

AI-Powered Smart Technologies for Enhancing Innovative English Teaching in Higher Education in Kazakhstan

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ABSTRACT

Objective: The development of foreign language teaching methodologies in the context of an evolving educational landscape is directly linked to the continuous integration of Artificial Intelligence (AI) in various fields. The integration of AI-driven tools and technologies has reshaped communication and educational experiences by creating opportunities for innovative pedagogical approaches in higher education in Kazakhstan. This paper explores the use of AI-powered smart technologies in English language learning and teaching, emphasizing their role in interactive educational activities, personalized learning environments, and critical thinking development among students at A.K. Kussayinov Eurasian Humanities Institute in Kazakhstan. **Method used:** Literature analysis, pedagogical experiment and students' feedback to assess the impact of AI-driven applications on English learning in a controlled setting and understand students' perceptions and motivation along with exploring existing research on AI-based approaches in education. **Results** showed that (1) the use of AI-driven smart technologies in English teaching significantly enhances the learning process. Students in experimental group, who used personalized AI-supported mobile applications, demonstrated improved engagement, motivation, and autonomy compared to the control group; (2) the increase of students' interest in using smartphones for educational purposes and a positive attitude towards AI-assisted learning; (3) the effectiveness of AI-based personalization confirmation in enhancing better language acquisition outcomes. **Novelty** lies in (1) the integrated application of AI-driven smart technologies to create personalized learning environments in English learning and teaching at the institute level; (2) offering a practical model for implementing AI innovations in language education, particularly within the context of Kazakhstan's higher education system.

INTRODUCTION

Recent studies indicate that AI technologies are transforming modern education by creating a dynamic and interactive learning environment, and also they affect our thinking, practice, and behaviors. In accordance with Kazakhstani education policy, the incorporation of AI into education aims to enhance digital competencies among educators and students, with a specific focus on smart technologies that optimize language learning by identifying the key areas, including (1) research on AI-based teaching methodologies in higher education; (2) development of skills for utilizing AI-driven digital tools in language instruction.

AI-based smart technologies serve as a powerful tool to meet various pedagogical challenges, facilitating adaptive appropriate learning, real-time feedback, and personalized educational experiences. AI-based tools enable: (1) Individualized and differentiated instruction; (2) Automated error diagnosis and feedback mechanisms; (3) self-paced learning opportunities; (4) enhanced student engagement through interactive AI applications.

The primary goal of AI-enhanced learning is to create an environment that maximizes educational competitiveness by developing 21st-century skills, such as collaboration, communication, critical thinking, and problem-solving.

With technological advancements, researchers and educators are increasingly leveraging AI-driven tools to enhance foreign language instruction. In global education systems, the concept of "educational technology" encompasses digital transformation in learning, improving educational outcomes through AI-driven resources and intelligent learning processes. Moreover, AI-based solutions – such as natural language processing, speech recognition, and adaptive learning systems – offer unprecedented opportunities for individualized and student-centered learning experiences (Gyawali & Mehandroo, 2022; AbuSahyon et al., 2023).

In Kazakhstan, the transition toward student-centered learning has redefined traditional pedagogical roles. AI-based tools foster an adaptive and interactive learning process, shifting from passive knowledge transfer to active engagement. One of the most prominent applications of AI in English Language Teaching (ELT) includes AI-driven mobile applications and chatbots, which allow learners to receive real-time feedback, practice speaking and listening skills, and engage in interactive dialogue (Saydibragimova, 2024). According to Karataş et al. (2024), generative AI tools like ChatGPT support foreign language learners by simulating realistic communication contexts, encouraging active learning and improving self-directed study habits. Thus, AI-based tools align with these pedagogical principles by facilitating:

1. Automated tutoring and intelligent feedback systems;
2. Data-driven insights into student progress and learning gaps;
3. AI-generated interactive content for language acquisition.

Cognitive presence, a crucial aspect of learning, is reinforced by AI through personalized and research-based learning approaches. AI applications support students in problem recognition, critical analysis, and decision-making. The integration of AI technologies helps address challenges in online and blended learning, ensuring a structured and efficient approach to language education. The presence of AI-driven teaching support plays a pivotal role in fostering an engaging learning community. Research indicates that AI-powered educational tools significantly impact student satisfaction, learning perception, and collaborative engagement. AI-driven teaching methodologies encompass three essential elements:

- a. Development of AI-enhanced learning environments;
- b. Facilitation of personalized and interactive learning activities;
- c. AI-supported guidance and adaptive assessment strategies.

