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DEVELOPING MORAL VALUES IN FUTURE TEACHERS IN THE DIGITAL EDUCATION SPACE

Abstract. Over the years, integrating moral values into pedagogical practices through online platforms has received significant attention as the teaching-learning process has been transformed by digital technology. It becomes needful to systematically study how future teachers develop moral values through digital technologies. This systematic review followed PRISMA guidelines by searching research published in Web of Science, ScienceDirect, Scopus and ERIC; these studies were published between 2020 and 2025. In addition, the framework analyzed and synthesized results from 10 research studies on online pedagogical approaches, theoretical frameworks, possible outcomes, and facilitators and problems associated with moral development. The results show that virtual simulations, structured digital discussions, and case-based learning are the key approaches. The predominant theories are Rest's Four Component Model and Kohlberg's cognitive development theory. Virtue ethics and care ethics receive less attention. Research that measures ethical reflection quality, moral judgments, and professional values most often does not assess long-term retention or the possible outcomes of behavior. Nevertheless, this systematic review shows that digital platforms promote moral education worldwide. These results inform policy-making, educational technology, and teacher education programs.

Keywords: digital education, virtual learning, moral education, teacher training, ethics, Kazakhstan.

Introduction

Every country values education because of its role in cultivating moral values and the all-round development of people and their environment. Perhaps this is why Abdullah et al. (2024) posited that education serves as a platform for cultivating moral values, achieved through the help of teachers. There are unprecedented problems and opportunities arising from the digitalization of teacher education. Many stakeholders, including teachers, researchers, and educational policymakers, have expressed concern about how digital technologies affect the ethical development of teachers and the increased use of mediated learning experiences. As Abdelhafez (2021) rightly stated, teachers and educational policymakers place great emphasis on the role of moral values in pedagogy, underscoring the profession's influence on cohesion and societal values. Despite this, the intersection of moral development and digital education remains underexamined, creating uncertainty about the best way to prepare and mold ethically grounded teachers. According to Aliyeva et al. (2025), teacher training has recently undergone a significant transformation, underscoring the urgent need to address this apparent knowledge gap.

Although digital tools enhance personalization and accessibility, they tend to dilute the reflective and relational aspects of learning moral values. In this vein, Alves et al. (2021) argued that there is a tension between the human-centered nature of ethical decision-making and the technology-driven efficiency in pedagogy. Despite these problems being recognized and growing, it appears that moral education in teacher training is at a fragmented stage, lacking a synthesis of contextual considerations and practical approaches.

This systematic review addresses a significant gap, particularly the ways digital education affects the development of moral values in future educators. In addition, there are conceptual gaps in defining moral values in the context of digital education, and prior studies exhibit methodological weaknesses: they rely on single-case research, limiting generalizability. There are also conflicting results, particularly regarding the efficacy of digital technologies. Hence, the essence of this review is to systematically analyze the available evidence on the use of digital methods in the development of moral values in teacher education programs, identify gaps, and outline future directions that would inform research, policy, and practice on ethical, grounded educators in the context of digital education programs (Omarov et al., 2016).

Background and rationale. The relevance of moral values in teaching cannot be overemphasized, as teachers are both purveyors of knowledge and models of moral behavior. Hence, teachers who are grounded in influence learners' attitudes and values positively. Consequently, Asyraf and Nazib (2021) stressed that teacher training in the development of moral values is crucial in digital teacher education. Nevertheless, the use of emerging technologies in teacher education programs raises some questions regarding the effects of digital technologies on the development of moral values. As Bazán-Ramírez et al. (2020) rightly put it, the way people work, live, and learn has been transformed by the advent of digital technologies in education. Moreover, the way in which people approach moral values in education has also changed. According to Bond et al. (2020), some researchers argue that moral education could be enhanced through the use of emerging technologies, which provide easy access to diverse opinions and experiences. Other researchers argue against the positive effects of digital technology on moral education, maintaining that it hinders the development of moral values by promoting relativism and superficiality (Nurbekova et al., 2023).

Although the relevance of moral education is clearly recognized in teacher training, there remains a paucity of studies examining the intersection of moral values development and digital education programs. It appears that most studies focus primarily on the effective use of emerging technologies for teacher training and content delivery, neglecting the critical aspect of moral development (Charbaji El-Kassem et al., 2021).

All these factors underscore the urgent need to systematically examine existing studies on digital approaches to the development of moral values in teacher education programs. Besides, studies addressing the development of moral values in the digital education context, the shaping of the moral landscape of teaching through digital technologies, and methodological weaknesses are very few, thereby impeding the generalizability of findings. This makes it necessary to conduct a comprehensive analysis to prepare teachers who are both technologically adept and ethically grounded to promote the integrity of education systems and the world at large.

Research gap. A significant literature gap persists regarding how moral development and digital technology intersect in teacher training, despite their widespread recognition in the context of moral education. The available studies on teacher education programs tend to focus on how digital technologies are used for pedagogical training and content delivery. This appears to neglect the vital aspect of moral development. This oversight is pathetic, considering the way teachers' influence shapes cohesion and societal values.

There is a conceptual gap in knowledge covering the development of moral values in the digital context. It is also the influence of digital tools on the landscape of teaching moral values. Additionally, many studies lack a proper understanding of how digital technologies can be used prudently to promote moral values in education, as well as of how they can be carefully designed to support teachers' ethical development. Regarding methodological weaknesses, most studies, to the best of our knowledge, limit the generalizability of their findings, necessitating a comprehensive analysis. Many research reviews to date have relied on small-scale experiments and single case studies; these methods limit the scope of their research and

the potential applicability of their results. Furthermore, the lack of longitudinal research has made it herculean to track the long-term effects of emerging technologies on the development of moral values.

Moreover, results differ regarding the efficacy of digital technologies in promoting moral values in the context of digital education. These conflicting results show the need for a proper understanding. To leverage this, some studies contend that digital tools and resources enhance moral values in education by making people's opinions and experiences easily accessible. At the same time, other related research refutes these assertions, stressing that the use of digital technologies in teacher training for values often results in superficiality and experiences. This knowledge gap is complicated further by the advent of digital technologies in the context of moral education. Hence, the use of various social media platforms, virtual reality, and the proliferation of artificial intelligence (AI) have transformed how people learn, live, and work. This has led educational stakeholders to ask questions about the effects of emerging technologies on moral development and how these technologies could be designed to strengthen the growth and development of ethically grounded teachers.

Research questions

The study addressed the following research questions:

- What are the adopted pedagogical approaches to enhance the development of moral values among future teachers from 2020 to 2025?
- What theories related to moral development have been used in research investigating the context of teacher education?
- What is the measurement of possible outcomes related to ethical reasoning, professional values, and moral values in digital education studies?
- What are the facilitators and problems shaping moral education integration within digital teacher training platforms?

Research objectives

The specific objectives of the study are as follows:

- To find out the adopted pedagogical approaches to enhance the development of moral values among future teachers from 2020 to 2025;
- To determine the theories that are related to moral development that have been used in research investigating the context of teacher education;
- To measure the outcomes related to ethical reasoning, professional values, and moral values in digital education studies;
- To ascertain the facilitators and problems shaping moral education integration within digital teacher training platforms.

Literature review

The review of related literature is structured thematically under the following sub-titles: conceptualizing digital education, conceptualizing moral values, pedagogical approaches to the development of moral values in pre-service teacher education, theoretical frameworks in digital teacher education with emphasizes on moral development, possible outcomes of moral development in digital teacher education, facilitators and problems associated with the integration of moral education in digital teacher training platforms.

Conceptualizing digital education. Many researchers have defined digital education in different ways. According to Chávez-Miyauchi et al. (2021), digital education as a concept is simply the use of digital technologies to facilitate support and promote the teaching-learning process and assessment in academic settings.

Similarly, Copeland et al. (2021) opined that digital education encompasses activities such as distance education, online learning, technology-enhanced learning, and blended learning. It is therefore expedient to affirm that digital education involves the use of emerging

technologies to enhance flexibility, quality, and ease of access to education. Perhaps this was the main reason Dennis and Harrison (2020) argued that digital education provides students with practical, personalized, and engaging learning experiences that address diverse needs, abilities, and interests. Digital education views present-day students as digital natives who are growing up in a world where digital technologies are part and parcel of their daily lives and their security (Nasimov et al., 2019).

In the words of Fuentes et al. (2025), digital education is a vehicle that utilizes technological power to create an enabling academic environment that is more effective, relevant, and engaging for these students. Through this, digital education could enhance collaboration, facilitate active learning, and provide easy access to diverse opportunities and educational resources.

According to Knopf et al. (2021), digital education uses technology, including online content, tools, and platforms, to offer flexible, accessible, and personalized education and to support pedagogical practices beyond traditional classroom settings. In this vein, Koseda et al. (2024) maintained that digital education provides easy access to academic data, builds critical online skills for survival in the 21st century, and also creates interactive content.

In another view, the online courses, apps, blended learning, interactive platforms and virtual classrooms are aspects of digital education. Also, the digital education integrates technology into the teaching-learning process to create educational experiences that are effective, dynamic and inclusive for everybody in the world.

Conceptualizing moral values. Moral values are fundamental to every society, as they help maintain order. According to Malika et al. (2022), moral values are the standards and principles that guide how people behave and make decisions, influencing their relationships with others and shaping their character. As Novella-García and Cloquell-Lozano (2024) rightly put it, moral values are critical to social and personal development, and people are informed about good and evil, right and wrong, and the unjust and the just. Moral values, therefore, involve different traits such as responsibility, honesty, compassion, fairness and respect. Diverse personal, cultural and social factors could influence these traits. As rightly stated by Piragaut and de Oliveira (2023), moral values can be described as an ethical foundation that guides people in making decisions to foster their well-being and that of others. In this regard, Turchyn (2023) stated that moral values encourage cooperation and tolerance and are essential for building strong societies, relationships, and communities. In another view, Zhao et al. (2023) posited that moral values shape people's self-worth as part of their identity; this goes a long way toward fostering their psychological/emotional well-being. According to Abdelhafez (2021), developing moral values can be regarded as a lifelong process, shaped by culture, family background, level of education, and life experiences. Hence, it deals with reflection, practice, and learning, and social, cognitive, and emotional factors can influence these three variables.

Furthermore, Abdullah et al. (2024) stated that moral values evolve and are not fixed. This is because people encounter diverse opinions and new experiences. Moral values are important in different contexts, such as personal relationships, the workplace, and education. Moral values, therefore, foster responsible citizenship, social cohesion, and respect for diversity. Academically, Aliyeva (2025) argued that moral values are relevant to shaping students' behavior and character and are often integrated into school curricula to enhance character development and social-emotional learning. Be that as it may, moral values may vary across cultures and be subject to interpretation. Besides, people tend to encounter dilemmas when faced with situations that are uncertain and involve conflicting values. Hence, it is vital to cultivate empathy, ethical reasoning, and critical thinking to overcome the diverse, complex moral problems and make good decisions. By way of recapitulation, it was expediently deduced that moral values are a critical aspect of social and personal development and influence

people's relationships, behavior, attitudes, and society at large. When moral values are promoted, members of society and the world at large can foster responsibility, a culture of respect, and empathy. This goes a long way to foster a world that is more compassionate and just.

Much research has shown the importance of integrating moral development, particularly in pre-service teacher education programs. In this regard, Alves et al. (2021) noted that teachers have adopted different teaching approaches to enhance teacher moral growth and development. This review, therefore, focuses on the available literature on teaching approaches used to enhance moral growth in teachers' pedagogical training and practices. One major approach, according to Asyraf and Nazib (2024). It is an effective use of case-based learning. In this case, teachers-in-training engage with life scenarios that help them raise moral dilemmas. As Bazán-Ramírez et al. (2022) rightly stated, this method helps teachers develop problem-solving and critical thinking skills, which are vital for addressing complex moral situations.

Secondly, the service-learning approach is another key approach that fosters teacher moral growth and development. In the words of Bond et al. (2020), service learning is a pedagogical approach that involves community reflection and engagement, and it has been highlighted for promoting moral commitment and a strong sense of social responsibility among teachers-in-training. In other words, other research has examined the effectiveness of discussion-based learning, reflective journaling, and role-playing in enhancing moral growth and development among teachers. Collectively, Charbaji El-Kassem et al. (2021) argue that these approaches motivate teachers-in-training to critically examine their own beliefs and values, engage in moral reasoning, and develop empathy. Given the diversity of teaching approaches, it is necessary to conduct a critical evaluation of their effectiveness, particularly in the context of digital technologies. Digital education became more popular in 2020, and it is essential to clearly understand how these pedagogical approaches can be used to enhance moral growth and development in pre-service teacher education in a digital context.

The need to successfully integrate moral development into pre-service teacher education programs, particularly in the digital context, has become a matter of concern for many educational stakeholders, including researchers. As Chávez-Miyauchi et al. (2021) rightly stated, for education stakeholders to clearly understand an essential aspect of moral growth and development in the context of digital education, it is necessary to determine the theoretical frameworks underpinning these initiatives.

The systematic review under this subheading aims to summarize existing studies on various theories of moral growth and development that could be applied to research on teacher education programs, particularly in the digital context. One such theory is Kohlberg's Moral Development theory, which has been examined in many research studies on moral development (Copeland et al., 2021). This theory, according to Kohlberg (1978), stresses that moral development progresses in stages, involving people's movement from a focus on punishment and obedience to a focus on people's rights and social contract. Many scholars have utilized this theory to examine how digital tools, including simulations and online discussions, foster moral development and reasoning among teachers undergoing training. Furthermore, the Moral Ethic of care is another influential theoretical framework for moral growth and development, focusing on relationships, empathy, and care in making moral decisions. Research such as Alves et al. (2021) and Bazán-Ramírez et al. (2020) supported this theory when examining how online tools, including online collaboration and conference videos, could enhance empathetic and caring relationships among teachers in pre-service teacher education programs. Interestingly, another theory applicable to digital teacher education is Social Cognitive Theory, propounded by Bandura in 1986. This theory affirms that people learn when they observe, reinforce and imitate.

Studies such as Bond et al. (2020) and Fuentes et al. (2025) argued that this theory could be used to determine how online tools, particularly peer feedback and video modeling, could foster moral development among teachers-in-training. Although research shows that this theory is effective in promoting moral development in the context of digital education among teachers in training, there is a need to explore the collective effectiveness of all the above theoretical frameworks in promoting the use of digital technologies in education.

The rapidly evolving nature of digital technologies makes it vital for individuals to clearly understand how theoretical frameworks can be used to design and implement moral values in education, particularly in the context of digital teacher education programs now and in the long run (Knopf et al., 2021). The available studies, therefore, highlight diverse suggestions for applying theories in the context of digital teacher education. Be that as it may, there is a need to conduct more studies to properly examine the reliability of these theoretical frameworks in fostering moral growth and development, as well as to identify the key areas that require new changes and improvements.

Many educational stakeholders, particularly researchers, teachers, and educational policymakers, have shown concern regarding the promotion of professional values, moral development, and ethical reasoning through the effectiveness of teacher education in the digital context. Accordingly, Chávez-Miyauchi et al. (2021) opined that online teacher education programs promote ethical decision-making and moral reasoning. In this vein, Copeland et al. (2021) stated that when teachers undergo training using digital tools and resources, their ability to analyze different moral dilemmas tends to improve; they learn to consider multiple opinions and develop reasonable arguments.

Hence, online tools, including simulations and digital discussions, tend to foster the development of problem-solving and critical thinking skills; these two skills are essential in making moral decisions (Piragauta & de Oliveira, 2021). In other words, studies by Turchyn et al. (2023) and Zhao et al. (2023) argue that cultural sensitivity and social responsibility are significant factors in an online teacher education program's impact on professional values. Therefore, online programs serve as vehicles for promoting social responsibility and a sense of community among teachers undergoing pedagogical training with digital tools and resources. Furthermore, studies by Turchyn et al. (2023) and Koseda et al. (2024) reported mixed findings, highlighting challenges in measuring ethical reasoning and moral development in the online context. According to these studies, moral development is complex, and the challenges of using digital technologies to capture expected outcomes make it necessary to conduct more critical evaluations of evaluation methods and assessment strategies.

The literature reviewed so far shows that online teacher education programs can enhance professional values, moral development, and ethical reasoning. Still, it is necessary to examine the long-term effects of digital programs on the moral growth and development of teachers undergoing training, and to identify effective measures for evaluating and assessing moral outcomes in an online context.

Integrating moral education into online teacher training platforms has received much attention from educational stakeholders, but its success is highly dependent on various factors. According to Abdelhafez (2021), there are various facilitators supporting the claim that there is a need to integrate moral education into online platforms.

One significant factor is the design of immersive, interactive learning experiences that involve virtual scenarios and simulations. As stated by Bazán-Ramírez (2020), these two learning experiences have the capacity to promote empathy and moral engagement. In addition, Aliyeva et al. (2025) posited that the use of collaborative digital tools, including group projects and discussion forums, is another major facilitator of the integration of moral education, particularly on online teacher training platforms. These collaborative tools enhance moral discourse and social interaction or relationships. On the other hand, several problems confront

the integration of moral education into online platforms for teacher training. The first issue concerns the lack of sufficient attention to moral development in teacher education curricula (Knopf et al., 2021).

There are also other problems, such as inadequate resources to develop high-quality digital content, inadequate technological infrastructure, and poor faculty training (Asyraf & Nazib, 2024). The studies reviewed highlighted the importance of providing leadership commitment and an institutional culture that supports the integration of moral education into online teacher-training platforms. By way of synthesis, one can infer that when the facilitators and problems affecting the integration of moral education in digital training platforms for teachers are addressed, fostering moral growth and development among teachers would be a remarkable success now and in the long run.

Materials and methods

Search strategy. A systematic literature review was conducted on the development of moral values among future teachers in digital education. To do this, effective searches were conducted in ERIC, Scopus, Web of Science, and ScienceDirect for peer-reviewed journals.

The reviewed studies were published between January 2020 and December 2025. In addition, the search strings used Boolean Operators, combining three keywords from the clusters. These words include teacher education, moral development and digital education. Filters included publications with a 2020-2025 publication date, English language, and reputable journals. Also, 89 records were obtained from searches conducted in January 2026, all of which were imported into reference management software for subsequent screening.

Eligibility criteria. Studies were selected based on pre-defined inclusion (Table 1) and exclusion (Table 2) criteria to ensure relevance and quality.

Table 1

Inclusion criteria for the systematic review

Criterion	Description
Population	Teachers under training
Intervention/Context	Online education
Outcomes	Ethical reasoning as well as the development of moral values
Study Design	Empirically reviewed studies
Publication Type	Peer-reviewed studies in reputable journals
Language	English language
Time Period	January 2020 and December 2025
Theoretical Framework	Moral ethic of care and Kohlberg's moral development theory

Table 2

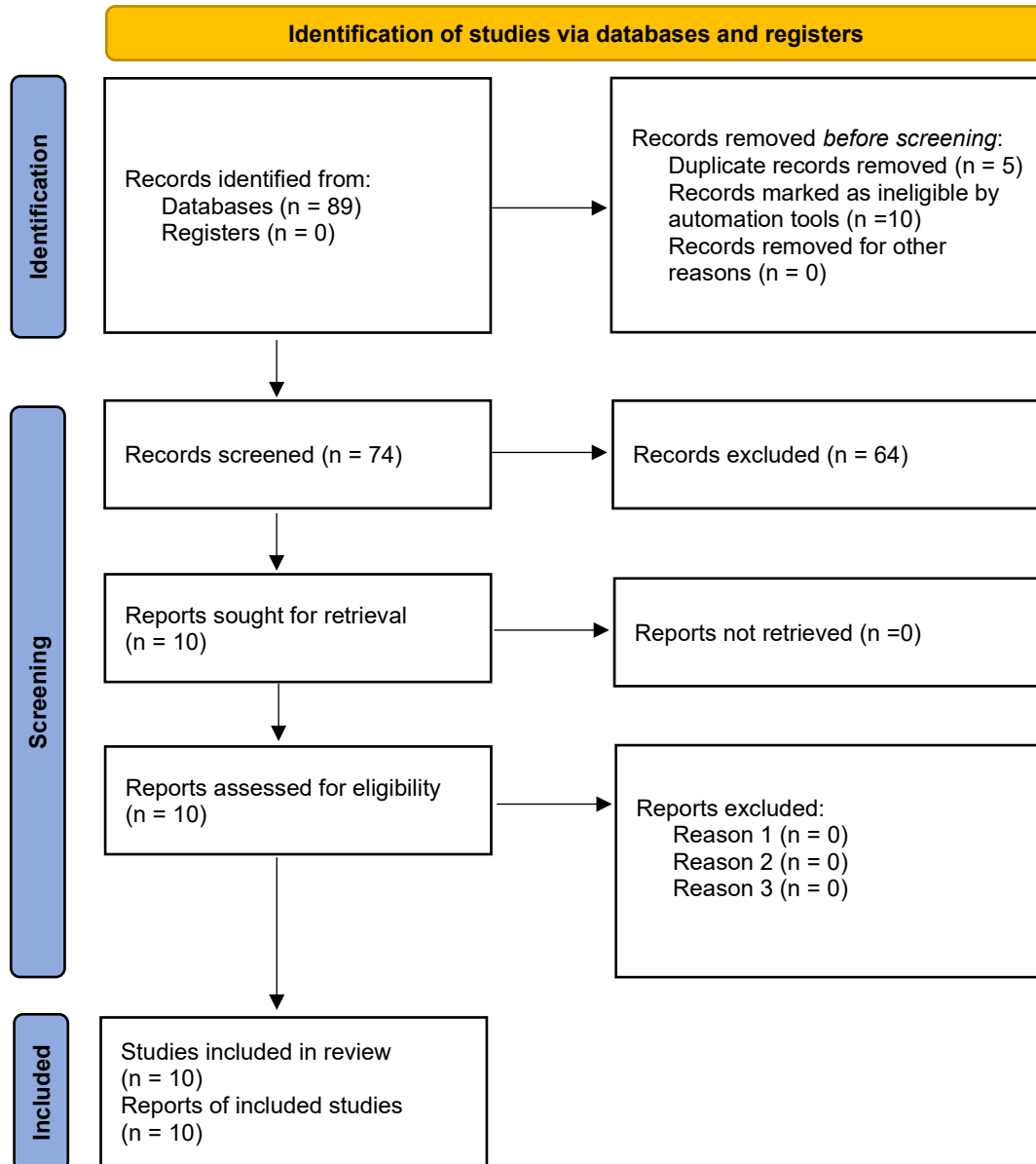
Exclusion criteria for the systematic review

Criterion	Description
Population	In-service teachers
Context	Non-online education
Publication Type	Peer-reviewed journal articles
Language	Non-English publications
Accessibility	Full-text not available or accessible
Quality	Low
Relevance	Irrelevance

Study selection process. This research is a systematic review that adheres to the 2020 guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

This PRISMA framework was employed in this study because of its rigor and because it is widely recognized in the fields of education and the social sciences, enabling verification and replication of the review results. Hence, the design adopted in this research is a systematic review with narrative synthesis, centering on the investigation of moral education in teacher education in digital contexts (Figure 1).

Figure 1
PRISMA 2020 flow diagram for systematic reviews



The temporal scope of this review covers research published from January 2020 to December 2025. The scope of this review encompasses recent research on moral development and online education. In addition, this review is geared toward the relationship among teacher education, moral development, and online education. It also investigates theoretical frameworks, teaching and learning approaches, implementation variables, and outcomes for teachers undergoing training in a digital context.

