also greatly expand its accessibility, overcoming time, geographical and economic limitations.

The incorporation of AI technology can profoundly influence the accessibility of high-quality language teaching in Uzbekistan, including various critical facets. Geographical accessibility is greatly enhanced by AI-supported online platforms, which can provide access to quality language education even in remote regions of the country where there has traditionally been a shortage of qualified teachers. This is complemented by a potential increase in affordability as the automation of some aspects of learning will reduce the cost of language courses, thus contributing to an increase in enrolment (Alqahtani et al., 2023).

An important factor is also the temporal flexibility provided by AI systems, allowing students to study at a time that is convenient for them, which is particularly relevant for working people or students with busy schedules. In addition, the inclusiveness of education is greatly enhanced by the ability to customise adaptive AI systems to teach people with special educational needs (Hopcan et al., 2023). AI can incorporate text-to-speech, speech-to-text, and audio navigation, for instance, to give visually impaired students access to instructional resources and real-time feedback. Additionally, it can change the contrast and font size to enhance visibility. For students with autism and ADHD, AI can provide personalized learning experiences by offering structured routines, reducing distractions, and providing visual or auditory cues to help maintain focus. In addition, flexible pacing can prevent pupils from being overwhelmed, increasing everyone's access to and effectiveness of learning. These elements establish a multi-faceted accessibility framework that can considerably enhance the availability of quality language education to various segments of the Uzbek populace, surmounting conventional obstacles and facilitating new avenues for personal and professional advancement of citizens.

The introduction of AI in language education in Uzbekistan entails several significant socio-cultural consequences that transform traditional educational paradigms and social interactions. First and foremost, the role of the teacher is fundamentally changing: the teacher is no longer the sole source of knowledge and is becoming a facilitator of the learning process, guiding and supporting students in their interaction with AI systems. Such a transformation requires a deep rethinking of pedagogical approaches and methodologies and adaptation of educational programmes and teacher training systems.

In parallel, there is an urgent need for cultural adaptation of AI systems to the specific context of Uzbekistan, characterised by a unique combination of Turkic linguistic background, Islamic cultural influence, Soviet heritage and a multi-ethnic population. The proposed measures include integrating elements of Uzbek folklore and art, accounting for the peculiarities of national etiquette, including topics on local traditions and holidays, adapting visual design using national motifs, creating multilingual modules and developing content reflecting the realities of life in Uzbekistan.

The widespread adoption of AI technologies in education inevitably stimulates the development of digital literacy among the general population (Smuha, 2022), which has far-reaching implications for the overall technological development of the country, enhancing Uzbekistan’s competitiveness in the international arena. However, the increasing share of online learning using AI is significantly affecting the forms of social interaction among students, which requires a balance between technological

innovations and traditional forms of learning that provide the necessary live interaction and social skills development. These socio-cultural changes combine to form a new educational reality in Uzbekistan that requires careful management and adaptation at all levels of society.

Firstly, AI systems are becoming substantial to support the state language policy, providing effective teaching of Uzbek as the state language and at the same time supporting the learning of national minority languages. This contributes to strengthening national identity while preserving cultural diversity. The development of the population's multilingual competencies is greatly accelerated by AI platforms, which enable the effective learning of several languages simultaneously, leading to a more diversely educated and competitive society (Aviv et al., 2024; Kolbayev et al., 2024). Of particular value is the potential of AI technologies to preserve linguistic diversity: the creation of educational resources for little-spoken languages not only contributes to their preservation (Meighan, 2021) but also stimulates their development in today's digital context. Lastly, improving the language skills of the population through AI technologies significantly accelerates Uzbekistan's international integration process, opening new opportunities for the country's participation in global educational and economic processes.

In conclusion, the prospective outcomes of implementing AI in language teaching in Uzbekistan appear favorable. However, to maximise the potential of the technology, an integrated approach that considers technological, pedagogical, socio-cultural and legal aspects is needed. It is also important to continue monitoring and evaluating the results of the implementation of AI technologies for timely adjustment of strategies and approaches.

The analysis of the technological infrastructure showed a high level of Internet penetration (83.3%) and a significant potential for the introduction of AI technologies in the educational process. The survey among teachers and students showed a generally positive attitude towards the use of AI in language teaching, especially among students (80% of positive responses). Potential benefits of AI implementation were identified, including personalisation of learning, increased accessibility to quality language education and the development of multilingual education. However, challenges related to the adaptation of pedagogies and the need for cultural adaptation of AI systems were also highlighted.

Positioning Uzbekistan's experience in the global discourse on AI in language education

In the context of using AI chatbots for language learning, this study's results align with K. Mageira et al. (2022), who demonstrated the effectiveness of educational AI chatbots in integrated content and language learning. This connection supports our findings regarding AI's potential to enhance interactivity and learner engagement. While Mageira et al. primarily focused on technical aspects, our study examines the socio-cultural context of AI implementation in Uzbekistan, providing a more comprehensive assessment of both opportunities and challenges for integrating AI into language education in the country.

The systematic review by C.W. Okonkwo and A. Ade-Ibijola (2021) on AI chatbots in education also supports our findings. Their work confirmed chatbots' diverse applications in educational processes, which corresponds with our identification of AI's potential to personalize learning and improve educational accessibility. However, Okonkwo and Ade-Ibijola did not address the specific considerations for chatbot implementation in language education within developing countries, making our study a valuable contribution to the existing literature.