Developing AI-powered online learning experiences requires careful planning to balance cognitive and social learning dynamics. AI-based tools can enhance digital learning platforms by ensuring student interaction, facilitating constructive discussions, and adapting instruction based on student progress. AI-driven discussion forums and virtual assistants contribute to effective learning by monitoring and moderating conversations, optimizing engagement, and promoting meaningful participation.

Liu and Ren (2022) emphasize the transformative power of AI-based platforms in English education, reporting improved student engagement and achievement. Their findings suggest that AI systems help create smart learning environments where the learning path can be adjusted according to each learner's performance, preferences, and progress. Moreover, research by Neupane et al. (2025) highlights how AI enhances educational inclusivity and adaptability by integrating multimodal learning styles and autonomous language learning mechanisms. Such innovations allow educators to shift from one-size-fits-all methods to more flexible, dynamic approaches.

Huang (2025) expands on this by discussing the application of AI in higher education learning management systems, noting that intelligent recommendation engines can customize learning content and support reflective practices. In other words, most of latest literature advocates a growing trend toward smart and AI-powered environments in ELT, which not only promote efficiency and motivation but also foster self-regulated and lifelong learning habits.

Objectives of the Study are:

1. to evaluate the effectiveness of AI-driven smart technologies in enhancing English language learning among EAGI students;
 2. to explore the impact of personalized learning environments (PLEs) created through smart technologies on student engagement, motivation, and academic performance in English language educational program;
 3. to identify barriers and challenges in integrating AI and smart technologies into English language teaching in higher education in Kazakhstan.
4. Research Questions are:
5. How effective are AI-based applications in improving students' English language proficiency in comparison to traditional teaching methods?
 6. What impact does personalized learning environments (PLEs); created through AI technologies, have on students' motivation and engagement in English language learning?
 7. In what ways do smart technologies influence students' self-assessment, self-correction, and metacognitive awareness during English language learning?
 8. What are the perceptions of students and instructors regarding the use of AI-driven smart technologies in enhancing English language teaching and learning?

While discussing and interpreting these research questions, the authors suggest that AI-based tools will contribute to ELT and their potential role in transforming the educational practices in the field of English teaching methodology.

RESEARCH METHOD

This paper employs a mixed-methods approach combining theoretical, quantitative, and qualitative research methods to comprehensively examine the efficiency of AI-based smart technologies in English language teaching within higher education.

The development of AI-driven smart learning environments has been a focal point of research in both computer science and education. Since the 1980s, Intelligent Tutoring Systems (ITS) have incorporated AI methods to personalize learning experiences. These systems often referred to as "adaptive learning systems," provide tailored educational support by analyzing student behavior, learning progress, and engagement levels.

With the proliferation of digital and mobile technologies, AI-powered platforms now offer greater accessibility, allowing students to engage with learning materials in flexible and context-aware settings. Researchers define these adaptive environments as "smart learning environments"—technologically enhanced spaces that respond to individual student needs by utilizing AI for real-time assessment, personalized content delivery, and interactive support.

A smart learning environment powered by AI-based tools integrates several key modules to optimize the learning process:

- a. AI-Based Learning Analytics Module: Monitors student interactions, evaluates learning progress, and provides real-time feedback.
- b. Adaptive Learning Content Module: Customizes educational materials to fit the learning styles and proficiency levels of individual students.
- c. AI-Powered Assessment Module: Conducts automated assessments and provides personalized feedback, allowing students to self-correct and improve performance.
- d. AI Chatbots and Virtual Assistants: Enhance student engagement through interactive dialogues, language practice, and automated tutoring.
- e. Personalized Learning Support Module: Offers customized learning pathways, including AI-generated study plans and recommendations for additional resources.

These AI-enhanced elements ensure that the smart learning environment is not only personalized but also adaptive and provide students with a responsive and engaging learning experience. AI applications in language learning, such as voice recognition, automated feedback, and conversational agents, further improve student outcomes by facilitating real-time language practice.

In Kazakhstan, the use of AI-driven smart learning environments presents an opportunity to align higher education with global digital transformation trends. By integrating AI into English language instruction, educators can create immersive and interactive learning spaces that cater to diverse student needs. The role of AI-based tools in fostering student autonomy, motivation, and engagement underscores its significance as a transformative tool in modern language education.