Data extraction and synthesis. The researchers systematically extracted data using a standardized form. The systematic review captured details of the authors and publication years,

sample attributes such as size, number of study participants, and context, theoretical frameworks and methods, significant results related to the outcomes of moral development, and conclusions and implications for teacher education in the digital context.

In terms of data synthesis, the researchers conducted a narrative analysis to identify themes, patterns, and relationships across the reviewed studies. Through this approach, a comprehensive understanding of moral growth and development in the context of digital teacher education was obtained.

Quality assessment. A proper evaluation was conducted of the included studies using the Mixed Methods Appraisal Tool (MMAT).

This tool was used to assess the methodological quality across different research designs. The MMAT was used to evaluate criteria related to data collection rigor, result interpretation, clarity of the research question, analysis procedures, and appropriateness of the study methodology.

In addition, research was categorized as high, moderate, or low quality according to MMAT criteria. Only high- and moderate-quality research was used in the final synthesis, ensuring the validity and reliability of the review results. Moreover, the process of this systematic review ensured evaluation, rigorous selection, and synthesis of facts regarding moral growth and development in the context of digital teacher education.

Results

In this systematic review, moral development was examined in the context of the digital teacher education program, and significant trends, themes, and outcomes were identified. In Table 3, the research attributes were reviewed and organized chronologically.

The table shows the different research, including the Name(s) of the Scholar(s) and year, the online platform used, the theoretical framework adopted, the measurement of primary outcomes, and the significant results.

Table 3

Characteristics of research included in the review from 2020 to 2025

S/ N	Name of scholar(s) and year	Online platform used	Theoretical framework adopted	Measurement of primary outcomes	Major results
1.	Fuentes, Bucheli and Alejo (2025)	Digital discussion forum	Cognitive development theory	Moral growth and development	Significant results for improvement in moral growth and development
2.	Asyaraf and Nazib (2024)	Virtual reality	Social learning	Moral judgment	Improvement in moral judgment
3.	Abdullah, Alam and Sanauddin (2024)	Simulation platform	Constructivism	Ethical reasoning	Promotion of ethical reasoning skills
4.	Knopf, Stumpp, and Michelis (2021)	Empathic Virtual Agents	Emotional intelligence	Educator empathy	Enhanced student academic engagement and teacher empathy
5	Piragauta and de Oliveira (2023)	Personalized videoing for feedback	Self-efficacy	Self-efficacy of teachers	Improvement of classroom management as well as the self-efficacy of teachers
6.	Turchyn, Zaitseva, Rudenko, Saienko, Kuzemko and Denefil (2023)	Interactive mixed reality	Social cognitive	Teacher-student relationships	Enhanced teacher-student relationships as well as socio-emotional skills.
7.	Zhao, Zhao, and Shi (2023)	Co-regulation model	Self-determination	Effective communication among teachers	Enhanced skills for effective communication among teachers and the motivation of students
8.	Malika, Ybyraimzhanov, Gaukhar, Nurdaulet and Ainur (2022)	Virtual reality simulation	Cognitive load	Pre-service teacher training	Enhanced pre-service outcomes of teacher learning and effective classroom management

9.	Novella-García and Cloquell-Lozano (2021)	Automated assessment system	Features of multimodal emotion	Encouragement of teachers	Improvement of teacher encouragement as well as classroom warmth
10.	Dennis and Harrison (2021)	Digital technologies	Socio-emotional learning	Teacher socio-emotional skills	The enhancement of student outcomes and the improvement of teacher socio-emotional skills

Table 4 shows the categories of pedagogical approaches in the digital context, highlighting the platform category, specific examples, primary pedagogical function, number of research studies, and reported effectiveness.

The table indicates that discussion forums, learning management systems, and virtual reality are commonly used pedagogical approaches.

Table 4
Digital pedagogical approaches

S/N	Category of platform	Specific Examples	Primary Pedagogical Function	Number of researches	Reported Effectiveness
1.	Systems of learning management	Teaching Blackboard, Moodle	Delivery of content	13	Very effective for retention of knowledge
2.	Virtual Reality	OpenSimulator	Simulation	10	Enhanced perspective-taking and empathy
3.	Forums for discussion	Digital Discussion Boards	Discussion facilitation	12	Improved collaboration as well as critical thinking

The outcome measurements were synthesized in Table 5, showing the measurement domains of the outcome instruments, primary pedagogical functions, numbers of studies, results directions, and effect sizes.

The analysis, however, indicated that ethical reasoning and moral judgment are commonly used outcomes.

Table 5
Outcome measurements

S/N	Domain of outcome	Instruments for measurement	Number of researches	Result directions	Effect sizes
1.	Moral Judgment	Scale for moral judgment	13	Positive effects	0.5-1.2
2.	Ethical Reasoning	Ethical reasoning inventory	10	Mixed findings	0.2-0.8
3.	Professional Values	Scale for professional values	12	Positive effects	0.6-1.5

In Table 6, the facilitators and barriers were documented, indicating the pedagogical, institutional, and technological factors that shape moral growth and development in digital teacher education.

Table 6
Facilitators and barriers

S/N	Category	Specific factor	Reported frequency	Level of impact	Possible recommendations
1.	Pedagogical factors	Time for reflection	10	Major	Provide reflection time with dedication
2.	Technological Factors	Discussion from anonymity	8	Major	Enhance anonymous participation
3.	Institutional factors	Instructor expertise	12	Minor	Offer teacher support and training

Discussion

Integrating moral education into digital teacher training has become a concern for many stakeholders in education. This is because traditional approaches to teacher education are being transformed into digital tools and resources.

Consequently, it is necessary to ensure that teachers undergoing training develop the moral skills and competencies crucial to effective pedagogical practices. Moreover, integrating moral education into digital platforms often creates problems, including poor teacher training, limited face-to-face interaction, and insufficient opportunities for reflection.

However, these problems tend to impede the development of professional, moral, and ethical reasoning among future teachers. Therefore, the purpose of this systematic review has been to examine moral development, the major trends, themes and outcomes in existing research and 2020 and 2025.

The purpose of this systematic review was to synthesize fragmented knowledge on teaching approaches, online tools, and the intervention outcomes of moral growth and development. This systematic review also identified key facilitators and barriers that hinder the integration of moral education into platforms for teacher training in the digital context.

The first research question ascertained the pedagogical approaches adopted to support moral development in teacher education programs from 2020 to 2025. The results of the review, in accordance with the first research question, show that there is a growing concern about moral development in the context of digital teacher education programs, and that these systematic reviews are mainly qualitative and mixed-methods designs.

Systematic studies are distributed worldwide, with central themes including the effective use of digital tools and resources to enhance professional values, moral reasoning, and ethical decision-making. In addition, this systematic review shows that there is much focus on digital discussion forums, virtual reality, and simulation platforms to enhance the development of moral values among teachers.

The findings align with those of Abdullah et al. (2024), who found that digital tools and resources are effective in fostering ethical decision-making and moral reasoning. Similarly, the findings of Aliyeva et al. (2025) showed that when digital technologies are integrated into curricula and used effectively in teacher education, they enhance moral reasoning.

Hence, when digital technologies foster effective use of role-playing, asynchronous formats, and case-based learning, they create space for reflection and anonymity and also aid in reducing social desirability bias.

The second research question sought to identify which theoretical frameworks related to moral development were applied in research on teacher education in a digital context.

The results of this research showed that Kohlberg's cognitive development theory and Rest's four-component model received more attention than care ethics and virtue ethics. The result of this systematic review shows different teaching approaches, such as role-playing, case-based learning, and discussions that revolve around dilemmas.

Various digital technologies, including simulation platforms, discussion forums, and virtual reality, facilitate these pedagogical approaches. The result indicated that asynchronous formats create space for anonymity and time reflection, and these formats help mitigate bias in social desirability, which affects the effective development of moral values.

The results of this research are consistent with those of Bazán-Ramírez et al. (2020), who found that digital technologies can promote emotional regulation and self-awareness among teachers undergoing training.

These results are consistent with those, where found that teacher emotions are regulated through the use of digital tools and resources, paving the way for the development of moral values among teachers. Thus, Kohlberg's cognitive development theory and Rest's four-

component model are suitable theories for addressing the development of moral values in future teachers through digital education.

The third research question was asked to determine possible outcomes related to moral development, ethical reasoning, and professional values, as measured in studies of teacher education in a digital context. The findings of this systematic review indicated that digital interventions influence positive outcomes in the development of moral behavior, professional values, and ethical reasoning. The results show that their effect sizes range between 0.5 and 1.2.

In addition, the findings show that collaborative problem-solving activities, as well as case presentations, enhanced perspective-taking and engagement through multimedia. These results are similar to those of Bond et al. (2020), who found that experiential and interactive learning approaches are practical for enhancing the development of moral values among teachers undergoing digital training. In addition, the findings of Aliyeva et al. (2025) supported the idea that once experiential learning is effective, it promotes moral growth and development. Interpreted, the intervention of digital technologies has a positive effect on professional values, moral behavior, and ethical reasoning. Finally, the facilitators and barriers to integrating moral education into digital teacher training platforms were identified.

This systematic review also shows the facilitators influencing the integration of moral education in digital platforms for teacher training. These facilitators include institutional support, instructor expertise, and dedicated reflection time. On the other hand, it indicated the problems that shape the integration of moral education in the digital context, particularly in platforms for teacher training, such as assessment problems in digital environments, technical issues, and limited training for instructors. The findings of this systematic review align with those of Bond et al. (2020), who found that faculty development programs are relevant for addressing digital facilitation of ethics discussion as well as features of learning management systems. In another study, Fuentes et al. (2025) posited that technical and assessment issues impede the integration of moral education into online platforms.

Nevertheless, this research has practical implications, suggesting that the theoretical foundations comprising use assessment approaches and practical applications should be integrated into teacher education programs to capture growth in moral reasoning. Apart from that, faculty development programs must be designed to provide suitable training in digital facilitation, the features of learning management systems, and the integration of moral education with pedagogical practices. There is also a need for educational policymakers to establish accreditation standards. These accreditation standards require maximum attention to prioritizing funds for excellent research approaches, moral development, and the evaluation of programs on ethical reasoning.

A significant limitation of this systematic review is reliance on existing studies. As a result, the full scope of moral education in the context of digital teacher training may not be captured. The review is also limited to studies from 2020-2025, thereby excluding relevant studies conducted before 2020. In addition, this research contributes immensely to scientific studies by providing a more comprehensive overview of theories and teaching approaches that encourage moral education in the context of digital teacher education.

These results show the capacity of digital tools and resources to promote moral education and also provide insights for teachers, researchers, and educational stakeholders seeking to develop moral education programs. The novelty of this systematic review, therefore, lies in teacher education in a digital context, which has received little attention in existing studies.

Limitations. No systematic review is exempt from limitations, and this review is no exception. The limitations of this systematic review are variation in study quality, language restrictions, and database coverage, all of which affect the generalizability of the results.

Moreover, the heterogeneity in the measurement of outcomes hindered quantitative synthesis. Another issue is a coherent understanding of fragmented knowledge.

This systematic review addresses gaps in the literature regarding the understanding of moral education in the context of online teacher education. This goes a long way to synthesize knowledge that is already fragmented into a coherent understanding. The fact that the results of this systematic review inform policy-making, teacher education programs, and the design of educational technology highlights actionable insights for enhancing moral development in the context of digital environments.

Conclusion

This review achieved its aim of investigating moral development in digital teacher education to a great extent. It also identified the major trends, themes and possible outcomes in existing studies from 2020 to 2025.

In this systematic review, fragmented knowledge on digital tools, teaching approaches, and possible outcomes of interventions on moral development was synthesized; however, this provides a clearer understanding of this field. The findings of this systematic review show that virtual simulations, structured digital discussions, and case-based learning via learning management systems support moral development.

The second finding indicated that Kohlberg's cognitive development theory and Rest's four-component model received the most attention, whereas virtue ethics and care ethics received less attention.

Thirdly, the findings of this review show that research measures professional values, moral judgment, and quality ethical reflection. Still, these studies hardly assess long-term retention or the outcomes of teacher behaviors.

The fourth finding indicated that facilitators of moral development include reflection time and diverse opinions, whereas assessment problems and technical challenges are the key constraints. Based on the above conclusions, future studies should conduct longitudinal research to track the development of morals, particularly from teacher training through their early years. They should also conduct experimental research comparing digital teaching methods, as well as comparative studies exploring traditional teaching instruction and digital approaches to teaching and learning.

Science studies should be implemented, focusing on the essential factors influencing the fidelity and adoption of digital moral education practices. Warranted attention should also be given to under-researched populations. It is essential to integrate moral psychology and digital ethics to address the moral problems in digital environments. As teacher education programs continue to digitalize, it is essential to attend to moral development in online environments.

However, the generalizability of the findings in this systematic review was limited by the review's focus on studies from 2020-2025. Hence, studies with relevant information regarding the topic were not reviewed and analyzed. On this basis, it is recommended that researchers conducting similar studies expand their scope to obtain more reliable results.

Conflict of Interest Statement

The authors declare no potential conflicts of interests regarding the research, authorship, or publication of this article.

Author Contributions

Galymzhan Tantakov: Conceptualization, Methodology, Supervision, Proofreading. Perizat Seiitkazy: Data Collection and Curation, Resources, Validation, Writing – Review and Editing. Sharban Maigeldiyeva: Literature Review, Data Analysis, Visualization, Writing – Original Draft, Final Editing.

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BUILDING A SUSTAINABLE SOCIETY: WHAT UNIVERSITIES CAN DO?

Abstract. This paper investigates how universities advance the global transition toward a sustainable society by moving beyond rhetorical commitments and embedding sustainability into their core institutional practices. Unlike existing studies that predominantly focus on curricular changes, this research offers a conceptual framework distinguishing two interconnected dimensions of sustainability implementation in higher education: sustainability of the university as an organization, and sustainability through university activities, particularly education and community engagement. This analytical distinction constitutes the original scholarly contribution of the study, enabling a more nuanced understanding of universities' strategic responses to sustainability challenges. The paper examines how global university rankings integrating sustainability indicators have re-shaped institutional priorities and accelerated progress in environmental and social responsibility. Through an analysis of international literature and selected institutional cases, the study demonstrates that universities not only reduce their ecological footprint by improving energy efficiency, minimizing waste, and lowering emissions but also shape societal attitudes by embedding sustainability principles into curricula, research agendas, and behavioural norms. The methodological approach combines qualitative and quantitative analysis of academic sources, institutional reports, and sustainability performance data. The findings highlight an emerging organizational shift: sustainability is increasingly treated as a prerequisite for competitive development in higher education, rather than a peripheral policy goal. The study argues that aligning governance, educational strategies, and operational management with sustainability principles is essential for universities to serve as effective agents of socio-environmental transformation.

Keywords: environmental sustainability, sustainable communities, sustainable practices, sustainable universities, university rankings.

Introduction

When most people hear the phrase “sustainable development”, they typically associate it with environmental protection, global warming, climate change, and organizations such as Greenpeace. However, these associations are oversimplified due to the way sustainable development is covered in today's information field. Sustainable development encompasses not only the environment but also economic, socio-political, and cultural issues. The realization of humanity's limited resources and the necessity for a comprehensive global assessment of social foundations emerged gradually, commencing in the 17th century, through the growing awareness of environmental and social issues. This culminated in the conceptualization of sustainable development in the 20th century and its subsequent evolution in the 21st century (Table 1). The table summarizes major historical milestones that shaped the concept of sustainable development, from early resource management ideas to contemporary global policy frameworks, including international agreements and strategic initiatives.

Table 1*Key milestones in shaping the concept of sustainable development*

Period / Year	Milestone
17th century	Hans Carl von Carlowitz (German accountant and manager of a mining company) proposed early ideas of sustainability, emphasizing that trees should be grown and preserved to ensure continuous resource use.
18th century	Thomas Robert Malthus (clergyman and economist) argued that population growth exceeds food production, leading to long-term risks such as famine, war, and social upheaval.
Late 19th century	John Muir founded the Sierra Club, developed trails and park facilities, and contributed to the establishment of the U.S. National Park Service.
1968	The Club of Rome was established to study global problems of humanity and disseminate this knowledge worldwide.
1972	The <i>Limits to Growth</i> report was published, serving as a tool for assessing long-term future scenarios.
1974	World Conference on Population developed a global plan of action for population and human development.
1980	World Conservation Strategy highlighted the need for environmental conservation as a foundation for sustainable human development.
1984–1987	World Commission on Environment and Development published the report <i>Our Common Future</i> , introducing the concept of “sustainable development.”
1989	Establishment of CERES (Coalition for Environmentally Responsible Economies), promoting socially responsible investment and sustainable business practices.
1972, 1992, 2012	Major World Conferences on Environment and Development (Stockholm, Rio de Janeiro, Rio+20).
2002	World Summit on Sustainable Development set specific global targets for sustainable development.
2015	UN General Assembly adopted 17 Sustainable Development Goals (SDGs), with 169 targets and 230 indicators.
2019	European Green Deal launched to promote environmental sustainability while supporting economic growth and social well-being.
2021	EU “Fit for 55” package introduced to reduce carbon emissions and implement climate policies, including the Carbon Border Adjustment Mechanism.

The history of sustainable development reflects the gradual evolution of ideas related to environmental protection and socio-economic responsibility, which have increasingly been integrated into political and economic agendas. In recent decades, international initiatives and agreements have contributed to the consolidation of a coherent concept of sustainable development, which now serves as a foundation for global policies and actions across multiple sectors. It is also important to acknowledge the contributions of organizations such as Greenpeace, the World Health Organization, 350.org, the Rainforest Alliance, the World Wide Fund for Nature, and the World Resources Institute, among others, which have played a significant role in advancing and implementing sustainable development principles at the global level.

In the last decade, the topic of sustainable development has also made its way into higher education. Universities have begun to actively integrate the principles of sustainable development into their educational programmes, research activities and daily practices. This process reflects a global shift in the realization of the role of higher education institutions as key actors in the movement towards a sustainable society. With the increasing global focus on sustainable development, many universities have begun to incorporate these aspects into their strategies, also fueled by the growing importance of global rankings assessing their contribution to sustainable development. The desire to improve their positions in such rankings motivates universities to take more active measures to implement environmentally and socially responsible practices, which, in turn, contributes to the wider dissemination of sustainable development principles at the regional and global levels. Universities are assuming an increasingly pivotal role in the pursuit of a sustainable future by leveraging their resources, knowledge, and expertise to address global challenges and enhance the quality of life.

The novelty of this study lies in addressing a critical research gap identified through a comprehensive literature review. While existing scholarship extensively explores sustainable education, our analysis indicates that the body of literature examining the nexus between sustainable development and the second (research) and third (societal) missions of universities remains comparatively limited in scope.

This gap is further supported by a targeted search in the Scopus database, which revealed only a small number of publications related to the query «university sustainability rankings». This finding suggests that studies investigating the relationship between sustainability rankings and the broader activities of universities are still underdeveloped and warrant greater academic attention.

Against this backdrop, the present study aims to identify and systematize approaches to integrating sustainable development principles into university activities. To achieve this, the paper is structured around three research questions:

First, the study examines current trends, key themes, and dominant narratives in contemporary sustainability-related publications, addressing the question: How is sustainable development conceptualized in current academic discourse?

Second, it analyzes the role of global rankings in assessing sustainable university performance, addressing the question: What factors have driven universities to adopt and implement sustainable development principles?

Third, the study identifies two principal directions through which universities can advance sustainability and evaluates practical approaches to their implementation, addressing the question: How can universities shape sustainable development within their activities?

Methods and organization of research

The methodology employed permitted the formulation of the general approach and methods utilized to accomplish the objectives and fulfill the tasks outlined. The research was guided by a set of principles, procedures, and tools that included the application of methods for data collection, analysis, and interpretation. Additionally, the use of both qualitative and quantitative approaches to information processing was employed. The division of the work into two distinct phases the theoretical analysis of the problem and the demonstration of practical experience facilitated a more structured and effective management of the project. Scientific works, policy and reporting documents of international organizations and official websites of these organizations served as the factual basis for this study. Secondary data were collected by analyzing scientific publications through searchable identification in the Scopus database using keywords and terms related to sustainable development. The authors performed a comprehensive literature analysis covering Russian and English language publications from 2000 to 2024. The following research methods were applied to analyze publications using the keywords «sustainable development in higher education».

In the preliminary search and filtering phase, a comprehensive search of all database fields was conducted to identify as many relevant publications as possible, resulting in the retrieval of 4,022 publications. The search was based on the use of keywords, which facilitated the focus on the research topic. Limiting the languages option to English and Russian ensured a focus on a specific audience and context. Exclusion of related fields of knowledge allowed to narrow the focus on the educational sphere and exclude irrelevant documents, resulting in the selection of 1,674 documents.

In the second stage, a stricter filter was applied, restricting the search to publication titles, abstracts and keywords, which significantly reduced the number of documents to 163. This approach enables a more exact correlation of publications with the research topic and provides access to the primary abstracts, which is beneficial for further analysis. After creating a database of 163 documents, a quantitative analysis was carried out, including a description of publications according to various criteria such as years of publication, countries,

organizations and other established categories. This made it possible to identify trends in publication activity and to identify the most active regions and organizations in the study area. Using a comparative approach allows the number of publications to be compared according to different criteria, such as types of knowledge areas or funding organizations. This helps to identify the areas or organizations that contribute most to the development of sustainable development theory and practice.

The research team evaluated the findings, identifying key trends and patterns. The paper also presents the results of its own research, obtained through quantitative calculations, statistical processing of data, illustrating the ways in which the university is moving towards a green policy. To present the experience of implementing sustainable development initiatives at the university, methods were used to present metrics on energy and water saving, waste recycling volumes by comparing data before and after the implementation of the initiatives. Tables and figures allowed visualizing the data.

The research methods used contribute to an in-depth understanding of the topic, allowing a holistic view of the research to be constructed. They also help to identify key actors, identify current trends, and identify possible directions for future research and practice.

Literature Review

In order to answer the first research question, a quantitative-qualitative analysis of the current scientific discourse was carried out at the initial stage of the study. Searching and filtering publications in the Scopus database allowed us to identify the most relevant studies to the topic of the work.

The following observations emerged from the analysis. First, publication activity on sustainable development in higher education appears to be closely linked to key milestones in the evolution of the sustainable development concept, as well as to broader global economic, political, and social trends:

2002 – The World Summit on Sustainable Development in Johannesburg brought heightened global attention to sustainability issues, which likely contributed to an increase in academic publications, including research conducted within universities.

2015 – The adoption of the Sustainable Development Goals (SDGs) by the United Nations established a set of global benchmarks for governments, organizations, and higher education institutions, leading to a notable surge in scholarly output aimed at supporting and analyzing these goals.

2020-2021 – The COVID-19 pandemic underscored the importance of sustainable development, particularly in relation to public health, economic resilience, and environmental sustainability, further stimulating academic interest in the field.

These trends suggest that scholarly attention tends to intensify in response to major global events and crises. At the same time, a tension persists between studies focused on historical and conceptual dimensions of sustainable development and those addressing its practical implementation within higher education institutions.