The results of the present study reveal a wide variety of possibilities for the application of AI in language instruction in Uzbekistan, covering multiple levels of the educational system – from school to higher education. The identified potential of AI to increase student engagement and personalise learning is confirmed by the high level of students' readiness to use AI technologies (82% of respondents). These findings are supported by L. Labadze et al. (2023) on the role of AI chatbots in education, especially concerning the potential of AI to increase student engagement and personalise learning. However, L. Labadze et al. addressed higher education, whereas the present study covered a broader educational spectrum including school education. This covered more prospects of introducing AI in language education in Uzbekistan, accounting for the specifics of different educational levels and the needs of different age groups of learners.

Addressing the personalisation aspect of learning identified in this study as one of the key benefits of AI adoption, parallels can be drawn with the work of X. Chen et al (2021). However, while X. Chen et al. addressed personalisation in the context of developed countries, the present study demonstrates the potential and specificity of applying a personalised approach in the context of a

developing country with a unique linguistic and cultural landscape. The analysis of the technological infrastructure showed a high level of Internet penetration (83.3%), which creates favourable conditions for the introduction of online platforms with AI components. However, the study also emphasises the need to accommodate regional differences in the level of development and access to technology.

The identified possibility of overcoming geographical and time barriers through AI technologies is particularly relevant for remote regions of the country with a shortage of qualified language teachers. These findings are confirmed by Z. Sun et al. (2020) on the development of an online AI-based English language learning platform. Their project demonstrates how technology can effectively overcome geographical and temporal barriers to accessing education. However, unlike the study by Z. Sun et al., which focused mainly on technological aspects, the present study also considers socio-economic factors of accessibility. This integrated approach enables a more realistic assessment of the potential and constraints of adopting AI in language instruction in the context of Uzbekistan, considering its particular geographical and socio-economic characteristics.

R. Rusmiyanto et al (2023) study of the role of AI in the development of English language learners' communicative skills emphasises the need to revise traditional pedagogical approaches. However, unlike R. Rusmiyanto et al. who focused on general principles, the present study offered a more detailed analysis of specific pedagogical challenges in the context of Uzbekistan, including the need for teacher re-training and curriculum adaptation.

Addressing the problem of cultural adaptation of AI systems, which is highlighted in this study as a critical aspect, parallels can be drawn with the study by H. Khosravi et al. (2022) on explainable artificial intelligence in education. Although H. Khosravi et al. considered the explainability of AI predominantly from a technical perspective, this study extends this concept by emphasising the need for cultural interpretability of AI systems in the context of Uzbekistan.

The survey results from this study indicate that a significant majority of students (82%) are prepared to utilize AI technologies in their learning, aligning with T.A. Baha et al. (2024) findings regarding the beneficial effects of educational chatbots on the learning experience of students. However, in contrast to the study by T.A. Baha et al., which focused on higher education, the present study covers a broader range of educational levels, thus providing a more comprehensive picture of readiness to implement AI in language education in Uzbekistan.

The analysis demonstrated that AI technologies can effectively support the state language policy, facilitating both the teaching of Uzbek as the state language and the preservation and development of national minority languages. The study emphasised the role of AI in building multilingual competencies of the population, which is critical for cultural diversity and economic development of the country. The potential of AI in the creation of educational resources for little-spoken languages is emphasised, thus contributing to their preservation and development in today's digital context. These findings align with L. Fryer et al.'s (2020) research on current and future applications of bots in language learning. While their work confirmed AI technologies' effectiveness for multilingual learning at the individual level, the present study expands this perspective by examining AI's potential within Uzbekistan's state language policy framework. This broader context reveals how AI technologies contribute not only to individual language development but also to a comprehensive national strategy for multilingual education and the preservation of linguistic diversity.

T. Chong et al. (2021), while not specifically examining the education sector, offer significant insights regarding AI chatbot implementation in service industries. Their emphasis on achieving equilibrium between automated systems and human engagement resonates with the findings of this research, underscoring the necessity of seamlessly incorporating AI into educational methodologies without sacrificing the crucial interpersonal dynamics between educators and students.

When comparing this study's outcomes with existing literature, it becomes evident that AI integration in Uzbekistan's language education system holds considerable promise, yet demands a holistic strategy addressing the country's distinctive socio-cultural, linguistic, and technological characteristics. The research highlights factors such as the necessity for culturally adapted AI systems and considerations for multilingual environments, which both complement and extend current scholarship on AI applications in language education, providing fresh perspectives for subsequent research and practical implementation.

CONCLUSION

The integration of artificial intelligence (AI) into language education in Uzbekistan presents significant potential to enhance learning quality, accessibility, and cultural preservation, especially when tailored to the unique linguistic features of the Uzbek language, such as its agglutinative morphology, vowel harmony, and free word order. While the country's strong internet infrastructure supports digital transformation, effective implementation also requires targeted teacher training, curriculum adaptation, and equitable access to AI tools across urban and rural areas. AI-driven platforms can offer personalized learning, real-time feedback, and support for multilingual education, fostering inclusivity and reducing regional disparities. However, challenges remain, including the need for culturally appropriate AI systems, digital inequality, and the risk of diminishing essential human elements in education. This study highlights the necessity of a comprehensive national strategy that balances technological innovation with educational values, ensuring AI supports—not replaces—effective pedagogy. Although the research is limited by its national scope and lack of long-term impact analysis, it offers valuable insights into the foundational requirements for responsible AI adoption. With an integrated and inclusive approach, AI can play a transformative role in modernizing Uzbekistan's language education system while promoting cultural diversity and national development.

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AUTHOR CONTRIBUTIONS

Conceptualization, B.P. and A.L.; Methodology, E.C. and A.H.; Formal Analysis, B.P. and E.C.; Investigation, A.H.; Writing – Original Draft Preparation, B.P. and A.L.; Writing – Review & Editing, E.C. and A.H.; Visualization, A.H.; Supervision, A.L.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the generation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

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