RESULTS AND DISCUSSION

Results

The pedagogical experiment of this paper is focused on testing the effectiveness of using smart technologies to enhance English language learning through the creation of a personalized learning environment. The experiment involved two groups: a control group and an experimental group composed of second-year students in the "Department of Theory and Practice of Foreign Languages".

The experiment was carried out over four key stages:

1. Preparatory stage (development of tools and materials);
2. Ascertaining stage (pre-testing of students' language level);
3. Forming stage (implementation of ai-driven learning interventions);
4. Analytical stage (post-testing and comparative analysis).

Academic performance and quality of knowledge were measured at multiple points using standardized tests. The results were analyzed quantitatively to determine the impact of AI-based technologies on student outcomes.

Student feedback

To assess students' attitudes and experiences with smart technologies, particularly AI-integrated applications, a questionnaire was administered. The survey collected data on device usage, time spent on mobile learning, learning preferences, and overall motivation. Both closed and open-ended questions were used, allowing for quantitative and qualitative interpretation.

This combination of methods allowed for a multi-faceted evaluation of AI's role in English language teaching, from conceptual understanding to practical application and learner reception.

1. Preliminary analysis and setup

- Initial student proficiency test:
 - Test type: Lexical grammatical proficiency test was administered to assess baseline language skills of both groups.
 - Pre-test results:
- Control group: The average academic performance score was 87.36, with a quality of knowledge scope of 83%
- Experimental group: The average academic performance score was 84.7, with a quality of knowledge scope of 70.5%.
- Observation: At the beginning, the control group performed slightly better on the initial test, suggesting they had a marginally stronger foundation in English. The experimental group scored lower on average, but the difference was not significant enough to undermine the potential impact of the personalized learning environment.

2. Student survey result

Before the experiment, the experimental group filled out a questionnaire regarding their smartphone usage and interest in using smart technologies for learning English. These survey results were crucial for designing the personalized learning environment. They are the following:

- 40% of students used their smartphones for 2-3 hours daily.
- 30% used them for 3-4 hours daily.
- 20% used them for 1-2 hours daily.
- 10% used their smartphones for more than 4 hours daily.

Interpretation: This high level of smartphone use suggested that integrating smart technologies into the learning environment was a feasible approach since students were already accustomed to daily smartphone use.

Usage purpose:

- 50% of students spent their time on communication (texting, social media, etc.).
- 40% used their smartphones for entertainment (watching videos, playing games, etc.).
- 10% used them for educational purposes (though this was quite low).

Implication: This highlighted the opportunity to shift part of their smartphone usage towards more productive educational purposes. The fact that students were already using their smartphones for non-educational activities suggested a gap that could be filled by integrating English learning apps into their daily routines.

3. Experiment procedure and content delivery

Smartphone-based application:

Based on the survey results and students' interest, several authentic mobile applications were selected to create a personal learning environment. These apps were designed to supplement the learning process with exercises related to vocabulary, grammar, speaking, and listening skills.

Apps like Duolingo, Babbel, Grammarly were chosen for their adaptive features and effectiveness in language learning.

Experimental Group: Over a 15-week period, these students engaged with mobile apps designed for English learning. The use of these apps was encouraged during class and for independent study.

Control Group:

This group continued with traditional English learning methods, such as textbooks, classroom activities, and face-to-face conversations without the integration of AI or mobile apps.

4. Mid-Experiment Test (7th week)

After 7 weeks, a mid-experiment test was administered to both groups. This test was similar to the initial proficiency test and aimed to evaluate any early changes in language proficiency.

Control group: Showed improvement in test scores, with the average academic performance rising to 90 points and a quality of knowledge improving to 85%.

Experimental Group: This group showed a slightly higher improvement, with their average academic performance rising to 88 points and a quality of knowledge increasing to 72%.

Analysis: The experimental group showed greater progress compared to the control group at the 7-week mark, possibly due to the personalized nature of the apps and the integration of self-paced learning. Even though the initial score was lower, the significant jump in performance suggested that the smart technology approach was motivating students to engage more actively with the material.

5. Post-Experiment Test (End of 15 weeks)

Final results:

Control group: Academic performance rose to 91 points, with a quality of knowledge of 87%.

Experimental group: Their academic performance reached 93.2 points, with a quality of knowledge of 80%.

Final analysis:

The experimental group's scores, while still slightly lower than the control group in terms of academic performance, showed a more significant increase in quality of knowledge (an 11.5% improvement compared to the control group's 4% increase)

The data suggests that the integration of smart technology through personalized learning environments contributed to not just improving proficiency but also increasing students' motivation and engagement. The higher increase in the experimental group's quality of knowledge indicates that AI and personalized learning environments can positively impact students' depth of learning.