2) There are leading positions of the UK, Germany, Sweden and the USA in publications on sustainable development, which is due to the political, economic, academic and cultural characteristics of these countries. To illustrate, the United Kingdom is one of the foremost global hubs for research and academic pursuits. Notable academic institutions such as the University of Oxford, the University of Cambridge, and the London School of Economics are actively engaged in research pertaining to sustainable development. Additionally, the country's policies are aligned with this objective, with a particular emphasis on the green economy and addressing climate change. Sweden has robust environmental legislation and a substantial investment in climate, sustainable development, and environmental research. The United States boasts a well-developed system of higher education

and is a global leader in scientific research. The United States has a plethora of publicly and privately funded programs and grants that serve to stimulate research and publications in the field of sustainable development.

A comparative reading reveals gaps: although research is concentrated in these countries, few studies examine whether these approaches are transferable to lower-resource contexts, which limits the generalizability of current findings.

3) A review of the distribution of publications by topic in the field of sustainable development reveals that the social sciences (29.8%) are the primary focus, with research investigating the impact of sustainable development on society, the economy, and politics. This analysis delves into the social and cultural dimensions of the transition to sustainability. Environmental sciences (19.9 per cent) focus on the study of ecological processes, climate change and biodiversity conservation, making them key in the context of sustainable development. Energy (14.6%) focuses on renewable energy and energy efficiency, which are important components of sustainable development. Engineering (10.7%) plays an important role in developing technologies and infrastructure that promote sustainable development, such as sustainable building materials and water supply and treatment systems.

While coverage is diverse, there is a notable gap in research linking sustainability to universities' research and social missions, and few studies analyze the impact of global sustainability rankings on university strategies.

At the next stage of the research, a content study of the outlined publication field was carried out. This work allowed us to see that most of the works consider the ideas of sustainable development from two perspectives:

- historical overview of the concept of sustainable development,
- ways of disseminating ideas in higher education and university activities.

Numerous works provide an overview and chronological description of the concept of sustainable development. Here are some examples of scientific works published in the last 2-3 years on this topic.

The research conducted by Justice Mensah from the University of Cape Coast in Ghana is highly valuable (Mensah, 2019). The paper presents a comprehensive literature review on sustainable development, providing a clear definition of the concept and explaining its key aspects. The author refers to 126 articles covering various aspects of sustainable development, of which 61 articles are subject to full analysis. Another work to keep the issue debatable for wider public awareness is the book «Materials and Sustainable Development» (Ashby, 2022) by Michael F. Ashby, a scientist and professor at the Royal Society and Cambridge University. The initial section of the book outlines the efforts and practical measures taken by the global community to address sustainable development concerns. This is achieved through an analysis of reports published by international experts and organisations. Agoga-Jonsson explores the approach to sustainable development by highlighting critical statements and responses in their work «The Sustainable Development Goals: A Universalist Promise for the Future» (Agoga-Jonsson, 2023). The paper by Yawer, Bakr, and Fathi (Yawer et al., 2023) from Alexandria University in Egypt explores the concept and principles of sustainable development to achieve the goal of preserving and enhancing urban history for the benefit of the environment, society, culture, and economy.

It should be noted that HEIs are often described as active participants in the sustainable development of society.

Universities are incorporating sustainable development goals into their activities, which are becoming an integral part of their identity and defining their organizational, academic, scientific, and social processes. Additionally, universities are actively informing the public about the transformations resulting from sustainable development (Cuesta-Claros et al., 2023; Zhao & Cheah, 2023).

Other papers present a diagnostic analysis of how higher education teachers integrate sustainable development into their curricula. It aims to reveal the peculiarities of their perception and behavior in this field (Leal et al., 2023; Howell, 2021).

In the academic discourse, we also find works on the evaluation criteria of «sustainable» universities (Dawodu et al., 2023), on the dependence of a student's conscious involvement in sustainable development on the profile orientation of his educational trajectory (Cachero et al., 2023), on the experience of applying an interdisciplinary pedagogical method to create a learning environment that stimulates problem-solving skills related to sustainable development (Alm et al., 2021), and on many other general and specific issues. Comparing these studies shows that while some focus on measurement and evaluation of sustainability, others emphasize pedagogy and curriculum integration, indicating a fragmented field with little consensus on holistic approaches.

The literature review revealed that the modern academic world focuses on studying systemic approaches and paradigms related to the modification of organizational and academic strategies of universities, as well as providing specific examples of sustainable development implementation in various university activities. These two directions can be labelled as papers on the creation of sustainable education and on how the university adheres to the principles of sustainable development. However, the literature reveals notable gaps and tensions: while a substantial body of research addresses sustainable education, comparatively fewer studies examine how universities implement sustainability within their research and social missions. Similarly, empirical analyses of the impact of sustainability-oriented university rankings remain scarce. These gaps highlight the need for further research to investigate how universities integrate sustainability principles across all dimensions of their mission, providing a more comprehensive understanding of their contribution to sustainable development.

Study Results and Analysis

The analysis of literature allowed us to answer the first research question, «How does sustainable development sound in contemporary publications?», showing that sustainable development in higher education is articulated as both a conceptual evolution and a practical institutional agenda. Publication dynamics reflect global milestones – such as the adoption of the SDGs and the post-pandemic context – indicating that scholarly attention intensifies in response to major social, economic, and environmental challenges. The discourse is dominated by contributions from countries with strong environmental policies and advanced academic systems, and by research within the social sciences, followed by environmental and technological fields. Across publications, two main lines of argument prevail: exploring how the idea of sustainability has been defined, expanded, and legitimised over time, and analysing how universities integrate sustainability principles into governance, campus operations, curricula, and public engagement. At the same time, the discourse remains uneven: significantly fewer studies address sustainability in the research and societal missions of universities or examine the influence of sustainability-oriented rankings. Overall, contemporary publications present sustainable development as a strategic driver of institutional transformation and competitiveness in higher education.

In order to answer the second research question «What prompted modern universities to move towards implementing sustainable development principles?», the paper analyzes the system of evaluation of universities by world rankings on sustainable development.

In the contemporary academic context, the question of university reputation has assumed a pivotal importance. A reputation for excellence is evidenced by a high ranking in global rankings of educational organizations. Participation in the rankings allows universities to gain recognition on the international stage, thereby enabling them to address significant challenges. These include attracting talented students, securing the interest of sponsors and partners willing to align their investments with successful universities, strengthening the

academic staff with leading scientists and teachers, stimulating improvements in the quality of education, research, and other aspects of their activities, and enhancing the international recognition of the university and its position within the global educational community. In this regard, many universities are actively working to improve their positions in the rankings, investing efforts in improving various aspects of their activities. It turns out that one of the tools that laid the foundation for the introduction of sustainable development principles in the activities of higher education organizations are international university rankings (Burmam et al., 2021).

World ranking agencies and companies have developed detailed criteria for assessing the performance of universities in terms of their involvement in the sustainable development of society. The most authoritative among such rankings are the following:

- UI GreenMetric, initiated by the University of Indonesia;
- Times Higher Education Impact Ranking, in co-operation with Times Higher Education (THE) magazine;
- QS Sustainability Ranking, developed by the British agency Quacquarelli Symonds (Table 1).

Table 1

Categories and indicators used in university assessment by international rankings on sustainable development

<i>Ranking and assessment criteria</i>	<i>Assessment categories</i>	<i>Indicators</i>
UI GreenMetric World University Ranking Number of universities assessed – 1050	6 categories: <ul style="list-style-type: none"> - overview of the university's size and zoning profile: urban, suburban - energy and climate change - waste - water - transport - education and research. 	39 indicators: Green spaces, open spaces, inclusive infrastructure, health care; electricity consumption, smart building, renewable energy, carbon footprint; recycling and reusing waste, reducing the amount of paper and plastic used; water conservation program, water recycling program, water saving program; zero-emission vehicle policy, reduction program, vehicles, pedestrian area enhancement program; student communities of engagement in sustainability, funding for sustainability research, activities, events, publications on sustainability, etc.
Times Higher Education Impact Ranking Number of universities evaluated – 1705	17 categories by number of sustainable development goals: <ul style="list-style-type: none"> - end poverty - end hunger - well-being - quality education - gender equality; - clean water and sanitation - affordable and sustainable energy - decent work - technology to benefit all - reduce inequality - safe cities and communities - responsible consumption by all - stop climate change - protect the ocean - take care of the earth - live in peace - mechanisms and partnerships to reach the goals 	10 and more indicators for each SDG: university anti-poverty programs; campus food waste; agriculture and aquaculture graduates; Health and well-being research; health services; lifelong learning; women scientists and faculty members; research on clean water and sanitation; water use and care; affordable and clean energy; trade unions and labor rights; equal pay rights; research on industry, innovation and infrastructure; non-discriminatory policies; diversity and equality; public access to university libraries, museums, exhibitions, open and green spaces; policies for proper disposal of hazardous waste, recycling, minimizing the use of plastic and disposable items; education programs or campaigns on climate change, climate change action plan, cooperate with NGOs on climate change adaptation issues; activities aimed at promoting the conservation and sustainable use of water bodies; conservation, restoration and sustainable use of land ecosystems associated with the university; academic freedom, anti-corruption, open financial reporting; partnership with regional NGOs and government to realize SDGs, etc.
QS Sustainability Ranking Number of universities assessed – 1400	2 categories: <ul style="list-style-type: none"> - environmental sustainability - social influence. 	More than 40 indicators for each area: sustainable institutions; sustainable education; sustainable research; equality; Knowledge sharing; impact on education; employment opportunities; quality of life.

This table demonstrates the approaches of international rankings to assessing the performance of universities in terms of their role in sustainable development. We see a detailed elaboration of criteria and indicators: a university must demonstrate its commitment to the principles of sustainable development in its academic activities, scientific research, social projects and environmental activities. The indicators reflecting the way the university organizes all cycles of life activity from the point of view of respect for the environment are of great weight. The methodologies of these rankings can be considered as a kind of guide to creating «sustainable» universities; they help universities become more environmentally friendly.

In response to the second research question «What prompted modern universities to move towards implementing sustainable development principles?», it can be concluded that international university rankings on sustainability played a decisive role. By establishing detailed criteria and indicators for assessing environmental, social, and academic performance, these rankings created incentives for universities to integrate sustainable development into governance, research, education, and campus operations. Participation in such rankings not only enhances institutional reputation and global recognition but also motivates universities to adopt concrete measures promoting environmental responsibility, social impact, and sustainable practices across all aspects of university life.

A review of the literature and an analysis of the methodologies used in leading international rankings enabled the identification of two distinct approaches to conceptualizing a sustainable university: sustainable development of the university and sustainable development within the university (addressing the third research question: «How can a university shape sustainable development in its activities?»). Although these formulations may initially appear tautological, they reflect two analytically distinct dimensions.

The sustainable development of the university is understood in terms of its infrastructure and operational environment. Firstly, this is the construction of all cycles and processes of the university's life on the principles of sustainable development, the creation of a «sustainable» university: energy saving activities, alternative sources and types of energy, environmentally friendly hygiene products, waste sorting and recycling, recycling and reuse of waste, ecology of water and transport, digital image of the university, smart university, etc.

Secondly, it is cultivating a healthy lifestyle, creating an environment in which students and staff are physically and mentally healthy, harmoniously developed and support the ideas of sustainable development: sports policy and corporate culture, psychological well-being and creating opportunities for personal growth and development, environmental and social initiatives and activities (greening, waste sorting and recycling, minimizing the use of paper and plastic).

Thirdly, this is the formation of a healthy socio-cultural environment: national, cultural, religious tolerance, respect for traditions, gender equality.

Fourthly, this is cooperation with partners on issues of sustainable development: volunteer activities together with private commercial and public organizations, participation in national projects.

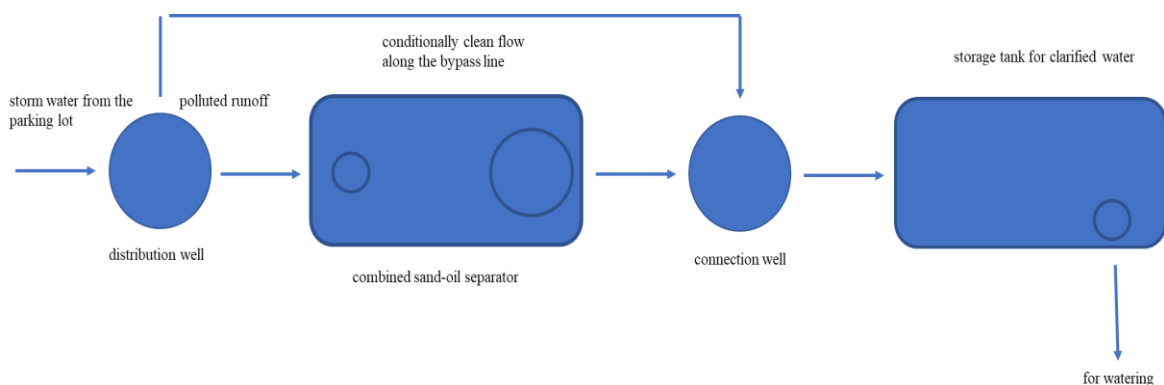
We describe sustainable development at the university through education and science. Integration of sustainability principles into educational activities is carried out through transformation of academic strategy; development and implementation of disciplines incorporating sustainability ideas; organization of student internships at enterprises promoting sustainable development; performance of diploma, master's, and doctoral theses on sustainability topics. It is also important to create new educational programmes that train specialists able to address these challenges (Saginova et al., 2012). In research, including sustainability issues in university projects helps popularize the topic and advance innovation to a sustainable-technological level.

In this section, we will examine the university's sustainable development practices by analyzing specific measures and initiatives implemented as part of this process. Particular emphasis will be placed on the efficacy of the implemented technologies and their influence on enhancing the environmental and educational performance of the university.

The introduction of energy efficient technologies into the university infrastructure has an impact on improving the public image of the institution, strengthening its reputation as a leader in sustainable development and attracting stakeholders, including students, partners and funding organizations. Energy-efficient technologies strengthens the university's public image and reputation as a sustainability leader. Replacing traditional lighting with Class A energy-efficient fixtures and implementing automated heating controls and solar systems have led to substantial reductions in energy use. For comparison, MIT reduced lighting energy by 50%, saving \$500,000 annually (Massachusetts Institute of Technology, n.d.).

Efficient water management is another key aspect. At D. Serikbayev East Kazakhstan technical university, the collection of rainwater and runoff from parking lots, installation of water-saving devices, and drip irrigation of plantings enabled a 54% reduction in water usage between 2022 and 2024. (Figure 2).

Figure 2
Surface wastewater treatment system for irrigation



In order to prioritize waste management and optimize waste treatment processes, it is necessary to assess current waste volumes and types, identify weaknesses in existing management and treatment systems, and analyze the effectiveness of already implemented technologies and practices. This will enable the development of targeted improvement measures, introduction of new technologies and process improvements based on the evidence and identified needs (Table 2).

Table 2
EKTU waste and recycling (2024)

Type of waste	Waste materials, tonnes	Reuse, tonnes	Recycling, tones	Total, tonnes	How it's recycled
<i>Organic waste</i>					
sawdust (carpenter's workshop)	0,48	0,48			are used in preparing plantings for winter, composting and construction
food waste (canteens, cafes)	17,22	17,22			pet food
grass clippings (campus)	10,23		6		composted to produce compost, which is then used for planting plants
fallen leaves (campus)	68,20		2		
<i>Organic waste, total</i>	96,13	17,7		25,7	
<i>Inorganic waste</i>					
hard plastic	2,8		2,8		processed by third-party companies: Eco Vostok Leader LLP, Clean Sky, Polygrand, Visit, ABS
soft plastic	1,5		1,5		
waste from furniture manufacturing	10	5			materials are used for the second time
metal structures	0,75	0,38			pipelines, metal frames for furniture, ventilation ducts, etc. are reused.
<i>Inorganic waste, total</i>	15,05	5,38	4,3	9,68	
<i>Toxic waste</i>					
electronic waste	1,5		1,5		recycled/properly disposed
mercury lamps	0,37		0,37		properly disposed
laboratory chemicals	0,03		0,03		stored safely and then transferred for disposal under an agreement
<i>Toxic waste, total</i>	1,9		1,9		

Note: The empirical institutional data include energy, water, and waste indicators derived from the university's internal reports for 2022–2024, collected by the Competence Center for Ecology and Life Safety through administrative statistics and internal monitoring procedures.

Waste management at EKTU (2024) demonstrates responsible and effective handling of materials. Organic waste (96.13 tonnes) is largely repurposed or recycled, with food waste and sawdust almost entirely reused, and significant portions of grass clippings and fallen leaves composted. Inorganic waste (15.05 tonnes) shows selective recycling and reuse, particularly plastics, metal structures, and furniture materials. Toxic waste (1.9 tonnes) is fully and safely disposed of, ensuring minimal environmental impact.

Based on this recycling data, it is clear that EKTU can further enhance its sustainability performance. The predominance of organic waste and its extensive reuse indicate that developing more advanced composting systems and expanding programs for repurposing organic materials should be a priority. For inorganic waste such as plastics, metals, and furniture, improving sorting and recycling processes and introducing additional methods could increase efficiency. Maintaining strict protocols for toxic waste disposal will continue to minimize environmental risks. Finally, fostering active participation of students and staff through training and sustainability projects will strengthen the university's environmental culture and support a broader implementation of practical waste reduction and recycling measures.

Regarding the sustainability of the university, we have only presented some of the results of sustainable activities. However, EKTU is also actively engaged in other areas such as transport, pedestrianization, smart building technologies, sustainable budgeting, and inclusion, demonstrating a multi-dimensional approach to campus sustainability.

The overarching objective of sustainable development at the university is the creation of a sustainable ecosystem. This encompasses the efficient management of energy, water, transport, and waste, with the aim of minimizing environmental impact and promoting long-

term sustainability. Such initiatives foster an environmentally aware community, enhance the level of responsibility among students and staff, encourage participation in sustainable practices, and serve as an exemplar for other organizations by promoting a culture of sustainability outside of the university.

As for the second direction, sustainable development within university activities, it primarily involves two key dimensions.

First, it includes the transformation of academic provision through the introduction of new educational programmes explicitly addressing sustainability challenges. Examples include programmes such as International Master in Sustainability and Circular Bioeconomy (Rome Business School), Design of the Built Environment (University of Dubai), and Bachelor of Science in Sustainable and Renewable Energy (University of Sharjah) (Abo-Khalil, 2024), as well as programmes focused on environmental and sustainable development offered by universities in Kazakhstan.

Second, it involves the integration of sustainability-oriented disciplines into existing curricula. These include courses such as ESG and Sustainable Development, Ecotoxicology and Environmental Sustainability, Economics for the Environment and Sustainability, Social Sustainability and Welfare Management, and Sustainable Industrial Pharmaceutical Biotechnology (Viviani, 2022). The introduction of these programs and courses is not only an expansion of educational offerings but also a deliberate strategy to increase interdisciplinarity, strengthen innovation in research, and attract students and faculty motivated by sustainability. By embedding sustainability principles into academic content, the university ensures that graduates are equipped with both theoretical knowledge and practical skills relevant to sustainable development. This approach also allows the university to contribute actively to global sustainability goals while enhancing its academic prestige and competitive positioning.

In response to the third research question, «How can the university shape sustainable development in its activities?», it can be concluded that universities promote sustainability through two interconnected dimensions. First, by developing their infrastructure and environment implementing energy- and water-efficient technologies, waste reduction and recycling systems, smart campus solutions, and creating a healthy, inclusive socio-cultural environment. Second, by transforming academic and research activities – introducing sustainability-oriented curricula, new educational programs, and research projects that integrate environmental and social responsibility. These combined efforts foster a sustainable university ecosystem, enhance environmental and educational performance, cultivate an engaged and environmentally aware community, and position the university as a model of social and ecological responsibility.

Discussion

The study shows that sustainable development is increasingly recognized as a core institutional responsibility, integrated across governance, social engagement, and educational and research activities. This aligns with contemporary publications, which present sustainability as a strategic orientation rather than a peripheral initiative. Importantly, universities embed sustainability into their institutional identity, reflecting a broader organizational commitment that goes beyond isolated initiatives.

The influence of sustainability rankings reflects the growing interconnection between global standards and institutional behavior. Universities are not only responding to reputational incentives but are also negotiating the expectations of multiple stakeholders, including governments, industry partners, and society at large. It raises questions about the balance between external expectations and genuine institutional commitment, suggesting that strategic decisions may prioritize visibility alongside substantive environmental and social outcomes.

The findings suggest that while universities implement sustainability through operations and education, their role in research and societal engagement is less developed.

From a discursive perspective, this indicates that current university practices may address internal sustainability effectively but have limited influence on broader social and environmental challenges. Compared to existing literature, which often emphasizes curriculum integration, this study highlights a gap in linking operational and educational efforts with external collaboration. Addressing this gap could strengthen the university's capacity to act as an agent of societal sustainability, suggesting that future strategies should prioritize structured partnerships with communities, industry, and international networks. This discussion underscores the need for a more holistic approach, integrating internal practices with outward-facing initiatives to maximize the university's impact.

Sustainable development within the university is an ongoing and participatory process that requires continuous improvement and engagement of all stakeholders. By embedding sustainability into every functional area governance, operations, education, research, and outreach universities become not only centres of knowledge generation but also active contributors to solving global sustainability challenges.

This study has several limitations that should be acknowledged. First, it focuses on a limited number of universities and specific institutional cases, which may constrain the generalizability of the findings. Second, part of the analysis relies on secondary data from institutional reports, which may contain reporting biases or incomplete information. Finally, the literature review is restricted to publications available in English and Russian, potentially excluding relevant contributions in other languages.

Conclusion

Higher education institutions have a significant responsibility for sustainability and achieving the Sustainable Development Goals, playing a fundamental role in the transformation of regional and national economies, politics, and cultures. Contemporary publications confirm that sustainable development is increasingly embedded in university governance, social engagement, education, and research, highlighting that universities integrate sustainability into their institutional identity, moving beyond isolated initiatives. This addresses the first research question by showing that sustainability is recognized as a core strategic orientation rather than a peripheral concern.

The study also demonstrates that global sustainability rankings and the expectations of multiple stakeholders including governments, industry, and society have prompted modern universities to implement sustainability principles systematically. Ranking indicators have influenced universities to develop comprehensive sustainability strategies, improve infrastructure, enhance energy efficiency, and adopt technologies such as smart buildings, renewable energy, and waste management systems. These measures not only reduce ecological footprints and improve campus environments but also reflect universities' responses to reputational and societal incentives, answering the second research question regarding the drivers of institutional action. Universities are revising their strategies to meet social needs and political-economic expectations, with a focus on sustainable development (Ferrer-Balas D. et al., 2009).

In terms of shaping sustainable development in their activities, universities implement a combination of operational, educational, and research initiatives. They transform academic programs by introducing sustainability-oriented curricula, establish research projects with environmental and social relevance, and integrate sustainability into daily operations. However, the analysis reveals that the integration of research and societal engagement remains comparatively limited. Bridging this gap through structured partnerships with communities, industry, and international networks could enhance universities' influence on broader societal sustainability. This addresses the third research question by emphasizing the need for a holistic approach that combines internal practices with outward-facing initiatives.

These findings carry important implications for policymakers and university leaders. Policies and institutional strategies should support the alignment of sustainability rankings with meaningful local and global impact, encourage resource allocation for operational and research initiatives, and foster interdisciplinary programs that equip graduates with both theoretical knowledge and practical skills. Leadership at universities should prioritize transparency, stakeholder engagement, and long-term planning to ensure that sustainability efforts go beyond compliance and generate measurable social, environmental, and educational outcomes.

Finally, the study suggests directions for further research. Future investigations could examine the effectiveness of integrated sustainability initiatives across diverse universities, explore the impact of partnerships between higher education institutions and external stakeholders, and develop frameworks for measuring the contribution of universities to societal sustainability beyond rankings. Such research would provide a more comprehensive understanding of how higher education can serve as a catalyst for sustainable development at multiple levels.

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Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

The authors affirmed that there is no conflict of interest in this article. Saule Zh. Rakhmetullina carried out the conception and investigation. Zhadyra T. Konurbayeva overlook the writeup of the whole article and prepared the relevant literature. Darya S. Surova wrote the research design and conducted the data entry, revised critically the article for intellectual content. Olga A. Petrova carried out the data analysis. Mikhail V. Sizov prepared the interpretation of the results, contributed to drafting and revising the article.

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LABORATORY WORK ON X-RAY DIFFRACTION AS A TOOL FOR DEVELOPING RESEARCH COMPETENCIES IN FUTURE PHYSICS TEACHERS

Abstract. This article demonstrates the effectiveness of methodological approaches to developing research competencies in prospective physics teachers. The implementation of advanced pedagogical technologies during laboratory work led to improved learning outcomes. The article presents the case of one master's student who completed a specialized elective course. The course methodology proved to be highly effective, resulting in the student's noticeable growth in research competencies. Subsequently, the student continued independent research activities, applying the acquired skills and competencies.

The paper presents the results of a pedagogical experiment aimed at fostering research competencies in future physics teachers through the integration of the X'Pert PRO X-ray diffractometer into the educational process. The experiment involved students and master's students enrolled in the "Physics," "Physics and Computer Science," and "Physics and Mathematics" academic programs, divided into experimental and control groups. The primary objective was to examine changes in students' research skills following a series of laboratory sessions on X-ray diffraction. The research employed methods of comparison, synthesis, abstraction, and statistical analysis to ensure the reliability of the results. The methodology included lectures, laboratory work, and independent assignments designed to reinforce both theoretical knowledge and practical skills. While the control groups studied theoretical material, the experimental groups completed hands-on laboratory sessions. As a result of the study, methodological foundations were developed to enhance the research competencies of prospective physics teachers, which, according to the analysis, contribute to the effective training of future specialists.

Keywords: physics teacher, laboratory work, methodology, research, X-ray diffraction.

Introduction

It is well established that laboratory-based physics practicum plays a crucial role in developing research competencies in prospective physics teachers. The physics practicum serves as a foundational component for the growth and formation of these competencies.

It is widely recognized that the research competency of a physics teacher plays a vital role in their professional teaching practice. The core professional skills of future educators are formed within the walls of higher education institutions. Therefore, particular attention is given to the methodology of developing research competencies in prospective physics teachers.

Experience has shown that laboratory work, as the practical component, cannot be separated from the theoretical foundation of the physics practicum or its underlying methodology. Thus, emphasis should be placed on a high-quality and effective methodology for conducting the physics practicum.

Modern education requires future physics teachers to possess not only in-depth subject knowledge but also well-developed research competencies essential for effective teaching and for fostering students' interest in science. As is well known, research competencies serve as a foundation for the professional development of educators, enabling them to apply modern teaching methods and introduce innovative approaches into the educational process (Johnson

& Lee, 2023). Moreover, (Johnson & Lee, 2023) emphasize that the development of such competencies should begin during the training of master's students in order to ensure their high level of professional readiness.

Laboratory work focused on studying X-ray diffraction offers unique opportunities for the development of research competencies. Several authors, such as (Imbert Romero et al., 2024), note that such practical activities help students gain a deeper understanding of scientific principles and foster the development of critical thinking. Research from (MIT OpenCourseWare, 2023) highlights the importance of understanding Bragg's law and the Laue and Debye–Scherrer methods, which are widely used for analyzing crystal structures and serve as a foundation for developing research skills in solid-state physics (MIT OpenCourseWare, 2023).

In the modern paradigm of professional education, future physics teachers must possess more than theoretical knowledge; they require well-developed research competencies to lead effectively in contemporary classrooms. X-ray diffraction (XRD) serves as a premier interdisciplinary tool to bridge the gap between fundamental physics, crystallography, and material science.

Recent studies emphasize that transitioning from passive lectures to active, XRD-based experimental modules significantly enhances student engagement. For instance, (Mešić et al., 2021) demonstrate the efficacy of inquiry-based learning through the use of desktop diffractometers. Their research highlights how prospective teachers develop critical analytical skills by interpreting real-world experimental data, navigating complexities such as instrumental broadening and peak overlapping that are often absent in idealized textbook problems.

The digital transformation of laboratory environments has also introduced new pedagogical dimensions. (Kin et al., 2022) argue for the integration of digital twin laboratories in XRD education. This approach allows students to refine their experimental techniques in a high-fidelity virtual environment before operating expensive physical equipment, thereby strengthening their technical literacy and procedural autonomy.

Furthermore, the development of research-oriented mindsets requires a structured didactic progression. According to (Bunaciu et al., 2015) moving from the abstract conceptualization of diffraction laws to the practical characterization of unknown materials allows future educators to build a holistic physical worldview. This competence is vital for their future role in supervising student-led research projects and translating complex physical phenomena into accessible classroom experiments.

At present, most universities are equipped with experimental and analytical instruments such as TEM, SEM, XRF, EPR, NMR, IR spectroscopy, and others. These instruments operate based on various physical principles. For example, TEM and SEM utilize the principles of electron and X-ray diffraction. Although primarily used to address tasks in research projects, their potential for developing students' research skills remains underutilized.

Research from the Paul Scherrer Institute also emphasizes that laboratory experiments involving X-ray diffraction enhance students' critical thinking and practical understanding of crystallographic structures. Working with real experimental setups enables master's students to master advanced techniques and deepen their understanding of atomic structures, thereby contributing to their professional development (Anderson, 2024).

The work of (Bukusheva et al., 2023) emphasizes that practical physics classes are not only a crucial stage in mastering theoretical content but also a foundation for fostering a research-oriented culture among prospective teachers. The study by (Johnson & Lee, 2023) demonstrates that laboratory sessions involving X-ray diffraction enable students to apply scientific methods in practical activities, simulate a real research environment, and enrich their methodological toolkit.

However, as the analysis of available literature shows, educational programs at higher education institutions lack a clear methodology for conducting laboratory work on the topics of "electron diffraction" and "X-ray diffraction."

Moreover, even in universities equipped with specialized instruments and facilities for laboratory experiments, there is often a lack of connection between laboratories and students. This was confirmed through a survey conducted among students and master's students.

Our study (Dalabayev et al., 2025) The main components of a special physics workshop on "X-ray diffraction" are separately disclosed. The theoretical support of the workshop and the complex of laboratory work related directly to the research work are considered, their main goals are analyzed. The paper develops methodological foundations for the formation of scientific research competencies of future physics teachers based on the example of performing a complex of laboratory practical training in X-ray diffraction.

In light of the above, the aim of this study is to demonstrate the effectiveness of implementing a methodological model for enhancing research competencies in prospective physics teachers, using laboratory work on X-ray diffraction as a case study. To achieve this aim, the following objectives were identified, in accordance with the recommendations of (Hattie, 2011):

First, to present the methodological model and its overall structure;

Second, to illustrate the application of the methodological foundations for developing research competencies in prospective physics teachers through the example of one master's student;

Third, to assess the formation and progression of the student's knowledge and demonstrate the implementation of the study's main hypotheses.

Materials and methods

The pedagogical experiment was carried out in three main stages. At the analytical stage, the relevant scientific and methodological literature was analyzed, the research problem was clarified, and existing contradictions in the preparation of future physics teachers were identified. Based on this analysis, the research hypothesis, goals, objectives, and methodological foundations of the study were formulated. At the constructive stage, the developed methodological model aimed at forming the research competencies of future physics teachers was implemented in the educational process. In particular, a specialized course titled "X-ray Diffraction" was introduced, and various forms and methods of teaching, including lectures, laboratory work, independent study, and research projects, were applied. At the feedback stage, the effectiveness of the implemented model was evaluated. Diagnostic tools were used to assess the level of development of research competencies among students, and the obtained results were analyzed to determine the effectiveness of the proposed methodological approach.

To address the research objectives and achieve the stated aim, the pedagogical experiment utilized the following materials: the X'Pert PRO X-ray diffractometer (Figure 1) of the National Research Laboratory for Collective Use at Sarsen Amanzholov East Kazakhstan University and its operator, as well as fourth-year students and first- and second-year master's students enrolled in the "Physics," "Physics and Computer Science," and "Physics and Mathematics" academic programs at Sarsen Amanzholov East Kazakhstan University and Khoja Akhmet Yassawi International Kazakh-Turkish University.

Figure 1.
XPert Diffractometer



Participants in this pedagogical experiment were divided into two groups: an “experimental group” and a “control group”.

For the purpose of conducting the research work systematically, the supervised students and master's students were divided into four groups: A, B, C, and D. To assess the effectiveness of the conducted surveys and the physics practicum, based on the main research design of the groups, the provided educational and instructional materials were classified into parts A and B, C and D, depending on the level of comprehension. (Table 1)

Information about the controlled groups is presented in the table below:

Table 1.
Participant Information

№ Group number	Educational Program Code of the Group	Group Name Used During the Pedagogical Experiment	Number of Students in the Group
1	7M01502	A	12
2	6B01502	B	8
3	6B01502	B	15
4	6B01520	C	20
5	6B01520	C	13
6	7M01520	D	22
			Total Number of Students 90

Six groups participated in the pedagogical experiment. Three of them served as control groups. The groups involved in the experiment were designated as A, B, C, and D. Groups A and B were assigned as the primary control groups; they were limited to working with the educational manual and completing the corresponding assignments. Groups C and D, by contrast, fully completed the physics practicum.

The main objective was to compare the “before-and-after” changes in the research competencies of prospective physics teachers through intergroup comparison.

The following research methods were employed in the study:

- Methods of comparison, synthesis, and abstraction to justify the applicability of the pedagogical experiment method, in accordance with (Prokopets, 2021);

- Empirical methods (observation, surveys, and pedagogical experiment) to examine and confirm the effectiveness of the methodological foundations for developing research

competencies in prospective physics teachers, based on the recommendations of (Ndiokubwayo et al., 2020);

- Statistical methods for collecting and analyzing experimental data and determining the statistical significance of the results obtained in the experimental part of the study (Nghiem-Phú et al., 2022);

- Experimental research methods applied during laboratory work (observation, comparison, modeling, experimentation, and measurement).

The pedagogical experiment was conducted in accordance with the framework proposed by John Hattie (Hattie, 2011), which consists of several key components.

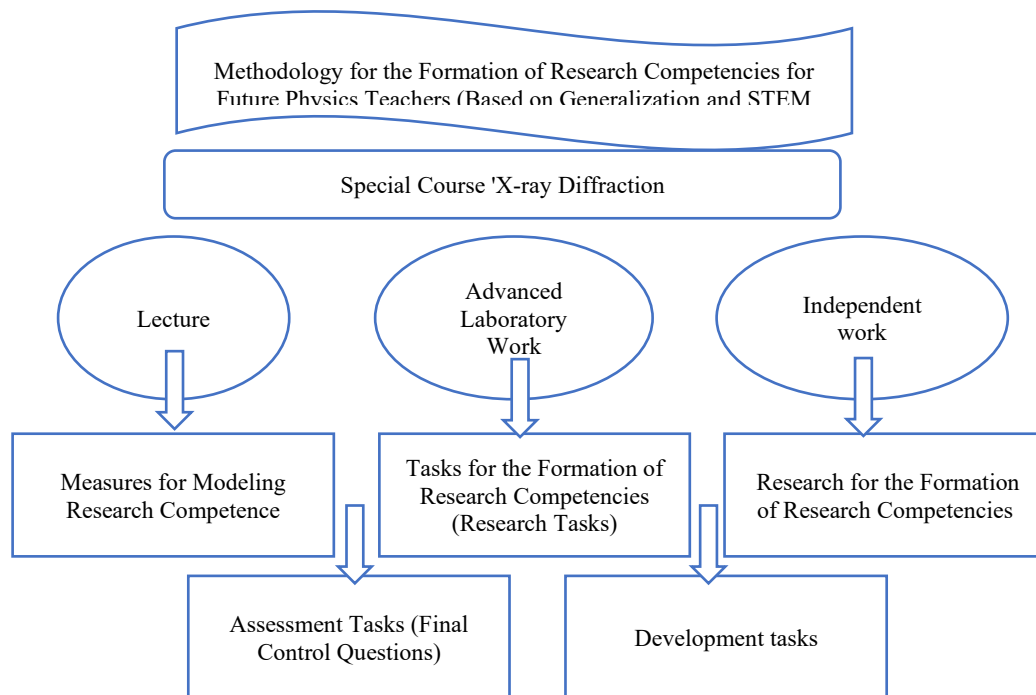
The developed methodological foundations for forming research competencies in prospective physics teachers comprise several core elements, both theoretical and practical. As part of the implementation, educational and instructional materials as well as electronic learning resources were developed. The instructional package includes lectures, practical tasks, and methodological guidelines for the instructor (methodology). The methodological framework for developing research competencies in future physics teachers is considered the theoretical foundation, which consists of lectures, laboratory work, and independent assignments (Figure 2).

The lecture serves as the first stage. It presents the theoretical foundations of the phenomena of diffraction and X-ray diffraction, including all key formulas and terms.

The laboratory work is aimed at developing and strengthening research competencies in prospective physics teachers. It includes three laboratory experiments that are logically interconnected.

The independent work is designed to apply and further reinforce the acquired knowledge and skills through the use of research competencies.

Figure 2.
Model of Methodological Foundations

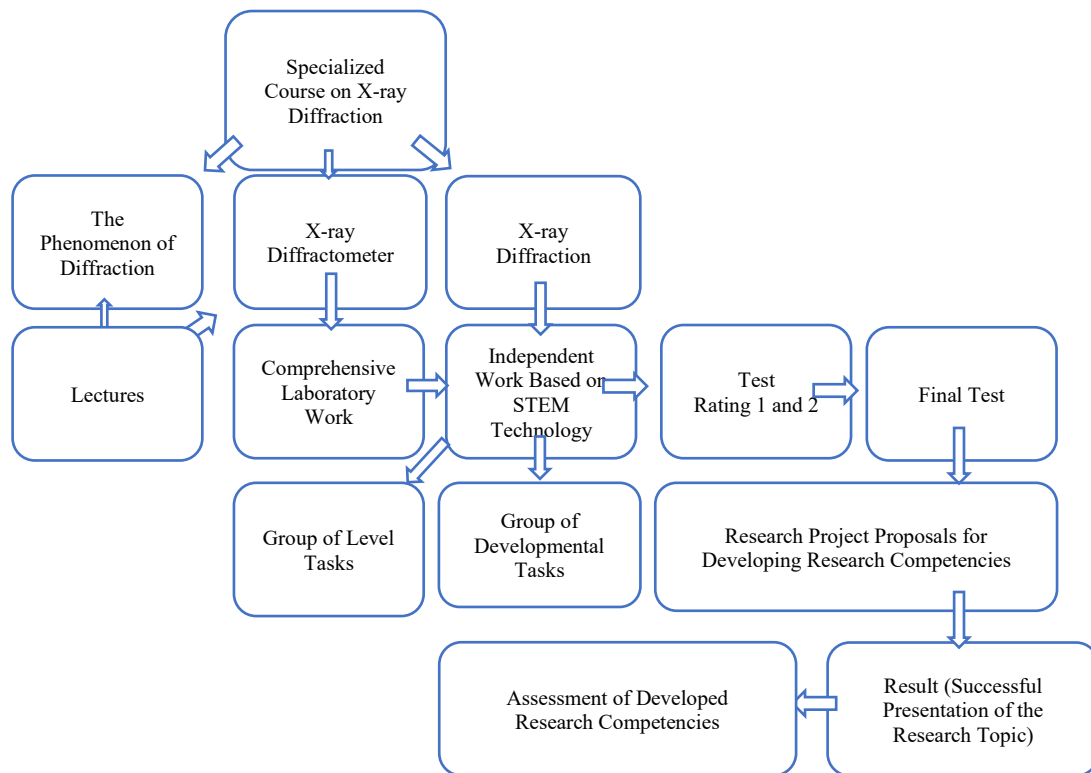


The methodology is implemented as part of a special elective course titled “X-ray Diffraction.” This elective is designed to develop and enhance research competencies in prospective physics teachers (Figure 3).

For future physics teachers, the development of research competencies is critically important. These skills not only enable effective organization of research activities in schools but also foster students' critical thinking, independence, and interest in science. A teacher equipped with well-developed research competencies can actively integrate modern scientific advances into the educational process, adapt teaching materials to current educational goals and students’ needs, and support students in conducting their own research projects.

Thus, the formation and development of research competencies in prospective physics teachers is one of the most essential components of professional training. It ensures high-quality teaching and contributes to the scientific development of students

Figure 3.
Model of the Elective Course



As mentioned above, the educational and methodological complex consists of a textbook, a methodological guide, and an electronic educational resource. The textbook titled "Theoretical Foundations of X-ray Diffraction" was approved by the University Academic Council and received a certificate of entry into the state register of rights to copyright-protected objects under number No. 42606 dated February 5, 2024.

The textbook comprises 10 chapters: 8 of them present the core theoretical material. The remaining 2 chapters cover topics for independent research projects and various reinforcing and developmental tasks. All tasks and exercises are developed using and incorporating key elements of STEM technology.

A teaching and methodological guide entitled “X-ray Diffraction Analysis: A Research Work Complex” was also developed. This guide serves as a continuation of the textbook.

Received a certificate of entry into the state register of rights to copyright-protected objects under number No. 53545 dated January 16, 2025.

The guide consists of three core practical and laboratory assignments. It also includes methodological recommendations for the instructor delivering the course. The guide outlines effective strategies for assessing laboratory work and provides evaluation criteria for various student tasks. In addition to these innovations, the guide offers an assessment sheet template, a student knowledge growth chart, and additional recommendations on writing conclusions and conducting engaging practical sessions.

Results

Research competencies represent a set of knowledge, abilities, and skills necessary for conducting independent scientific work and solving research problems. These competencies are particularly important for future teachers, as they enable not only active participation in research but also the effective organization of students' research activities. Research competencies comprise several key components (Table 1).

Table 1

Structure of Research Competences in Physics Education

Competence Type	Description / Components
Theoretical Competence	1. Mastery of the fundamentals of the scientific method and understanding of key scientific concepts and theories. 2. Understanding the principles and laws of physics, with the ability to systematize and analyze theoretical knowledge. 3. Ability to critically evaluate scientific sources and identify relevant data for research.
Methodological Competence	1. Knowledge and application of research methods (experiments, observation, modeling, mathematical modeling, statistical analysis). 2. Ability to select appropriate methods for specific research problems. 3. Ability to formulate hypotheses and define research aims and objectives.
Practical Competence	1. Ability to organize and conduct experiments, observations, and measurements, and analyze results. 2. Use of specialized equipment, software, and technologies in physics research. 3. Designing and implementing laboratory work and educational projects.
Information Competence	1. Skills in working with scientific and technical sources (databases, journals, monographs). 2. Ability to process, analyze, and interpret data using scientific and statistical tools. 3. Presentation of research results in reports, articles, and presentations.
Analytical Competence	1. Ability to analyze data, identify patterns, and compare with theoretical frameworks. 2. Critical evaluation of research findings, including identification of errors and biases. 3. Ability to draw conclusions and formulate recommendations for further research.
Communicative Competence	1. Ability to present research results effectively in oral and written form. 2. Proficiency in scientific communication (presentations, papers, conferences). 3. Ability to explain complex scientific concepts at different levels of understanding.
Project Competence	1. Ability to plan and organize research projects. 2. Development of research strategy, resource and time allocation, coordination of participants. 3. Ability to anticipate risks and adapt the project to changing conditions.
Reflective Competence	1. Ability to evaluate one's actions and research outcomes. 2. Awareness of strengths and limitations in scientific activity. 3. Openness to feedback and readiness to adjust approaches.

The above-mentioned competencies are developed and strengthened through a structured system of laboratory work, which plays a central role in the formation of research skills among students and master's students. In particular, Laboratory Work No. 3 was designed as a comprehensive task integrating theoretical knowledge, practical application, and analytical thinking.

The procedure of Laboratory Work No. 3 includes several последовательных этапов. First, students familiarize themselves with the theoretical materials related to X-ray diffraction. This is followed by the design of a sample, taking into account the operational procedures of

the device as demonstrated during Laboratory Work No. 1. Subsequently, students record the data generated by the software and perform a detailed analysis of the obtained values.

At the next stage, students carry out calculations using the given formula and compare the results with the software output. Special attention is paid to the comparison and analysis of diffraction patterns (diffractograms), which enables students to interpret experimental results. Based on this analysis, students describe the sample and identify the unknown material through comparison of diffraction patterns. They then provide a detailed description of the unknown sample, formulate conclusions, answer control questions, and present their laboratory work for evaluation.

Within the broader methodological framework aimed at developing research competencies in prospective physics teachers (using X-ray diffraction as an example), the educational process is organized as a последовательная система взаимосвязанных этапов. Initially, students are introduced to the objectives and goals of the elective course “X-ray Diffraction,” followed by an assessment of their prior knowledge. This diagnostic stage ensures alignment between students’ initial preparedness and the course content.

The next stage involves studying the theoretical foundations using specialized literature, such as the textbook “Theoretical Foundations of X-ray Diffraction,” and completing consolidation exercises on key topics, including the phenomena of X-ray diffraction. Practical training is then implemented through a series of laboratory works. Laboratory Work No. 1 focuses on familiarizing students with the operational principles of the X-ray diffractometer, while Laboratory Work No. 2 involves conducting X-ray diffraction analysis of aluminum. Laboratory Work No. 3 extends this experience by requiring students to analyze copper and identify an additional unknown component in the sample.

In addition to laboratory activities, students complete independent assignments incorporating elements of STEM technologies, solve differentiated tasks, and engage in developmental exercises aimed at enhancing higher-order thinking skills. Their progress is monitored through intermediate rating assessments, followed by a final evaluation of their knowledge and competencies.

An important component of the methodology is the inclusion of individual research work. Students are assigned research topics, conduct independent investigations, and present their findings in the form of presentations, thesis defenses, or academic articles. The level of research competency formation is then assessed, and students are encouraged to continue their scientific research activities, ensuring the sustainabilityPoint 1. The goal of the elective course “X-ray Diffraction” (“Рентген сәулесінің дифракциясы”) is to deepen students’ understanding of the phenomenon of X-ray diffraction while developing research competencies in prospective physics teachers.

Point 2. At the beginning of the academic year, before starting the course, master's and bachelor's students completed a diagnostic test on the topic “X-ray Diffraction” and a survey on “Research Competencies.” The average level of subject knowledge among students was 65.5%. The survey results indicated that most students had never visited the university’s Shared Research Laboratory and were unfamiliar with the concept of an X-ray diffractometer. In addition, they experienced difficulty listing the research competencies required of a physics teacher.