6. Qualitative feedback from students

After the final test, students in the experimental group were asked for feedback regarding their learning experience with smart technologies.

Positive feedback:

80% of students reported feeling more motivated to learn English due to the interactive nature of the apps.

70% of students appreciated the ability to study at their own pace, especially with applications that tailored lessons to their individual needs.

60% of students felt that their speaking and listening skills improved due to the real-time pronunciation feedback provided by AI tools like ELSA Speak for example.

Negative feedback:

A small number of students (around 20%) mentioned feeling overwhelmed by the large volume of information provided by the apps, suggesting that the pace of some learning apps should be adjusted.

Conclusion from Feedback: Overall, students were enthusiastic about using smart technologies, and the feedback aligns with the quantitative findings, suggesting that the personalized nature of learning environments enhances student engagement and learning outcomes.

7. Comparative results: control vs. experimental group

Table 1. Control Vs Experimental Group.

Metric	Control group (Post-test)	Experimental group (Post-test)
Academic performance	91 points	93.2 points
Quality of knowledge	87%	80%
Increase in academic performance	+3.64 points	+8.5 points
Increase in quality of knowledge	+4%	+11.5%

Discussion

The rapid introduction of AI-based tools in the academic processes has reshaped the English language learning and teaching methodology including assessment. The benefit of AI tools use in conversational tutoring, automated feedback systems, assessing and fostering personalized learning experiences in education and research is invaluable to overcome many challenges in this context (Goodwin-Jones, 2023). Moreover, many faculties, scientists and expertise need to learn how to “provide students with guidance about how to use it” (Chapelle, 2024, p.539), and remind them about AI’s limitations.

How could AI-based tools enhance the Existing Pedagogical Model through:

1. **Personalized Learning Paths:** Based on the results of our experiment AI customized the learning experience identifying the specific content based on individual needs, such as grammar drills, listening exercises and cultural learning.
2. **Enhanced Engagement:** AI tools as interactive chatbots and voice-based assistants, students feel more engaged in active learning, thus improving retention and interest in English.
3. **Improved Feedback Mechanism:** Based on instant feedback on students’ performance, like grammar corrections, pronunciation help, or writing suggestions which help students reinforce learning continuously.

Thus, the objective here is to show how AI integration in mobile applications for English learning and teaching has incorporated into the personal learning environment:

1. **AI Language Apps:** Apps like Duolingo and Babbel use AI to adapt lessons based on students’ performance and interactive engagement.
2. **Writing Assistants:** Apps like Grammarly helps students to improve their writing by suggesting edits in real time.

Nevertheless, Handley (2024, p.553) indicated to the “limited” ability of AI to represent language in a way that facilitates learners’ comprehension”. At the same time, we have to keep in mind such sensitive issues as ethics, equity, and pedagogical effectiveness to be solved wisely. Certainly, AI-powered applications’ integration into the personalized learning environment have ensured a more immersive, adaptive, and interactive experience for students, improving their engagement and learning outcomes. Finally, the integration of AI-based tools within foreign language education should be in accordance with the goals for language education in Kazakhstan.

CONCLUSION

Fundamental Finding : The findings of the pedagogical experiment indicate that the use of AI-driven smart technologies in English teaching significantly enhances the learning process. Students in the experimental group, who used personalized AI-supported mobile applications, demonstrated improved engagement, motivation, and autonomy compared to the control group. Although initial test scores were slightly lower in the experimental group, by the end of the 15-week period, their academic performance and quality of knowledge had notably improved. The analysis also showed increased student interest in using smartphones for educational purposes and a positive attitude

toward AI-assisted learning. These results confirm the effectiveness of AI-based personalization in fostering better language acquisition outcomes. **Implication** : Effectiveness of smart technologies: The results suggest that using smart technologies to create a personalized learning environment can significantly enhance students' motivation, engagement, and language proficiency. Despite initial lower scores, the experimental group showed a greater improvement in quality of knowledge, indicating that personalized, technology-enhanced learning can produce better long-term outcomes. **Limitation** : The inclusion of AI-powered tools like speech recognition and writing assistance could further optimize the personalized learning experience. A larger sample size would help confirm these findings and allow for more robust conclusions on the generalizability of the approach. **Future Research** : Expanding the study with a larger sample size and longer duration would help validate the effectiveness of these technologies and provide more robust evidence for their integration into English language teaching.

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