Point 3. During the elective course, master's and bachelor's students studied the textbook titled Theoretical Foundations of X-ray Diffraction (Рентген сәулесі дифракциясының теориялық негіздері), which was approved by the University Academic Council. Through the lectures presented in the textbook, students acquired essential theoretical knowledge related to the phenomenon of X-ray diffraction.

Point 4. Upon completion of the theoretical part, master's and bachelor's students completed reinforcement exercises on the topic The Phenomenon of X-ray Diffraction. The

results demonstrated a high level of understanding, with students scoring an average of 95 out of 100 points.

Point 5. To foster and develop research competencies in prospective physics teachers, an instructional-methodological guide titled X-ray Diffraction Analysis: A Set of Research-Based Laboratory Activities was developed in addition to the textbook. The guide includes three laboratory experiments along with a variety of tasks and problems based on STEM technology elements. A step-by-step procedure is provided for each lab, all of which follow a standardized structure from defining the objective to answering control questions.

For instance, Laboratory Work No. 3, titled Identification of a Second Unknown Element Through Diffraction Analysis, aims to determine an unknown element in a mixture using a copper X-ray diffraction sample under the guidance of a research supervisor. Equipment used: X'pert PRO X-ray diffractometer and a copper sample (with impurity).

As a result of the experiment, the students obtained the diffraction patterns (see Figures 4 and 5). The unknown element was identified as cobalt.

Figure 4.
Diffractogram No. 1

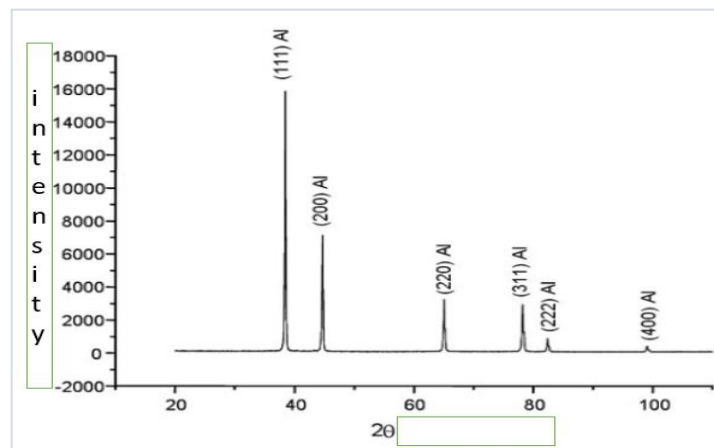
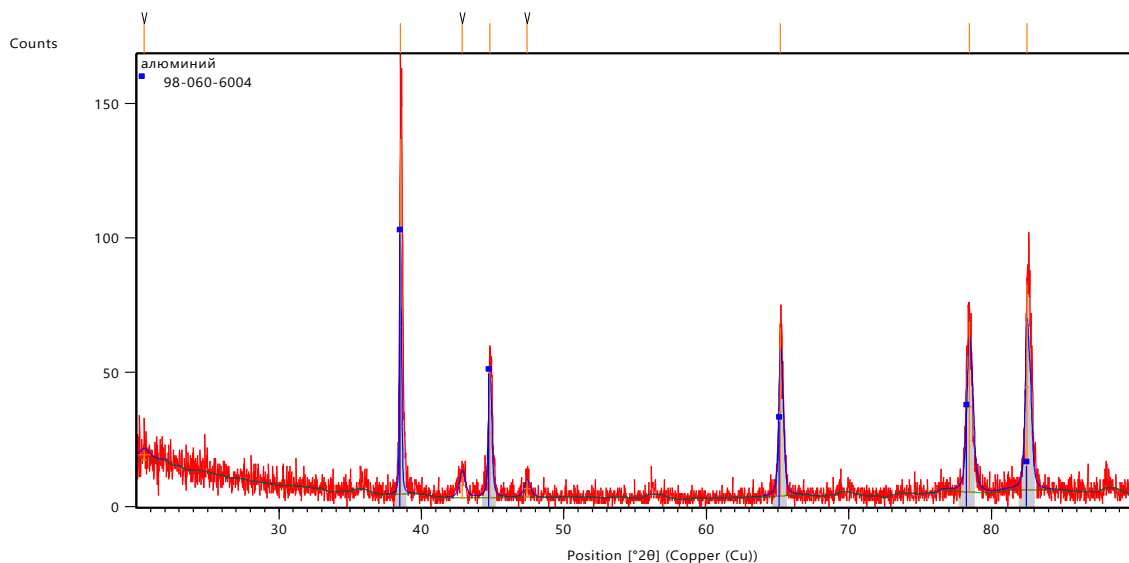


Figure 5.
Diffractogram No. 2



Point 6. Independent assignments based on elements of STEM technologies were completed. These assignments came in various formats. For example, the “Word Cloud” activity aimed to develop and reinforce students’ understanding of physics definitions and laws; “Build the Formula” targeted deeper knowledge of formulas related to the topic and other areas of physics. In addition, a range of test tasks incorporating innovative approaches was used.

Point 7. During the course, special attention was given to solving problems, with a primary focus on using the Bragg–Wulff formula. Differentiated tasks at three levels were provided. By solving each task, master's students would obtain a key word or term. As a result, upon completing the stage, they would collect various definitions of physical laws.

Point 8. Master's and undergraduate students successfully completed the stage involving developmental tasks.

Point 9. According to the plan, master's and undergraduate students completed Rating 1 and Rating 2 assessments. Both were passed as credit-based evaluations.

Point 10. At the end of the main stages of the elective course, a final assessment was conducted to evaluate the level of students’ knowledge. The knowledge quality reached 100%. Thus, it can be concluded that the goal of the course was achieved.

Point 11. To support further independent research activity, topics for research projects were assigned.

Point 12. Master’s and undergraduate students continued working on their projects under the guidance of academic advisors.

Point 13. A master's thesis defense on the topic is planned.

Point 14. An analysis of the results showed that the level of research competency development among students was rated as “excellent.” During interviews with students, positive feedback was received regarding the course and the relevance of the topic.

Point 15. Master’s students plan to pursue doctoral studies in the scientific-pedagogical track, while undergraduate students intend to apply for master's programs.

Discussion

The aim of this study was to demonstrate the effectiveness of a methodological model for developing research competencies in prospective physics teachers through laboratory work on X-ray diffraction. The following tasks were addressed during the course of the research: (1) the development and presentation of the methodological model, (2) the implementation of the proposed methodology with master’s and bachelor’s degree students enrolled in physics and mathematics programs, and (3) the evaluation of the outcomes of the pedagogical experiment in order to analyze changes in the level of knowledge and research skills.

The results of this study, centered on structured laboratory work in X-ray diffraction (XRD), align with the global shift toward research-oriented teacher education. While (Mešić et al., 2021) advocate for the use of desktop XRD units to simplify the experimental process for students, our methodology emphasizes a deeper immersion into the full analytical cycle. Unlike their approach, which focuses on simplified data interpretation, our laboratory framework requires future teachers to master the transition from sample preparation to the final structural analysis, ensuring a more comprehensive development of research competencies.

A significant point of divergence is found in the role of simulation. (Kin et al., 2022) prioritize "digital twin" environments to build procedural knowledge. While virtual labs offer accessibility, our findings suggest that physical interaction with the diffractometer is indispensable for future physics teachers. The tactical experience of aligning samples and troubleshooting real-time hardware issues-aspects often absent in digital twins-provides a level of professional autonomy that prepares educators for real-world laboratory management.

Furthermore, our didactic sequence expands upon the "theory-to-practice" model proposed by (Bunaciu et al., 2015). While they focus on the conceptual transition from diffraction laws to materials science, our work introduces a competency-based assessment at each stage of the lab. This allows for a quantifiable measurement of how a student's ability to hypothesize and verify results evolves through repeated XRD cycles.

In summary, while international trends lean toward digitalization and simplified instrumentation, our methodology reinforces the necessity of "hands-on" experimental physics. This approach ensures that future teachers are not merely users of technology, but researchers capable of designing and implementing complex experiments in their future professional practice.

The results of the pedagogical experiment confirmed the hypothesis that the use of laboratory work contributes to the development of research competencies. Students in the experimental groups demonstrated a higher level of understanding of both the theoretical and practical aspects of X-ray diffraction. These findings are consistent with conclusions drawn in the work of (Prokopets, 2021), which emphasizes the importance of methodological approaches in educational practice, as well as (MIT OpenCourseWare, 2023), which highlights the significance of hands-on experiments in studying complex physical phenomena.

Moreover, our approach aligns with the recommendations of (Ndihokubwayo et al. 2020), who argue that the use of experimental methods in education enhances students' skills in analyzing and synthesizing information. The application of statistical analysis, as suggested in the study by (Nghiem-Phú and Nguyễn, 2022), confirmed the reliability of the obtained results, allowing for an objective evaluation of the method's effectiveness.

Thus, the conducted study contributes to the development of educational technologies aimed at fostering research competencies. However, there remain prospects for further work, including expanding the participant sample, developing additional laboratory activities, and integrating them into teacher training programs. Future research could also explore the impact of digital tools on the development of research skills, which is a relevant issue for modern educational programs.

For example, by applying the acquired knowledge in practice, a novice teacher achieved success in their professional activity. In particular, they prepared prize-winners for a Republican scientific and practical conference. This indicates that the physics teacher developed and enhanced their research competencies and skills gained through the implemented methodology.

For instance, in the 2021–2022 academic year, a 10th-grade student won 2nd place at the district stage of the Republican Science Project Competition in general education subjects with a project titled "The Phenomenon of Deformation in Household Conditions." In the 2022–2023 academic year, another 10th-grade student won 1st place at the district stage of the same competition with a project titled "Supplying Shopping Centers with Electricity Using Piezoelectric Elements," and was recommended for participation at the regional level. In addition, a team of 11th-grade students took 1st place in the district Physics Tournament "Physics Battle," where students from 12 schools participated. In the 2023–2024 academic year, an 11th-grade student won 3rd place at the regional stage of the Republican Science Project Competition and was recommended for the national stage, where they ultimately received 3rd place (awarded with a third-degree diploma, a bronze medal, and the Shakarim Educational Grant from Shakarim University in Semey). Also, in the same academic year, a 10th-grade student took 1st place at the district stage of the competition with a project titled "Development of a Waste Sorting System for Industrial Enterprises," and was recommended for the regional stage. In the 2024–2025 academic year, this student, now in 11th grade, is participating in the regional stage of the competition.

Conclusion

This paper proposes a method aimed at developing research skills in prospective physics teachers through the study of the X-ray diffraction unit within the physics curriculum. A task-based system was designed, including specially selected problems and laboratory activities, all aligned with the goals of the study. The conducted research demonstrated that this system and the methodology for its implementation are indeed effective. Theoretical foundations for preparing future teachers for research activities were identified based on the analysis of psychological-pedagogical and methodological literature on the topic. It was confirmed that the ability to conduct research is a crucial component of professional training for future physics teachers. The importance of STEM education in fostering research competencies was emphasized, and scientifically grounded criteria for assessing the levels of research skill development were established. The proposed model can serve as a reference for other natural science disciplines.

It has been demonstrated that the research skills of physics students as an integral part of their personality, representing a harmonious combination of a persistent drive for scientific inquiry in the field of physics and the ability to apply physical methods in conducting research can be effectively developed through the integration of STEM elements within laboratory practicums focused on X-ray diffraction. The incorporation of such elements into physics laboratory work in general, and into X-ray diffraction practicums in particular, promotes the development of research competencies among physics students, preparing them for independent scientific work in the later stages of their university education. In turn, this contributes to the advancement of research skills in future physics teachers.

During the course of the study, a set of research competencies essential for prospective physics teachers was systematically identified. Based on this framework, a set of criteria for assessing the level of research competence development was established, including: motivation to engage in research activities; interest in working with scientific literature; initiative in identifying and solving research problems; consistency and awareness in the implementation of research stages; ability to conduct competent analysis of research results; capacity for justified evaluation of obtained findings; logical presentation and defense of research outcomes; and readiness to integrate research activities into future professional practice.

Building upon these competencies and evaluation criteria, a methodology for assessing the level of research competence development among prospective physics teachers was developed. The results of the study demonstrate that the implementation of the proposed instructional model based on laboratory work in X-ray diffraction serves as an effective pedagogical tool for enhancing research competencies in both undergraduate and graduate students.

The study yielded the following key findings. First, participants were introduced to the conceptual and methodological framework underpinning the proposed model. Second, the practical implementation of the methodology was carried out in groups of bachelor's and master's degree students, allowing for the validation of its applicability in different educational contexts. Third, a comparative assessment of the dynamics of knowledge quality and research competence development was conducted, which enabled the verification of the main research hypotheses.

The results of the pedagogical experiment confirmed the effectiveness of the proposed methodology. In particular, a statistically significant improvement in academic performance was observed, with an overall increase of 34.5% among both undergraduate and graduate students (see Figure 6). This outcome indicates the high potential of integrating research-oriented laboratory practices into physics teacher education programs.

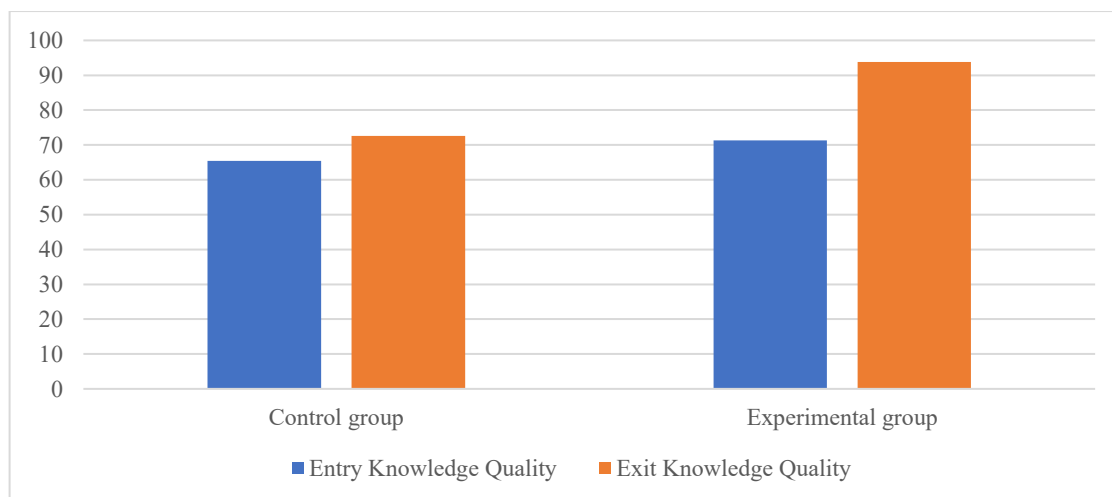


Figure 6. Graph of academic performance quality

Based on the data obtained, we developed a methodological model for fostering research skills in prospective physics teachers using a STEM-based approach. This methodology was successfully integrated into the undergraduate and graduate programs in Physics, Physics and Computer Science, and Physics and Mathematics at S. Amanzholov East Kazakhstan University and Khoja Akhmet Yassawi International Kazakh-Turkish University.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

Tleubek Dalabayev, Mazhyn Skakov, and Makpal Nurizinova contributed equally to this work. All authors were involved in the conceptualization, methodology, data collection, analysis, and interpretation of the results. All authors participated in writing, reviewing, and editing the manuscript and approved the final version for publication.

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DEVELOPING SPEAKING AND LISTENING THROUGH PODCASTS

Abstract. This article is devoted to studying the effectiveness of using podcasts in teaching English to master's students. The paper explores the concept of podcasting, its origin, and its features in the context of foreign language education. The author emphasizes that podcasts are primarily an audio format containing authentic speech samples, which can be used to develop both receptive and productive skills. It is noted that podcasts allow learners to independently choose the topic, pace, and format of study, which contributes to increased motivation and learner autonomy. The experimental part of the study was conducted among 30 second-year master's students at Al-Farabi Kazakh National University. The participants were divided into two groups: experimental and control, with 15 students in each. Over the course of four weeks, the students in the experimental group listened to English-language podcasts three times a week and completed tasks aimed at developing listening and speaking skills.

Keywords: podcasts, listening, speaking, master's students, digital technologies, ICT, language learning.

Introduction

English as a global language is recognized as one of the most widely spoken in the world. Being an international language, it plays an important role in uniting people who speak different languages. Therefore, foreigners all over the world strive to learn English. Theoretically, learning English involves mastering four basic skills: speaking, listening, reading and writing. Since speaking and writing are aimed at creating a text, they are productive skills, and reading and listening are receptive skills, since they are associated with the perception of information. Both are important, but productive skills are considered fundamental, since they contribute to the active acquisition of the language. Thus, speaking can be called one of the most important skills in mastering the English language. Currently, there are a huge number of tools and methods for teaching listening and speaking skills. With the development of information technology and the Internet, new opportunities have appeared for learning English using the podcast service (Alfa, 2020). The term "podcasting" comes from iPod and broadcasting and is the process of creating and distributing audio and video files (podcasts) in the style of radio and television broadcasts on the Internet (Internet broadcasting). As a rule, podcasts have a specific topic and frequency of publication. Podcasts have become popular all over the world due to their varied content, easy access, and compact format. They allow people to receive information and share it (Alsmadi et al., 2020). Podcasts are mainly audio conversations between people without visual accompaniment. Over time, podcasts with visual content have also appeared, such as those of bloggers on YouTube. Abdulrahman et al. emphasize that podcasts are audio and video broadcasts available for downloading and playing on mobile devices. They have become a useful means of receiving news and knowledge. Unlike radio, podcasts allow the listener to independently select the content of interest to him. Initially, podcasts were created for information and entertainment, but soon found wide application in education. Numerous studies have proven the effectiveness of technology in teaching English. Podcasts are effective in developing speaking and listening skills in Indonesian students

because they contain authentic content, support autonomous learning, build confidence, and promote active learning (Odaryuk & Gamparzumov, 2020)..

The development of information and communication technologies in education opens up new opportunities for language teaching. Particular attention in the last decade has been paid to podcasts as a means of increasing motivation and developing communicative competence. The relevance of the study is due to the need to improve the effectiveness of language training for master's students in the context of the digital transformation of education (Anggraini & Hartati, 2022).

Materials and methods

The study involved 30 second-year master's students of Al-Farabi Kazakh National University majoring in English (15 in the experimental group and 15 in the control group). The experiment lasted 4 weeks. Master's students in the experimental group listened to thematic English-language podcasts 3 times a week and completed assignments (summary writing, oral summary, debates). In the control group, traditional audio materials from the teaching and methodological kit were used.

The study employed a combination of qualitative and quantitative research methods to ensure a comprehensive assessment of the effectiveness of podcast-based instruction in developing speaking and listening skills among master's students.

Questionnaires administered before and after the experiment served as the primary tool for evaluating changes in students' attitudes, motivation, and self-assessment of language skills. The pre-experimental questionnaire aimed to identify the baseline level of interest in podcasts, confidence in listening comprehension, and perceived speaking ability. The post-experimental questionnaire was designed to capture shifts in these indicators following four weeks of systematic exposure to podcast-based learning. The comparison of pre- and post-intervention data enabled the identification of changes in learners' motivation and self-perceived competence.

Analysis of oral responses was conducted throughout the experimental period during classroom activities, including oral summaries, discussions, and debates based on podcast content. This method allowed for the evaluation of students' speaking performance across several criteria, such as fluency, pronunciation, coherence, and argumentation. The oral responses of students in both experimental and control groups were comparatively analyzed to determine the impact of podcast integration on productive language skills.

Listening testing was used to objectively assess the development of receptive skills. Standardized listening tasks were administered before and after the experiment, with results measured on a 10-point scale. The tests evaluated students' ability to comprehend authentic English speech, identify key information, and interpret meaning in context. This approach provided measurable evidence of improvement in listening comprehension as a result of regular exposure to podcast materials.

Finally, statistical data processing was applied to analyze the collected data and ensure the reliability of the results. Descriptive statistics were used to summarize questionnaire responses and test scores, while comparative analysis of pre- and post-experimental results allowed for the identification of significant changes. The performance of the experimental and control groups was also compared to assess the effectiveness of the intervention. The integration of quantitative and qualitative data ensured a robust and evidence-based evaluation of the proposed teaching methodology.

Results and discussion

Podcasts provide an opportunity to optimize the learning process due to the creativity of both the teacher and the graduate students. The use of podcasts in the learning process

contributes to the comprehensive development of students. Graduate students can act in various roles when working with podcasts: as recipients, when they listen to a podcast and complete tasks compiled by the teacher to understand what they heard; and as creators within the framework of a productive approach, when they independently create and post their “author’s” podcast on the Internet (Odinokaya & Nesvetova, 2017).

Working with a podcast, when graduate students act as recipients, is absolutely no different from the traditional form of organizing the formation of listening skills and also includes three stages: before, during and after listening.

The results of the graduate students' survey showed the following:

Figure 1
Level of Interest and Confidence

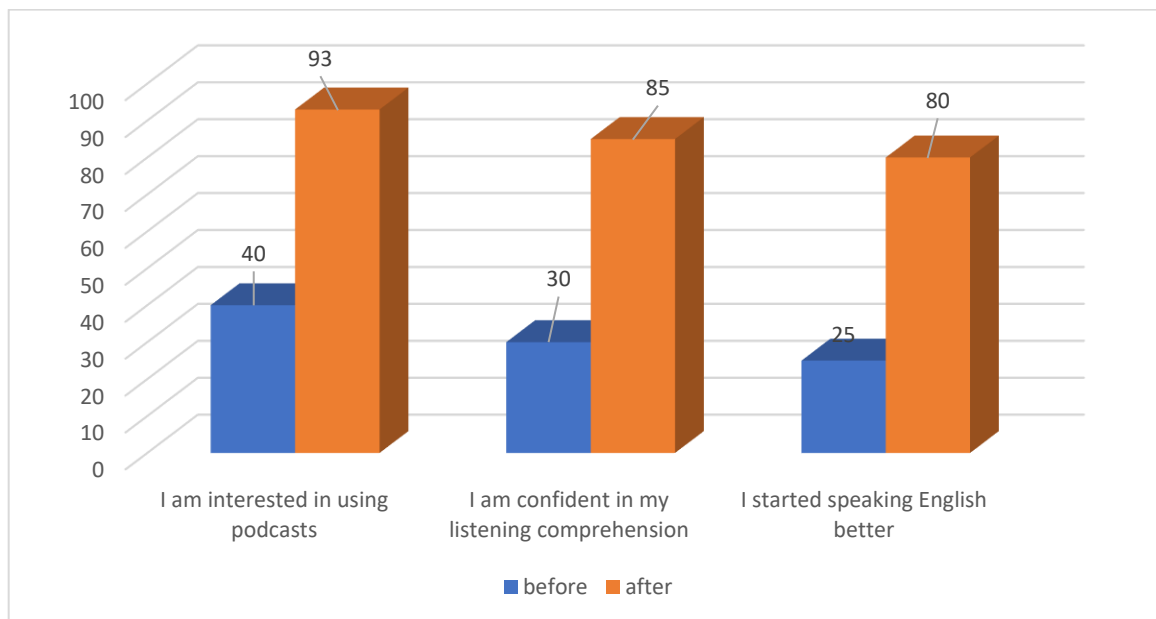


Figure 1 shows the change in respondents' attitudes and skills before and after using podcasts in learning English. After the introduction of podcasts, interest in them increased significantly: if before using them only about 40% of respondents showed interest, then after - already 93%. This indicates high involvement and a positive perception of this format of learning. Students' confidence in perceiving English speech by ear also increased significantly: before using podcasts, about 30% of participants expressed confidence, and after - about 85%. This suggests that regular listening to podcasts helps develop listening. In addition, the use of podcasts had a positive effect on speaking English: if before only about 25% of respondents believed that they spoke well, then after - already about 80%. Thus, podcasts have a complex positive effect on learning English, increasing both the interest and practical skills of students (Camelia et al., 2021).

Figure 2
Listening test results on a scale of 0 to 10

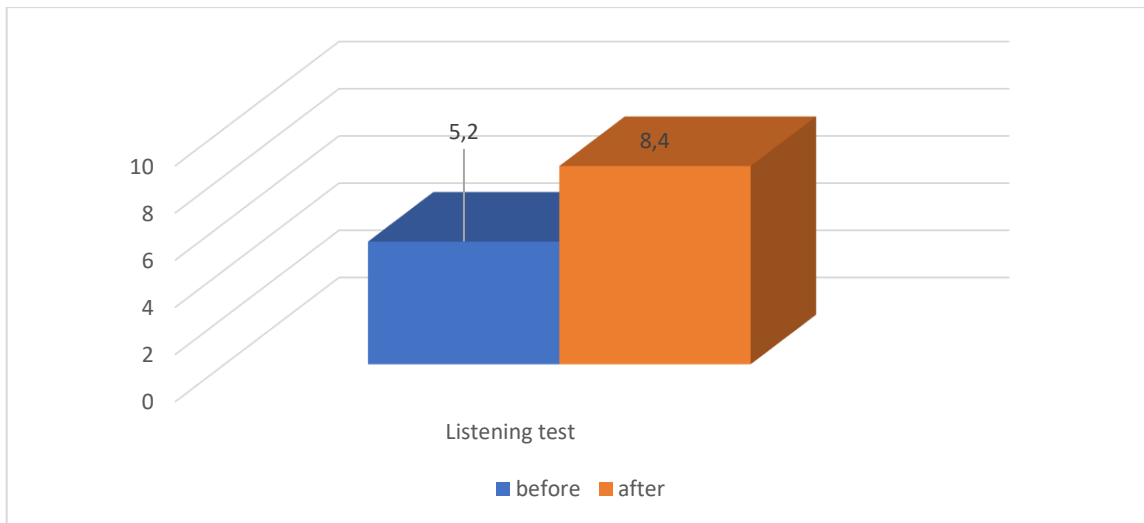


Figure 2 illustrates the listening test results before and after using podcasts. On a scale of 0 to 10, the average score before working with podcasts was 5.2, while after it was 8.4. This means a significant increase in the level of listening comprehension of English speech. An increase of almost 3.2 points indicates that podcasts had a noticeable positive impact on the development of listening skills. Thus, it can be concluded that listening to authentic materials contributes to a more effective perception of English speech (Kolker, 2002).

Figure 3
Speaking Skills Development Results on a Scale from 0 to 10

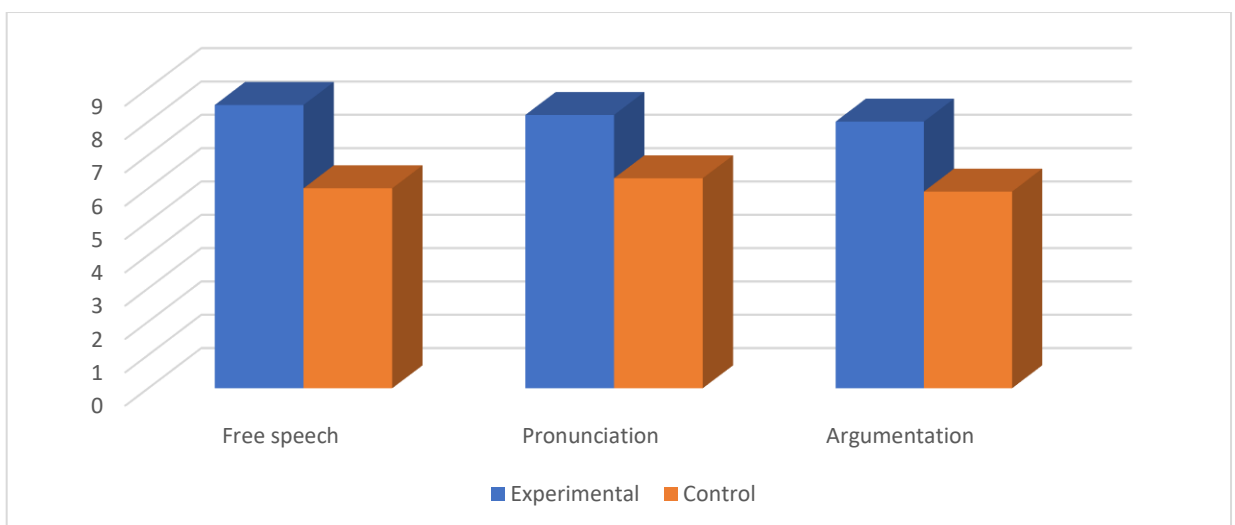


Figure 3 compares the results of the two groups, the experimental and the control, in three aspects of oral speech: fluency, pronunciation, and argumentation. The assessment was conducted on a scale from 0 to 10. In all three categories, the experimental group showed higher results compared to the control group. In fluency, the experimental group scored about 8.5

points, while the control group scored about 6. This indicates a higher ability to freely express their thoughts in those who participated in the experiment (probably associated with the use of podcasts or other methods) (Dewaele, 2019).

In pronunciation, the experimental group scored about 8.2 points, while the control group scored 6.3. This shows that the pronunciation work in the experimental group was more effective. As for argumentation, there is also a noticeable difference: about 8 points for the experimental group versus 5.9 for the control group. This indicates that students from the experimental group were better at formulating and justifying their thoughts.

Overall, these diagrams demonstrate a clear advantage of the experimental group in all indicators, which indicates a positive impact of the teaching method used in it (Ediyani et al., 2020).

The use of podcasts had a positive impact on master's students in the process of learning English. Firstly, podcasts significantly increased interest in the learning process, making it more exciting and motivating. Authentic audio materials contributed to engagement and allowed students to immerse themselves in a real language environment. Secondly, regular listening to podcasts improved listening skills. Master's students became more confident in understanding English speech at a natural pace and with various accents, which is especially important for successful communication in an academic and professional environment. Thirdly, listening and analyzing podcasts contributed to the development of oral speech. Students began to speak more freely, expressively and competently. Pronunciation improved, vocabulary expanded, and the ability to logically construct arguments and formulate thoughts increased. As a result, podcasts became an effective tool for the comprehensive development of master's degree students' communication skills (Giawa, 2022).

Conclusions

The study confirmed the high efficiency of using podcasts in teaching English to master's degree students. In the context of digitalization of education and the rapid development of information technology, podcasts are becoming one of the most relevant and accessible tools for developing language competence. They allow integrating learning into the daily life of students, creating conditions for continuous, autonomous and conscious language learning.

An analysis of the experimental work results showed that listening to podcasts contributes to the development of several key skills at once. Firstly, receptive skills, especially listening, improve significantly. Master's degree students begin to better perceive speech by ear, understand various accents and features of live conversational English, which is especially important for future specialists in the field of linguistics and intercultural communication. Secondly, podcasts have a positive effect on productive skills - speaking, pronunciation, argumentation. Working with podcasts, especially in combination with oral summarizing tasks, participating in debates or creating your own podcasts, develops fluency, expands vocabulary and improves the logic and coherence of statements.

In addition to language skills, podcasts help increase learning motivation. Master's students show greater interest in classes, become more active, begin to realize the value of authentic materials and their application in real life. This allows for more personalized and adaptive learning. A comparative analysis of the control and experimental groups also demonstrated a significant superiority of the latter in all assessment criteria. This indicates that traditional approaches are inferior to modern digital formats in terms of engagement and effectiveness of material acquisition.

Thus, we can conclude that podcasts are a powerful tool not only for improving individual language skills, but also for developing general communicative competence. Their use in educational practice of the Master's degree program is appropriate and necessary in the conditions of the modern digital educational environment.

Conflict of Interest Statement

The authors declare no potential conflicts of interests regarding the research, authorship, or publication of this article.

Author Contributions

Meruert Akbergenova, Marina Zhambylkyzy, and Nurettin Demir contributed equally to this work. All authors were involved in the conceptualization, methodology, data collection, analysis, and interpretation of the results. All authors participated in writing, reviewing, and editing the manuscript and approved the final version for publication.

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TEACHING RUSSIAN AND ENGLISH LOANWORDS IN KAZAKH VIA “NEWSPAPERS IN EDUCATION” FRAMEWORK

Abstract. This study explores the use of newspapers as a pedagogical tool to teach Russian and English loanwords in Kazakh using the Newspapers in Education (NiE) framework. In the multilingual post-Soviet context of Kazakhstan, loanwords play a significant role in both academic and everyday discourse; however, structured teaching methods are still lacking. This study presents and evaluates a newspaper-based instructional model that helps students recognize, analyze, and contextualize loanwords in authentic texts. A mixed-methods design was used in three stages: framework development, a six-week intervention, and a post-course evaluation. Ninety third-year students of the Kazakh language and Literature program at Korkyt Ata Kyzylorda University took part in the intervention, which involved analyzing newspapers from the Soviet times to the present day. Activities included group presentations using the Jamboard platform, semantic interpretation, and etymological analysis. A post-course Likert scale survey revealed strong student agreement with the value of the method and high internal reliability (Cronbach’s alpha = 0.924). Participants reported increased vocabulary, sharpened critical thinking, and increased awareness of borrowings. The results demonstrate how effective newspaper-based learning is in promoting vocabulary development and intercultural literacy, providing useful information for curriculum developers and language teachers working in multilingual environments.

Keywords: loanwords, Newspapers in Education (NiE), Kazakh language, Russian loanwords, multilingual education, authentic materials, language pedagogy.

Introduction

Newspapers, as a form of real-world discourse, introduce students to a variety of language structures, contemporary vocabulary, and text genres. Unlike traditional textbooks, which often rely on simplified or contrived content, newspapers present language in its natural, contextualized form, developing both communicative and critical literacy skills. The Newspapers in Education (NiE) program, implemented in over 52 countries, is an example of such a pedagogical approach that connects formal curricula with real-world information and develops critical 21st-century competencies. Programs like NiE show that newspapers are more than just sources of information about current events. Using newspapers in teaching has been shown to significantly improve students’ media literacy. NiE programmes aim “to inspire interactive approaches to teaching and to develop a generation of critically thinking and informed citizens”, as Simons et al. (2020) note. According to their study of 219 teacher candidates and 454 teachers in Flanders, newspapers were widely used, especially when they were distributed freely. More importantly, teachers were more likely to successfully integrate newspapers into their lessons when they used them and encouraged students to create their own media content.

“This reflects a pedagogical shift towards active learning strategies based on media engagement and critical consumption”. Claes and Quintelier (2009) offer further empirical support in their study of the Flemish NiE initiative, which involved over 3,400 secondary school students. They found that participants followed the news significantly more often, especially online, and demonstrated a modest but measurable increase in political knowledge. Importantly, vocational school participants showed greater gains in identifying school as a

source of political information, suggesting that NiE may be an equalizing mechanism for underrepresented or less academically inclined student groups. Newspapers stimulate pedagogical innovation when used in classrooms. Simons et al. (2020) found that teachers were highly satisfied with the NiE program, with over half of them believing that media literacy was necessary to teach. The use of the materials in classrooms continued beyond the two weeks, with 35% of teachers continuing to use the materials regularly. Teachers valued the versatility of newspapers and the opportunities they provided for cross-curricular learning, especially in reading, writing, and social studies. Importantly, newspaper use increased over time as teachers recognized the motivational power of news stories, especially for disadvantaged students or those with special needs.

This is consistent with earlier findings by Yapp et al. (2023), who reported that students who read newspapers in school were more likely to become regular readers, supported by commercial and societal benefits.

In addition to general literacy and engagement, newspapers can promote deeper critical thinking, particularly in science education. Head et al. (2020) demonstrated this in a study involving 61 students who critically read newspaper articles with scientific content. Their results showed that well-structured reading tasks that included the reasoning elements suggested by Riyanti et al. (2026) enabled students to carefully analyze evidence, identify bias, and evaluate claims using their scientific knowledge. For example, students reading about graffiti removal or Olympic swimsuit achievements were asked to identify the author's assumptions, evaluate the validity of the claims, and draw conclusions supported by scientific evidence. Although students initially trusted the text implicitly, by the end of the lesson, many began to question the credibility of the sources and recognize the lack of scientific evidence in journalistic texts. This illustrates how newspaper-based learning can promote higher-order thinking skills such as evaluation and synthesis.

Newspapers act as "living textbooks" that reflect the immediacy of social, political, and scientific events. As Song et al. (2025) suggested, newspapers can help students understand the core concepts and generalizations of the social studies curriculum while developing their reading, critical thinking, and problem-solving skills. Unlike traditional textbooks, newspapers offer topicality, relevance, and multiple perspectives, making them ideal for interdisciplinary learning. Claes and Quintelier (2009) note that NiE programs expose students to a variety of newspaper genres, including political analysis, sports commentary, and economic reporting, thereby expanding their vocabulary, comprehension strategies, and ability to distinguish between facts, opinions, and arguments. Moreover, students acquire functional media skills that extend beyond the classroom and into the public sphere.

NiE programs are particularly effective at engaging students from less privileged or professional backgrounds. Research shows that when students who do not have newspapers at home participate in NiE activities, they develop stronger attachments to the media as a lifelong habit. For example, Head et al. (2020) found that students initially unfamiliar with science journalism began to critically evaluate information through reading assignments. Similarly, evidence from Claes and Quintelier (2009) suggests that NiE reduces gaps in political knowledge and tolerance across socioeconomic groups. The use of newspapers also promotes differentiated instruction. Teachers in Simons et al. (2020) emphasized the value of adapting NiE materials for students with special needs and advocated for greater digital access to improve inclusivity. The increasing availability of online archives and digital tools, such as *Gopress* and *Newspaper Maker*, further facilitates personalized learning and media production, key skills in today's information society. Research also identifies some limitations and challenges associated with their use in educational contexts; however, newspapers have significant pedagogical potential in developing media literacy, civic engagement, and critical thinking. These shortcomings are due to both structural and pedagogical issues, including the

brevity of presentation, inadequate teacher training, student misconceptions, and the nature of journalistic content itself.

Another key issue is the superficial or mechanical use of newspapers in the classroom. As noted by Simons et al. (2020) and Claes and Quintelier (2009), some teachers view newspapers as mere routine tasks rather than opportunities for critical analysis. Teachers may rely heavily on the ready-made exercises provided by NiE programs without tailoring them to the specific needs or interests of their students. This reliance may result in students experiencing the tasks as monotonous or lacking depth. In qualitative interviews, students noted that such tasks sometimes felt “childish” to them. They involved little more than guessing names or summarizing articles, which did not encourage deeper understanding or critical analysis.

Students often accept newspaper content uncritically, especially in the absence of experience in media discourse analysis. Head et al. (2020) found that many high school students assumed that information published in newspapers must be accurate simply because it appeared in print. For example, students accepted erroneous scientific claims in an article about graffiti without questioning the lack of empirical evidence. Some even justified their acceptance by stating, “It is true because it’s in the newspaper”. This tendency to equate publication with truth highlights the risk of reinforcing naïve epistemologies when newspapers are not integrated into pedagogical approaches that explicitly teach source criticism. Students often struggle to apply critical thinking skills learned in school to real-life media consumption, despite structural interventions. Head et al. (2020) highlight that while students can engage in reflective thinking in the classroom, applying this thinking to external, uncontrolled contexts, such as interpreting online news or overcoming media bias, remains challenging. Many students were unable to distinguish between facts, opinions, and scientific evidence when analyzing course texts. The abstract nature of critical literacy, compounded by students’ limited prior experience with structured discussions or epistemological training, further hinders this transfer.

The success of newspaper-based pedagogy depends largely on teachers’ media literacy and pedagogical beliefs. Simons et al. (2020) found that the most consistent users of NiE materials were teachers who regularly incorporated media creativity into their teaching. However, many teachers lacked confidence in their ability to evaluate or teach media content, especially digital content. Teachers may avoid using newspapers altogether or revert to traditional lecture-based approaches that undermine the interactive goals of NiE programs in the absence of adequate professional development. Newspaper content is not always a perfect match for learning objectives, particularly in science and mathematics. As Head et al. (2020) noted, scientific information in newspapers is often simplified, anecdotal, or competition-based, making it difficult to directly align with the structured knowledge taught in classrooms. For example, many articles lack a theoretical basis, experimental data, or methodological transparency, limiting their usefulness for developing scientific thinking. Therefore, educators must make additional efforts to contextualize newspaper content and help students interpret it critically, a task that not all educators are prepared or have the resources to undertake. Finally, inequalities in access to and proficiency in digital technologies may limit the effectiveness of newspaper-based learning, especially as programs increasingly shift to online delivery. Simons et al. (2020) highlights that some educators and students did not have access to digital archives or learning platforms, limiting their ability to explore different sources or compare perspectives. Educators also lamented the lack of open access to online newspaper archives, which required subscriptions or special access codes. Such barriers prevent students from verifying information or conducting comparative analysis of sources, undermining one of the main goals of media education.

Thus, this study aims to apply the Newspaper in Education (NiE) program to teaching loanwords in Kazakh. Several objectives were formulated to achieve this aim:

- To examine the strengths and limitations of the “Newspaper in Education” (NiE) program.
- To develop an instructional framework based on the NiE approach to teaching loanwords.
- To implement this framework in teaching Russian and English loanwords in Kazakh using newspaper materials.
- To assess the effectiveness of the educational intervention through a participant survey.

Methods and organization of the research

This study used a mixed methodological approach (Kolisnychenko et al. 2025; Pregoner, 2024; Robinson & Williams, 2024) implemented in multiple stages to examine the effectiveness of teaching English and Russian loanwords in Kazakh using newspapers as teaching materials.

Phase 1: Theoretical Foundation and Framework Development

The first stage was devoted to the theoretical investigation of the “Newspapers in Education” (NiE) program. A comprehensive literature review was conducted to identify the pedagogical implications, advantages, and limitations associated with the NiE approach. Existing research on NiE was analyzed to assess the critical function of newspapers as authentic teaching resources, especially in the context of language acquisition. The researcher developed a customized teaching framework adapted for teaching loanwords in Kazakh using newspapers. This framework aimed to address previously identified shortcomings of the NiE program and to increase student engagement in learning real language data.

Phase 2: Instructional Implementation

In the second phase, the researcher implemented the new methodology into a six-week curriculum at Korkyt ata Kyzylorda University. Three groups of third-year students majoring in Kazakh Language and Literature participated in the project. The curriculum was designed to help students identify, analyze, and contextualize English and Russian loanwords found in contemporary Kazakh-language newspapers. Students were asked to complete tasks such as identifying loanwords in articles, exploring their etymology, and discussing their use in various fields, including politics, science, and technology.

Phase 3: Survey and Data Analysis

All students (N=90) were administered a structured survey to assess their perception of the curriculum and its impact on their understanding of loanwords after the end of the curriculum period. The survey included 20 Likert scale items (Kusmaryono et al. 2022) assessing students’ engagement in learning from newspapers, vocabulary development, etymological awareness, and perceived difficulty in dealing with borrowings.

The quantitative survey data were analyzed using the Statistical Package for the Social Sciences (SPSS) (Habes et al. 2021). The Cronbach’s alpha coefficient was 0.924, indicating a high level of reliability (Table 1). This suggests that the scale items demonstrate excellent internal consistency and are likely measuring the same underlying construct. In addition, the Cronbach’s alpha value calculated for the standardized items is slightly higher at 0.925, confirming the consistency of the scale even with standardized responses. According to generally accepted cutoff values, a Cronbach’s alpha value above 0.9 is considered excellent, indicating high reliability of the instrument for research or evaluation purposes.

Table 1
Scale reliability statistics

Reliability Statistics		
Cronbach's alpha	Cronbach's alpha based on standardized items	N items
,924	,925	20

Research results and discussion

Loanwords are an integral component of modern language systems, reflecting historical contacts, cultural exchange, and dynamic vocabulary development. In an increasingly globalized world, including loanwords in language teaching is not just useful; it is vital to equipping learners with the linguistic and communicative resources they need to interact effectively in a variety of contexts. One of the main justifications for teaching loanwords is their role in bridging lexical gaps. Many loanwords enter a language because the native lexicon lacks precise terms for certain foreign or new concepts. This is especially true in the fields of science, technology, economics, popular culture, and world politics. Learners unfamiliar with these loanwords may be unprepared to engage in debates, interpret media content, or understand academic texts in these areas. Teaching loanwords provides learners with access to and expression of contemporary realities that may not yet be represented in their native language proficiency. These words are commonly found in everyday communication, media, advertising, education, and entertainment. Mastering loanwords allows learners to understand and interpret authentic materials more effectively, thereby improving their overall language proficiency. Using loanwords correctly helps promote fluency and contextual appropriateness in both formal and informal settings, as many of them are used in spoken and written language.

Another important reason for including loanwords in the teaching process is to prevent misunderstandings. Loanwords often undergo semantic shifts, phonological adaptation, or morphological changes when acquired in the host language. Learners may mistakenly believe that a word borrowed from a familiar language retains its original meaning and pronunciation, which leads to false cognates and linguistic interference. Structured teaching helps clarify these discrepancies by explicitly explaining the changed meanings, functions, and phonological structure of loanwords in the new context. This prevents errors in interpretation and usage that can hinder effective communication. Loanwords serve as a valuable resource for developing intercultural competence that goes beyond their linguistic function. They often carry cultural, historical, or ideological connotations of the source language. Teachers can help students develop a deeper understanding of cultural diversity and global interconnectedness by exploring the origins, evolution, and sociocultural implications of loanwords. This approach encourages students to think critically about the interaction of languages and the influence of social factors, migration, globalization, and media on vocabulary.

Furthermore, incorporating loanwords into instruction is consistent with effective vocabulary acquisition strategies. Loanwords that are phonologically or morphologically similar to words in learners' native language can serve as cognitive anchors, enhancing retention and inferential learning. Recognizing these familiar elements helps learners decode meaning more effectively and expand their vocabulary. This form of linguistic scaffolding builds on learners' existing knowledge and improves their ability to make the cross-language connections that are essential for language development.

Finally, there is a pressing practical need to teach loanwords to meet real-world communicative needs. In many linguistic contexts, particularly in multilingual societies or globalized sectors such as media and education, loanwords are common. Ignoring loanwords is risky leaving learners unprepared for the realities of communication outside the academic setting in the classroom. Students will often encounter loanwords, whether they are reading an

article, watching a movie, or participating in a conversation. Detailed instruction ensures that they not only recognize and understand these words, but also use them confidently and appropriately. Teaching loanwords is essential, especially for pre-service teachers.

However, despite the growing recognition of the importance of loanwords in language education, there remains a noticeable lack of structured pedagogical approaches and methodologies specifically designed to teach them. This gap poses a serious challenge, especially in a multilingual context where loanwords play a crucial role in communication and culture. An educational framework for the systematic teaching of Russian and English loanwords in the context of the Kazakh language was developed to address this issue. This framework not only provides a structured method for introducing and contextualizing loanwords but also contributes to the development of learners' linguistic awareness, vocabulary acquisition, and intercultural competence.

English and Russian loanwords were taught within the framework of the Newspapers in Education (NiE) programs over a six-week teaching period for several reasons. The integration of authentic materials is becoming increasingly important, and newspapers are becoming one of the most pedagogically valuable resources in the context of contemporary language education. Their role in teaching borrowings, terms borrowed from one language and incorporated into another, is of particular importance, especially in multilingual societies and globalized language environments. Newspapers not only reflect actual language use but also reflect ongoing lexical borrowing, making them an ideal medium for teaching borrowings in meaningful contexts.

First, newspapers serve as a rich source of authentic linguistic information, often including loanwords from dominant world languages such as English, Russian, and Arabic. These loanwords appear in a variety of registers and genres, from headlines and editorials to advertisements and cultural commentary, giving learners natural access to loanwords used in real life. According to research on the use of newspapers in language teaching, learners benefit from exposure to vocabulary in context, where meaning is reinforced by surrounding, linguistic, and thematic cues. Such contextualization improves both the recognition and retention of loanwords.

Second, the use of newspapers allows teachers to illustrate the functional and stylistic role of loanwords. Loanwords are often used to convey modernity, accuracy, or relevance to global discourse, particularly in areas such as business, technology, fashion, and international politics. Newspapers provide current and relevant examples of such usage, allowing students to observe how loanwords are used to create tone, reflect socio-cultural trends, or appeal to a particular audience. This not only enriches students' vocabulary repertoire but also enhances their sociolinguistic competence by helping them understand why and how loanwords are used in public discourse.

Furthermore, learning loanwords through newspapers promotes critical reading skills and vocabulary development. Students are encouraged to infer the meaning of unfamiliar loanwords by analyzing headlines, context, visuals, and topical content. This process facilitates deeper engagement with text and develops independent learning strategies. As noted in the literature, such skills are essential for students to become independent language users who can navigate unfamiliar lexical units in various communicative contexts.

Importantly, newspapers also provide a platform for studying the linguistic transformation of loanwords, including phonological adaptation, semantic shift, morphological integration, and code-switching. Newspaper articles allow for comparative analysis of the source language and the adapted loanword in the target language when used in the classroom. For example, students can analyze how English words are transformed when integrated into Kazakh and discuss any changes in meaning or usage.

Moreover, using newspapers as a source for learning loanwords promotes interdisciplinary and cross-cultural inquiry. Students are exposed to vocabulary that reflects the interrelationships of cultures and languages by reading articles on international relations, scientific innovations, and global entertainment. Loanwords serve as linguistic evidence of cultural exchange, and newspapers serve as a gateway to understanding these cross-cultural dynamics. This not only promotes language acquisition but also develops students' global literacy and cultural sensitivity.

Ultimately, teaching loanwords through newspapers is consistent with learner-centered pedagogical principles that emphasize relevance, authenticity, and engagement. Activities such as identifying, categorizing, and analyzing loanwords can be tailored to the interests and academic needs of learners. They also promote collaborative learning, critical discussion, and application of learned knowledge to real-life situations. This approach is effective in reaffirming learners' linguistic realities while simultaneously promoting formal language development in multilingual classrooms, especially in post-Soviet or postcolonial contexts.

A key component of the course was a longitudinal study of Russian and English loanwords in Kazakh through the lens of historical and contemporary newspapers. Students were assigned a comparative assignment that involved analyzing newspaper articles published in three different periods: the Soviet era, the early years of Kazakhstan's independence, and the present, to provide learners with a deeper understanding of lexical borrowings and language change.

Students systematically identified Russian and English loanwords embedded in newspaper discourse throughout the course. Each identified term was analyzed for its meaning, etymological origin, and, where appropriate, a Kazakh equivalent. This process not only strengthened skills in lexical analysis and semantic interpretation but also deepened understanding of linguistic adaptation and cultural mediation. Particular attention was paid to tracking the evolution of the function, frequency, and connotation of loanwords in the selected historical periods. For example, Russian lexical loanwords often dominated and were ideologically entrenched in Soviet-era publications. At the same time, English loanwords began to play an increasingly prominent role in technology, commerce, and youth culture.

Importantly, students were encouraged to go beyond simple lexical identification and engage in critical discourse analysis. They explored how socio-political contexts impacted the meanings and roles of borrowed words, including the strategic use of borrowed terms to signal modernity, prestige, or ideological affiliation. This critical approach highlighted the dynamic nature of language and the interplay between language, power, and identity. Students discussed issues such as lexical purity, linguistic nationalism, and the cultural implications of borrowing in postcolonial language settings.

Students presented their findings using the *Jamboard* digital platform to consolidate learning and facilitate collaborative knowledge construction. This interactive tool allowed them to map linguistic trends, share comparative examples, and reflect on their observations visually. The use of *Jamboard* not only facilitates student engagement and interaction with peers but also integrates digital literacy skills, aligning with contemporary pedagogical practices in language education.

Figure 1

Examples of student analysis of loanwords from Soviet-era, post-independence, and contemporary Kazakh newspapers using the Jamboard platform



Figure 2

Visual presentation of loanword categorization and etymological mapping by students during the instructional intervention



This learning component demonstrated the pedagogical value of combining authentic materials, historical analysis, and digital tools in teaching loanwords. It allowed students to reflect on the lexical layers of the Kazakh language critically, understand the socio-historical factors influencing language change, and appreciate the nuances of the development of loanwords from Russian and English in a multilingual context.

Upon completion of the course, students were asked to complete a questionnaire to evaluate the effectiveness of the teaching methodology. Table 2 presents descriptive statistics for the 20-item scale designed to assess students' perceptions of the use of newspapers to

facilitate understanding of loanwords in the Kazakh language. Each item was rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Responses were received from 90 participants, with item 20 having a smaller sample size (N=73), likely due to missing responses for individual items. The mean values indicate a generally positive attitude toward the use of newspapers to teach loanwords, with most items' mean values ranging from 3.54 to 4.09. The highest mean (M=4.09, SD=0.830) was found for item 18 (“Learning about the etymology of loanwords deepens my understanding of global language influences”), indicating that students particularly valued the etymological component as a significant cognitive advantage of this approach. Similarly, item 4, 8, and 19, all with means about 4.00 or higher, reflect students' understanding of the importance of vocabulary development, domain-specific use of loanwords, and their relevance to academic and professional discourse.

Items with moderately high mean values were item 3 (M=3.86), suggesting that encountering loanwords in authentic news contexts enhances comprehension, and item 20 (M=3.86), suggesting the need to include more lessons devoted to learning loanwords from the media. Other highly rated statements include Item 17 (M=3.92), which deals with the replacement of some loanwords with native equivalents, and Item 5 (M=3.91), which deals with critical thinking prompted by translation tasks.

At the lower end of the spectrum, item 9 (“Teaching loanwords in the context of newspapers is more beneficial than just learning them from textbooks”) received the lowest mean score (M=3.54, SD=0.781), although it was moderately positive. This may indicate a perception that while newspapers are useful, they are best used in conjunction with more structured materials such as textbooks. Similarly, items 7 and 13, concerning the Russian-English transfer path of loanwords, received scores below the overall item mean, indicating perceived difficulty or complexity in these patterns (M=3.58 and M=3.57, respectively). Item standard deviations are generally low to moderate (ranging from 0.758 to 0.949), indicating relatively uniform responses across participants. The greatest differences in responses were observed for items 7, 8, 12, and 13, possibly due to different levels of awareness or experience with loanwords derived from Russian.

The descriptive results demonstrate a positive perception of newspaper-based learning as an effective tool for understanding, contextualizing, and critically analyzing loanwords in Kazakh. Students value the importance of etymological analysis, contextualization of usage, and multilingualism developed through such integrative learning.

Table 2

Results of the survey on students' perceptions of instruction using newspaper-based loanwords

	N	Minimum	Maximum	Mean	Standard deviation
1. Learning loanwords through newspaper articles helps me better understand their meaning and usage.	90	1	5	3,63	,827
2. The method of analyzing loanwords in newspapers is effective for language learning.	90	1	5	3,73	,818
3. I can understand loanwords when they appear in a real context, such as a news article.	90	2	5	3,86	,758
4. The task of finding loanwords and providing their definitions and etymology helped improve my vocabulary.	90	1	5	4,00	,861
5. Creating equivalents for loanwords in Kazakh encouraged me to think more critically about the language.	90	2	5	3,91	,793
6. Taking screenshots of loanwords in real articles made the learning process more interesting.	90	2	5	3,73	,832
7. Loanwords in Kazakh are mostly borrowed through Russian rather than directly from English.	90	1	5	3,58	,936

8. I noticed that most loanwords are used in specific fields such as technology, economics, or politics.	90	1	5	3,93	,934
9. Teaching loanwords in the context of newspapers is more beneficial than just learning them from textbooks.	90	1	5	3,54	,781
10. The use of trilingual education in Kazakhstan (Kazakh, Russian, English) makes it necessary to understand loanwords in all three languages.	90	2	5	3,91	,774
11. I feel more confident reading Kazakh newspaper articles after learning about loanwords.	90	1	5	3,70	,867
12. The adaptation of foreign words into Kazakh using Russian language patterns is an effective strategy.	90	1	5	3,77	,937
13. I believe that borrowing from English through Russian creates additional challenges for Kazakh language learners.	90	1	5	3,57	,949
14. I can distinguish whether a loanword comes from English, Russian, or another language.	90	1	5	3,66	,850
15. Newspaper articles provide authentic examples of how loanwords are used in everyday communication.	90	1	5	3,79	,868
16. I believe loanwords enrich the Kazakh language.	90	1	5	3,88	,885
17. Some loanwords should be replaced with original Kazakh equivalents when possible.	90	1	5	3,92	,824
18. Learning about the etymology of loanwords deepens my understanding of global linguistic influences.	90	1	5	4,09	,830
19. Loanwords are an important part of modern Kazakh, especially in academic and professional settings.	90	1	5	4,03	,785
20. I think more classes should focus on identifying and understanding loanwords in media and public discourse.	73	1	5	3,86	,805
N valid (according to the list)	72				

Conclusion

This present study addresses a topical and pedagogically significant issue at the intersection of vocabulary teaching, multilingual education, and the use of authentic materials. In the era of linguistic hybridity, cultural exchange, and rapid globalization, teaching loanwords has become a critical aspect of contemporary language education. Loanwords, as lexical units borrowed from other languages, not only fill semantic gaps but also serve as markers of historical, cultural, and technological change. Their prevalence in contemporary discourse, especially in the media, education, and professional spheres, requires language learners and future teachers to be able to interpret, contextualize, and use them appropriately. Integrating newspapers as pedagogical tools creates an authentic, dynamic, and contextually rich environment that facilitates achieving this goal.

The primary aim of the study was to implement the “Newspapers in Education” (NiE) program to develop and evaluate a pedagogical framework for teaching loanwords from Russian and English in the Kazakh language. Four main objectives were achieved to achieve this goal: (1) to explore the strengths and limitations of the NiE program; (2) to create a structured teaching framework based on NiE principles; (3) to execute this framework through a six-week teaching intervention with the Kazakh Language and Literature students; and (4) to assess its effectiveness through student feedback and statistical analysis.

The study employed a mixed-methods approach. In the first stage, the theoretical foundations were laid through a literature review on NiE and loanword pedagogy. In the second stage, the framework was piloted with three student groups at Korkyt Ata Kyzylorda University. The learning content included an analysis of newspapers from the Soviet, post-independence, and contemporary periods, with students identifying, categorizing, and contextualizing loanwords. In the third stage, 90 participants completed a 20-item Likert scale survey to assess their perceptions of the teaching methodology. High reliability (Cronbach’s

alpha = .924) confirmed the internal consistency of the instrument. The results of the study were overwhelmingly positive. Survey responses indicated that students found newspaper-based learning effective in expanding vocabulary, increasing awareness of the etymology and uses of loanwords, and developing critical reading skills. Tasks related to etymological analysis, academic relevance, and the multilingual context of Kazakhstan received particularly high scores, indicating that students appreciated both the cognitive depth and the real-life applicability of the approach. Students also noted the role of newspapers in providing reliable examples of the use of loanwords and appreciated the opportunity to critically analyze the transformation of vocabulary across historical periods. The use of the *Jamboard* platform further facilitated student engagement, digital literacy, and collaborative analysis.

The study had its limitations despite these promising results. The duration of the educational intervention was relatively short (six weeks), limiting the possibility of long-term tracking of retention or transfer. The sample was drawn from a single institution and a single discipline, which may affect the generalizability of the results. Moreover, qualitative data, such as interviews with focus groups, could have enriched the interpretation of the students' experiences, while the survey provided quantitative information. Another issue relates to the complexity of Russian-English-Kazakh lexical transfers, which some students found difficult to untangle, highlighting the need for additional support in future iterations of the program. This study is of particular value to language teachers, curriculum developers, and applied linguists working in multilingual and post-Soviet settings. It offers an empirically grounded and pedagogically innovative framework for incorporating loanwords into language teaching through the use of authentic materials. It is particularly relevant for teacher education programs aimed at preparing pre-service teachers to teach in trilingual environments. More broadly, the study contributes to ongoing debates about the integration of media literacy, critical thinking, and culturally responsive pedagogy into language education. The study confirms the enduring educational potential of real texts in developing multilingual competence and global awareness, demonstrating how newspapers can serve not only as a source of linguistic information but also as sites for cultural and linguistic inquiry.

Conflict of Interest Statement

The author declares no potential conflicts of interest regarding the research, authorship, or publication of this article.

The use of artificial intelligence (AI)

The capabilities of AI were used to search and analyze the references and perform preliminary language editing.

Author contribution

The author confirms the sole responsibility for the conception of the study, the presentation of results, and manuscript preparation.

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THE IMPACT OF DIGITAL EDUCATIONAL PLATFORMS ON STUDENTS' LEARNING MOTIVATION IN ENGLISH LANGUAGE ACQUISITION AT UNIVERSITIES IN KAZAKHSTAN

Abstract. The relevance of the study is determined by the need to enhance students' learning motivation in the context of educational digitalization, where traditional methods of teaching English are losing effectiveness under distance and blended learning formats. The aim is to conduct a comprehensive analysis of the impact of digital educational platforms on students' motivation in learning English and to identify ways to enhance their effectiveness in Kazakhstan's higher education system. The methodology is based on the analysis of academic literature on digital learning motivation, the systematization of platform characteristics, and elements of comparative and structural-functional approaches to evaluate their didactic potential. Results indicate that interactivity, adaptivity, and timely feedback enhance students' cognitive and emotional engagement, autonomy, and goal orientation. Future research prospects involve exploring the influence of adaptive algorithms and learning analytics on long-term motivation, as well as developing region-specific strategies to overcome infrastructural and social barriers to digital education.

Keywords: digital learning environment, motivational strategies, language engagement, gamification, learner autonomy, multimedia content, feedback mechanisms.

Introduction

Modern trends in the digital transformation of education necessitate a reassessment of traditional approaches to teaching foreign languages, including English as the primary means of international academic and professional communication. In the context of the rapid development of information and communication technologies, digital educational platforms gain particular importance; integrating them into the learning process opens up new opportunities to increase learners' motivation, personalize instruction, and foster a sustainable interest in language practice. However, despite the widespread adoption and popularity of these tools, their impact on the motivational aspects of learning remains unclear and warrants further scholarly reflection.

The relevance of this issue stems from the necessity to cultivate students' stable learning motivation in remote and blended learning formats. This need became especially acute in the post-pandemic period. On the one hand, digital platforms offer flexibility and accessibility to educational content; on the other hand, they may lead to cognitive overload, reduced engagement, and superficial assimilation of material in the absence of adequate pedagogical support. In this context, it is crucial to identify the patterns and mechanisms through which digital learning environments influence students' intrinsic and extrinsic motivation, including their academic engagement, goal orientation, and self-esteem.

Addressing this issue has both theoretical and practical significance. From a scientific standpoint, studying the motivational potential of digital educational platforms deepens our understanding of the psychological and pedagogical foundations of digital learning, refining models of motivational interaction in virtual educational environments. Practically, the results of such analysis can be used to develop adaptive English teaching methodologies that enhance the effective use of digital resources in Kazakhstani universities. This, in turn, aligns with the

goals of modernizing higher education in the country, aimed at integration into the global educational space and the development of teachers' digital pedagogical competence.

Research objective is to analyze the influence of digital educational platforms on the level of students' learning motivation in the process of English language acquisition, and to determine ways to enhance their usage effectiveness in Kazakhstani higher education institutions.

To achieve this objective, the following tasks have been set:

- analyze the potential of digital educational platforms in shaping students' cognitive and emotional engagement in English language learning;
- identify the main components of learning motivation and uncover the barriers to digital participation in language instruction;
- formulate recommendations for strengthening the motivational impact of digital platforms within the system of higher language education.

Literature review

Analysis of current studies dedicated to the impact of digital educational platforms on students' motivation in learning English reveals four thematic directions:

The first direction involves analyzing the educational potential of digital platforms in fostering students' cognitive and emotional engagement. K. Zh. Karabaeva and B. A. Abdraimova emphasize the role of the informational space created by digitalization as an environment for the development of language competence, directly affecting motivation in linguistic universities (Karabaeva & Abdraimova, 2020). E. S. Burdina demonstrates that platforms enable individualized approaches in teaching English, thereby increasing students' interest and facilitating knowledge acquisition (Burdina, 2023).

M. V. Zakharova notes that digital tools provide content visualization, enhance emotional engagement, and support the sustainable formation of learning motivation (Zakharova, 2020). N. S. Dotsenko emphasizes how digital technologies alter the structure of motivation, shifting the focus toward cognitive and professionally oriented interest (Dotsenko, 2024). H. M. Alakrash et al. prove the effectiveness of digital platforms in creating flexible educational environments adapted to individual student needs, thereby activating their intrinsic motivation (Alakrash, Razak, & Krish, 2022). Further study of the relationship between platform type and cognitive engagement, especially regarding academic autonomy, is warranted.

The second direction investigates mechanisms by which digital learning environments shape motivational attitudes toward English as a second language. M. A. Bhatti and S. A. Aldubaikhi explore the role of informal digital learning in fostering positive attitudes and self-determination in English learning (Bhatti & Aldubaikhi, 2023). F. Masitoh, I. Fitriyah, and I. K. Mumtaza highlight the significance of flexible online learning formats in promoting inclusivity and positively affecting academic motivation (Masitoh, Fitriyah, & Mumtaza, 2024).

N. Natasha and M. Jannah show that convenience, instant feedback, and adaptive content are key motivational drivers in digital learning (Natasha & Jannah, 2024). J. Jerković, B. Komaromi, and D. Rakić compare motivational effects of online courses with traditional learning, revealing that digital formats better support academic engagement (Jerković, Komaromi, & Rakić, 2022). Further empirical research should focus on changes in motivation structure as a function of the duration and intensity of platform usage.

The third direction concerns the influence of social-media platforms as tools for informal language learning. A. Meirbekov, S. Nyshanova, A. Meirbekov et al. compare the effectiveness of educational blogs on TikTok and Instagram with traditional formats, noting that visually rich, socially relevant content significantly enhances student motivation (Meirbekov et al.,

2024). I. Shakhmalova and N. Zotova emphasize the effectiveness of educational games in digital learning, combining emotional engagement with grammatical accuracy and encouraging repeated practice (Shakhmalova & Zotova, 2023). T. Meng, A. Faizan, B. Qu, and C. He highlights the role of subjective satisfaction with the platform as a determinant of intrinsic motivation and sustained participation (Meng et al., 2024). Future studies should explore blended approaches that combine informal and formal digital sources for English language learning.

The fourth direction addresses behavioral and cognitive consequences of using digital platforms for English learning. M. Lamb and F. E. Arisandy show that frequent use of English in digital environments boosts students' confidence in language communication and fosters a sustained interest in the language (Lamb & Arisandy, 2020).

U. Noor, S. Ali, N. Yousaf et al. identify that students' behavioral strategies in digital space are predictors of their learning motivation and success (Noor et al., 2022). N. P. Harvey Arce and A. M. Cuadros Valdivia study the role of gamification in supporting competitive interest and increasing cognitive engagement in language learning (Harvey Arce & Cuadros Valdivia, 2020). Future work should consider the neuropsychological effects of digital learning on memory, attention, and the regulation of motivation.

Materials and methods

The study is based on the analysis of functional characteristics of the most widely used digital educational platforms in English teaching at Kazakhstani universities: Moodle, Google Classroom, Quizlet, Microsoft Teams, and Duolingo for Schools. The empirical foundation includes data on their use in various national and regional universities, obtained from open sources and summarized in institutional reports and educational portals.

Empirical data was taken from official documents of the Ministry of Science and Higher Education of the Republic of Kazakhstan (2024), as well as from publicly accessible institutional reports and materials presented on the official websites and methodological centers (e.g., Nazarbayev University CiLT, Al-Farabi Kazakh National University Smart Learning Lab, M. O. Auezov South Kazakhstan University). Their selection was related to their credibility, recent publication, and practical applicability for the research problem.

Inclusion criteria for the literature review were the scientific publications, peer-reviewed journal articles, official reports, empirical studies, and the materials of conferences published between 2020 and 2025. All such sources directly addressed the motivational aspects of digital educational platforms in English language learning. Also, they were related to the usage of digital education platforms in higher education and their contribution to students' motivation, interest, and learning autonomy when learning English language.

Exclusion criteria for the literature review were the sources that dealt only with general ICT use in education without a focus on motivation or language acquisition. Only cases providing documented evidence of platform integration into English teaching were included, while general digitalization initiatives without explicit reference to language instruction were omitted.

Methodology consisted of an integration of content analysis and a structural-functional approach. Utilization of content analysis consisted of the coding, identification, and incorporation of motivational factors within the literature and institutional materials chosen for the analysis.

Utilization of the structural-functional approach allowed for an analysis of the interaction of the functional features of digital platforms with the formation of cognitive engagement, self-regulation, and intrinsic motivation. It allowed to assess the didactic potential of platforms in shaping cognitive and emotional engagement. Systematization of motivational components

was performed via content analysis of psychological and pedagogical studies on digital learning.

Comparative analysis methods were used to contrast factors affecting student motivation in digital environments. Logical generalization and graphical systematization methods were employed to identify links between platform types, digital interaction forms, and levels of learning engagement.

These methods also carried out for the purpose of establishing convergences and divergences of the integration of digital platforms among universities within different locations within the nation of Kazakhstan, for the purpose of forming a more nuanced understanding of motivating factors among students.

The choice of these methods is driven by the need for a comprehensive examination of both technological and motivational-psychological aspects of the problem studied.

Results

Digital educational platforms have become an essential tool for transforming the traditional learning process in higher education in recent years. Against the backdrop of rapid advances in information technology and the shift toward blended and distance learning formats, their use in teaching English is particularly pertinent. This is explained not only by the need to provide flexible access to instructional materials but also by the desire to increase students' learning motivation through interactivity, multimedia capabilities, and the personalization of educational content. Digital platforms offer extensive opportunities for organizing independent study, monitoring knowledge acquisition, implementing formative assessments, and delivering feedback, making them especially valuable in foreign language instruction. Within Kazakhstan's higher-education landscape, both global and local digital solutions are being gradually adopted and tailored to meet institutional needs, technical infrastructure, and instructors' varying levels of digital competence. The comparative table below outlines the most widely used digital educational platforms for teaching English (Table 1).

Table 1.

Comparative characteristics of digital educational platforms used for teaching English in Kazakhstani universities

Platform Name	Primary Purpose	Functional Capabilities	Degree of Adaptation to Higher Education	Advantages of Learning English
Moodle	Learning Management System	Integration of videos, quizzes, forums, and flexible course customization	High	Structured learning, convenient for independent study
Google Classroom	Distance-learning organization	Cloud storage, integration with Google Docs, comments	Medium	Simple interface, fast feedback
Quizlet	Vocabulary study	Flash cards, quizzes, and gamification elements	High	Vocabulary expansion, motivation through game formats
Microsoft Teams	Communication platform + LMS	Video calls, file sharing, assignments, and integration with OneNote	Medium	Synchronous learning, support for teamwork
Duolingo for Schools	Individual language learning	Adaptive exercises, point system, feedback	Limited	Autonomous reinforcement of basic skills in game form

Source: compiled by the authors from materials. (Moodle, 2025; Google Classroom, 2025; Quizlet, 2025; Microsoft Teams, 2025; Duolingo for Schools, 2025)

The use of digital educational platforms in Kazakhstan’s higher education demonstrates a stable trend toward integrating hybrid and distance learning formats into English-language instruction. The most functionally rich and versatile system is Moodle, which enables instructors to create comprehensive courses with modules, testing, and analytics, providing comprehensive management of the learning process (Moodle, 2025).

In situations that require prompt action and minimal digital barriers, Google Classroom is widely used due to its ease of setup and synchronization with Google accounts (Google Classroom, 2025). Quizlet has established itself as an effective tool for vocabulary practice and short test formats, especially in individual and pair work (Quizlet, 2025).

Microsoft Teams is used primarily as a synchronous environment for video sessions and group projects, offering enhanced communication capabilities (Microsoft Teams, 2025).

Duolingo for Schools plays a supportive role in forming students’ language habits through the regular completion of mini-tasks and instant feedback (Duolingo for Schools, 2025).

The practical application of these platforms demonstrates that the motivational effect is most pronounced when multimedia, interactive, and trackable formats are combined, which not only increases student engagement but also enhances the autonomy of their learning activities. The effectiveness of platforms directly depends on course instructional design, the instructor’s level of digital literacy, and support from university administration.

Learning motivation is a complex, multi-component system that encompasses both the learner’s internal attitudes and external stimuli, ensuring a sustained drive to acquire knowledge and achieve learning goals. In the context of educational digitalization, the traditional structure of motivation is transforming, as the digital environment imposes new demands on student activity, self-organization, digital literacy, and the perception of virtual content. At the same time, motivational mechanisms in online learning largely depend on the quality of the digital interface, the availability of interactive content, platform adaptability, and the level of feedback and personalization of the educational experience. In the digital environment, such components of motivation as autonomy, intrinsic interest, a sense of competence, and the ability to monitor progress become especially important.

Based on an analysis of contemporary pedagogical and psychological literature, as well as the practical functioning of digital platforms, several key components of learning motivation relevant specifically to the digital educational space can be identified. They are presented in Table 2.

Table 2.

Key components of learning motivation in the digital educational environment

Motivation Component	Content in Digital Context	Significance for English Language Learning
Autonomy	Ability to independently control the pace and trajectory of learning	Increases responsibility for results, stimulates regular practice
Competence	Awareness of progress and successful completion of tasks	Builds confidence when performing speaking and grammar exercises
Goal-setting	Clear understanding of learning goals and stages	Helps plan a study better and achieve interim results
Feedback	Availability of instant or periodic evaluation of results	Clarifies errors, reinforces correct actions
Emotional Engagement	Interest, aesthetic appeal, and gamification elements	Maintains sustained attention and desire to return to activities
Social Interaction	Opportunity for communication and collaboration with the instructor and peers	Enhances sense of belonging and reduces anxiety when learning the language

Source: compiled by the authors from materials. (Bhatti & Aldubaikhi, 2023; Meng et al., 2024; Masitoh et al., 2024; Noor et al., 2022)

In practice, the successful engagement of learning-motivation components in the digital educational environment requires thoughtful instructional design in which each component performs a specific function.

The autonomy component is implemented through anytime access to materials, the ability to choose task sequences, and independent workload planning – particularly effective in English learning, where regular yet flexible practice is essential.

Competence is reinforced by progress-visualization tools: digital platforms display task-completion statistics, error levels, and topic-mastery indicators, giving students a sense of growth and boosting confidence, which is vital for productive tasks (essay writing, oral activities).

Goal-setting is realized via a modular course structure: each module has its own objective, skill set, and success criteria, allowing students to view the learning process as a manageable pathway rather than an endless information stream. Instant feedback – one of digital platforms' strongest features – must be substantive as well as automatic, explaining errors and suggesting additional resources or tasks, thereby promoting meaningful learning rather than merely formal test completion.

Emotional engagement is heightened through unconventional tasks (quizzes, gamification, video work) and visually appealing interfaces; students more readily engage in activities that elicit an emotional response and provide enjoyment.

Social interaction is especially critical in learning English: forums, discussions, pair work, and online role-plays create a motivational environment in which students are included in a learning community rather than isolated. Digital technologies support such communication regardless of physical presence, increasing engagement and reducing anxiety in speaking tasks.

Kazakhstan's digital transformation of education has recently gained strategic importance, driven by the COVID-19 pandemic and state programs aimed at digitalizing higher education. Digital educational platforms have become key tools for maintaining and updating the learning process, including English instruction. Yet their integration into teaching practice remains uneven, depending on infrastructural, organizational, and methodological factors such as access to ICT, instructors' digital competence, university administrative support, and the availability of adapted materials.

Reports from the Ministry of Science and Higher Education of the Republic of Kazakhstan indicate that digital platform implementation is often mandated administratively without prior pedagogical expertise or evaluation of effectiveness within specific disciplinary contexts (Ministry of Science and Higher Education of the Republic of Kazakhstan, 2024; Ministry of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan, 2020). Consequently, platforms are sometimes used formally, integrated without regard to subject specifics, learning goals, or student needs.

This is particularly problematic in foreign-language instruction, where active interaction, prompt feedback, individualized tasks, and gamification are essential for success. Without these components, the digital environment loses motivational potential and teaching devolves into simple information transmission. Therefore, identifying factors that genuinely facilitate or hinder the effective didactic integration of digital platforms into English teaching at Kazakhstani universities becomes a crucial task (see Table 3).

Table 3.

Factors influencing the effectiveness of implementing digital platforms in teaching English in Kazakhstani universities

Factor Group	Typical Manifestations in Kazakhstani Universities	Potential Impact on Learning Effectiveness
Infrastructure	Availability of stable Internet access; presence of computers and digital classrooms	Without a technical base, even the best platforms cannot operate effectively
Organizational-managerial	Administrative support, presence of standards, stimulation of digital activity	Shapes sustainability and institutional motivation
Methodological	Instructors' readiness to adapt content and lesson formats to the digital environment	Determines how fully the platform is integrated into the learning process
Staffing	Level of instructors' digital and language competence; participation in training	Affects the quality of material delivery and interaction with students
Student-centered	Students' readiness for self-directed learning, digital literacy, and motivation	Conditions for the actual use of platforms outside the classroom

Source: compiled by the authors from materials. (Karabaeva & Abdraimova, 2020; Dozenko, 2024; Burdina, 2023; Natasha & Jannah, 2024)

An analysis of official reports (Ministry of Science and Higher Education of the Republic of Kazakhstan, 2024; Government of Kazakhstan, 2024) and faculty interviews shows that the level of integration of digital platforms into English-language teaching at Kazakhstani universities differs not so much by the type of platform used as by the depth of their didactic application.

At Nazarbayev University, Moodle serves as the primary learning environment, providing a modular course structure, automated assignment checking, integration of interactive video via Edpuzzle, as well as tasks with elements of self- and peer-assessment, indicating a high degree of integration (Nazarbayev University, 2025).

At Al-Farabi Kazakh National University, Moodle and Microsoft Teams are also utilized; however, instructors note a lack of methodological support, resulting in the irregular use of tools such as adaptive tests and gamification, which suggests a medium level of integration (KazNU, 2025).

In regional universities, such as M. Auezov South Kazakhstan University, platforms (primarily Google Classroom) function mainly as file repositories: assignments are posted as documents, while interactive and game-based formats are scarcely used, indicating a low level of didactic integration (M. Auezov University, 2025).

Thus, differences in the level of integration lie not in the mere presence of a platform but in the extent of its functional and methodological mastery – ranging from simple file exchange to the whole organization of adaptive, motivation-rich learning.

The actual effectiveness of digital platforms depends less on their technical availability than on instructors' level of digital pedagogical readiness. University centers for methodological support play a significant role in this process, such as the Center for Innovation in Learning and Teaching at Nazarbayev University and the Smart Learning Lab at Abai Kazakh National Pedagogical University, where training is offered in LMS use, digital course design, and the integration of interactive tools into language teaching (Nazarbayev University, 2025; Abai KazNPU, 2024).

The experience of these universities confirms that merely having a platform does not ensure high student motivation – the decisive factor is the quality of didactic integration and the institutional support for its implementation.

Discussion

Despite the widespread adoption of digital educational platforms and their evident potential in teaching English, the actual level of student engagement remains unstable, pointing to barriers to digital participation arising from a combination of external and internal factors (Karabaeva & Abdraimova, 2020; Burdina, 2023). Analysis reveals that these barriers arise within a complex sociocultural, institutional, and psychological context, necessitating an interdisciplinary examination (Dotsenko, 2024; Masitoh, Fitriyah, & Mumtaza, 2024).

One key reason for the low degree of student engagement is the fragmented nature of the digital experience, where platforms are used merely as auxiliary shells without deep didactic content. Such “surface-level integration” limits the perceived value of the digital environment and demotivates students (Zakharova, 2020; Natasha & Jannah, 2024). Additional self-management difficulties are exacerbated by the absence of external control and constant distractions, which diminish concentration and impair the quality of language practice (Bhatti & Aldubaikhi, 2023; Meng et al., 2024).

Cognitive and emotional barriers play an equally significant role: anxiety during asynchronous speaking tasks and audio recordings hampers active participation and undermines confidence in verbal self-expression (Lamb & Arisandy, 2020; Shakhmalova & Zotova, 2023). A low level of digital literacy among some students (especially in the regions) heightens dependence on the instructor and impedes self-directed learning (Noor et al., 2022). In Kazakhstan, the problem is exacerbated by infrastructural inequality, as differences in internet quality and device availability between regions and major cities hinder equitable access to educational resources (Meirbekov et al., 2024).

Empirical data indicate that overcoming these barriers is possible given systematic institutional support. Effective measures include not only technical provisioning but also the creation of adaptive digital scaffolding, such as online mentoring, regular consultations, group collaboration, and formative assessment (Masitoh, Fitriyah, & Mumtaza, 2024; Jerković, Komaromi, & Rakić, 2022). Training students in digital self-regulation skills (planning, progress monitoring, and reflection) also reduces psychological barriers and increases responsibility for outcomes (Alakrash, Razak, & Krish, 2022; Harvey Arce & Cuadros Valdivia, 2020).

Thus, sustainable digital student participation requires a blend of technological solutions with pedagogical strategies aimed at systematically lowering cognitive, emotional, and organizational barriers. Further research should focus on a comparative analysis of institutional support models and the development of metrics to assess the impact of digital interventions on motivation and academic outcomes.

Building lasting learning motivation for English in a digital environment demands not only the use of appropriate platforms but also the application of well-designed pedagogical strategies that enhance student engagement and interest. Achieving this requires moving from the formal use of digital solutions to their meaningful integration into the course’s didactic model. First, it is advisable to provide a modular digital course structure in which each thematic block includes clearly formulated objectives, success criteria, and progress visualization elements. Such a structure promotes intrinsic goal-setting and helps students track personal achievements. Second, the motivational effect is strengthened through multimedia content: video tasks, voiced dialogues, audio podcasts, and interactive simulations stimulate emotional involvement and activate various channels of perception.

Particular attention should be paid to gamification elements such as point accumulation, ranking systems, achievement badges, and challenges, which create a competitive element and heighten interest in completing assignments regularly. Personalized tasks adapted to a student’s language proficiency and learning pace are likewise practical. It is also important to implement tools that foster and support learning autonomy. The course should include options for task

selection, scheduling, and training blocks on digital self-organization and planning. This fosters a sense of control over the learning process and boosts intrinsic motivation.

Digital feedback is of special importance: it should be timely, constructive, and multi-layered – from automated checks to detailed instructor comments or individual video reviews. Digital feedback reinforces a sense of recognition and the value of student effort, especially in productive language activities (speaking, writing).

Finally, digital interaction among students should be encouraged through group work, discussions, online projects, and pair assignments. This creates a learning-community atmosphere, reduces isolation, and nurtures the sense of belonging that is vital for sustained motivation in distance or hybrid learning. Hence, enhancing the motivational impact of digital platforms is achievable when they are used on a didactically sound basis, adapted to the real needs of students, and embedded in a supportive educational environment in which technological tools serve concrete pedagogical goals.

Conclusion

The study established that digital educational platforms possess significant potential to enhance students' learning motivation when studying English. Their use promotes the development of learners' autonomy, cognitive and emotional engagement, goal setting, and self-regulation. Platforms that provide interactivity, adaptivity, and prompt feedback prove particularly effective, provided they are didactically integrated into the instructional process.

At the same time, key barriers to digital participation were identified, including insufficient digital literacy, fragmented platform use, students' psychological insecurity, and infrastructural constraints, particularly in regional universities. These factors diminish the motivational impact of the digital environment and necessitate comprehensive pedagogical solutions.

The recommendations proposed include modular course organization, the introduction of multimedia and gamified tasks, enhanced feedback, and the development of students' digital autonomy. A promising avenue for further research is to assess the impact of specific platforms and formats on students' motivational indicators, taking regional and institutional differences into account.

Conflict of Interest Statement

The authors declare no potential conflicts of interests regarding the research, authorship, or publication of this article.

Author Contributions

Ilvira Aleshkina: Conceptualization, Methodology, Supervision. Olga Novosselova: Data Collection and Curation, Resources, Validation, Writing, Original Draft. Raushan Zhunussova: Data Analysis, Visualization, Writing – Review and Editing. Natalya Bubnova: Literature Review, Proofreading, Final Editing.

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PREPARING FUTURE TEACHERS FOR INCLUSIVE EDUCATION

Abstract. In the modern educational environment, inclusive education is increasingly recognized as a necessity. Therefore, in order to effectively support this paradigm, it is essential to provide teachers with practical experience working with students with special needs. The aim of this study was to evaluate the preparedness of prospective teachers for implementing inclusive education in classroom settings, to identify the key competences they possess in the domain of inclusive pedagogy, and to determine effective methods for improving the training of future educators in pedagogical universities to support the implementation of inclusive practices in schools. Using a combination of questionnaire and interviews, we aimed to find out the competencies that future teachers associate with inclusive education, as well as to identify the key factors influencing their readiness. The results of the study showed a link between university preparation and the readiness of future teachers for inclusive education; the need to provide future teachers with comprehensive training and practical experience to ensure that they are adequately prepared to adopt inclusive education principles and work effectively with diverse student populations.

Keywords: inclusion, inclusive education, students with special needs, SEN learners, future teacher's preparation.

Introduction

In the twenty-first century, there has been a marked increase in the number of children identified with special educational needs (SEN), prompting significant developments in health, social, and educational policy frameworks. This demographic shift has catalyzed advocacy efforts by families and civil society organizations, emphasizing the right of individuals with disabilities to participate fully in all aspects of society. Inclusion, therefore, transcends policy implementation; it reflects a paradigmatic transformation in societal perceptions of diversity, promoting equity and access within educational systems.

Conventions, declarations and other regulations have been created, aimed at providing and receiving equal and quality higher education for every person with special needs, as well as lifelong learning. Kazakhstan became signatory to them. In 2011, the authorized state body in the field of education initiated the State Program for 2011–2020 (Government of the Republic of Kazakhstan, 2021) which aimed to transition all schools towards inclusive environments by the year 2020. This program included the establishment of pilot inclusive schools and the introduction of courses on inclusive education within university curricula. However, the prevailing cultural attitudes in the country, as well as the mindset of educators responsible for developing the competencies of future teachers, significantly impact the education of individuals with special needs.

The growing emphasis on inclusive education in international policy frameworks further reinforces the urgency of addressing teacher preparedness. The 2030 Agenda for Sustainable Development, specifically Goal 4 (Quality Education) (United Nation, n.d.), commits nations to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.” This makes the professional development of teachers in inclusive practices not just a national concern, but a global priority. Kazakhstan's alignment with this global agenda highlights the need for research that evaluates how well local institutions are

meeting these expectations particularly teacher training programs, which are central to implementing inclusive education effectively.

In addition, as the concept of inclusion evolves to encompass not only physical and cognitive disabilities but also linguistic, cultural, and socio-economic diversity, the expectations placed on teachers have become more complex. Inclusive classrooms today may consist of neurodiverse learners, or children affected by trauma and displacement. This broadening scope demands that teachers possess not only theoretical knowledge but also hands-on, practice-oriented skills that allow them to differentiate instruction and manage diverse learning needs in real time. Therefore, investigating the current state of teacher readiness in Kazakhstan is a timely and necessary step toward bridging the gap between inclusive policy and classroom realities. Investigating this issue within the context of Kazakhstan may provide valuable insights for the enhancement of teacher preparation programs.

The aim of this research is to assess future teachers' readiness to work in inclusive classroom settings, and identify competences they possess in realm of inclusive education as well as identify methods for enhancing the preparation of prospective teachers in pedagogical universities for the implementation of inclusive practices in schools.

Advancing inclusive education: challenges, teacher readiness, and institutional roles

UNICEF (2017) emphasizes that inclusion represents a vital opportunity for all students, regardless of their diverse backgrounds, to engage in a shared learning experience that fosters mutual growth and development. In alignment with this perspective, Dyssegaard C.B. and Larsen M.S. (2013) articulate that inclusive education facilitates a gradual convergence of special and general education systems. This integration is underpinned by common principles that promote success and accountability for educational outcomes.

The UNESCO Global Education Monitoring Report of 2020, titled "Inclusion and Education: All Means All," (2020) highlights a significant concern regarding the inadequacy of teacher preparation programs in numerous countries. These programs often fail to adequately address the complexities of teaching within inclusive settings. Consequently, the topic of inclusive education is gaining popularity, particularly those that arise from educators, universities, peers, and parents. For instance, the research conducted by Lohrmann S., and Bambara L. M. (2006) delves into teachers' preparedness for functioning effectively in inclusive classrooms. Their qualitative study reveals several critical factors that contribute to the establishment of an effective and supportive inclusive environment. These factors include a school-wide culture that prioritizes support, a clearly articulated vision for inclusion, in-class support mechanisms, and a collegial atmosphere among staff.

Furthermore, the work of Zagona, Kurth, and MacFarland (2017) examines the correlation between the completion of inclusive education courses and teachers' readiness to operate in inclusive classrooms. Their experimental findings substantiate a strong connection between these two variables, indicating that professional development in inclusive practices is essential for enhancing teacher readiness.

Teachers are tasked with the responsibility of designing educational programs that meet the diverse needs of all learners. However, they often encounter significant time constraints that hinder their ability to address the wide array of individual requirements present within their classrooms. Jardinez M. J., and Natividad L. R. (2024) argue that not all educational institutions are equipped to provide the necessary conditions for effective inclusive education. They identify various physical barriers, such as the presence of stairs without ramps, insufficient adaptive equipment, a lack of Braille educational materials, and the absence of sign language interpreters and screen readers.

Moreover, Chen et al. (2021) highlights the detrimental psychological and emotional effects of peer rejection on students with special educational needs (SEN). Students who experience behavioral inclusion often face bullying and exclusion from their peers, which can

lead to a range of negative outcomes, including diminished self-esteem, reduced self-confidence, limitations in social development, feelings of loneliness, and heightened stress levels. This underscores the urgent need for comprehensive strategies to foster inclusive educational environments that support the well-being and development of all students.

Previous studies have demonstrated that challenges related to inclusive education persist across various countries, with scholars exploring multiple dimensions of this issue. The present research aims to investigate the readiness and preparedness of prospective teachers to effectively operate within inclusive classroom settings.

Methods and materials

In the process of working on the study, an analysis of Kazakhstani policies, documents on inclusive education and international literature on the research topic were done. A questionnaire “Me and inclusive education” was implemented. Students were also interviewed on the obstacles of deterring them from working in inclusive classrooms. The experiment was held in a university of Astana city. The participants of the experiment were students of the 4th course (46 participants), educational program “English and primary school teacher”.

When completing the questionnaire, respondents were asked to select a few of the most important statements regarding inclusive education. The questionnaire data include questions about inclusive education in Kazakhstan, the existing law about inclusion that was accepted in 2021, and understanding of the term “inclusion”. Also, this methodology provides an opportunity to identify the attitude of respondents to inclusive education and readiness to work with children with special needs; the assessment of the formation of professional competencies required to work in inclusive education was revealed.

It should be mentioned that students had the course “Inclusive education”.

Participation in the study was voluntary, and students were made aware of the study’s objectives as well as the anonymity of the collected data.

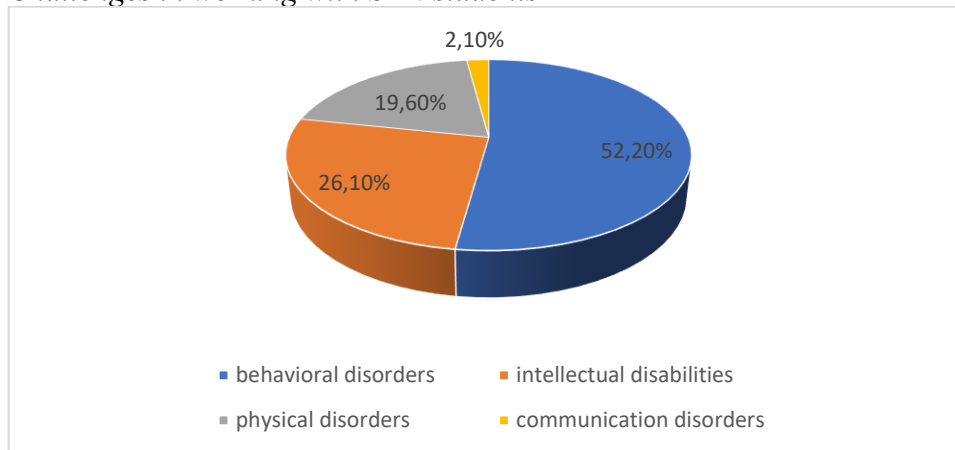
Results and discussion

The results of the study indicate that merely 43% of students demonstrate awareness of the law of the Republic of Kazakhstan pertaining to inclusive education. Among the participants, only 30.4% have experience working with students who have special needs. Furthermore, 69.6% of respondents claim to comprehend the term “inclusion,” while 45.7% have participated in professional development courses outside of their university education.

In addressing the challenges faced when working with students with special educational needs, the findings reveal that 52.20% of students encounter difficulties with students exhibiting behavioral disorders, 26.10% with those experiencing intellectual disabilities, 19.60% with physical disorders, and a minor 2.10% with communication disorders.

Picture 1

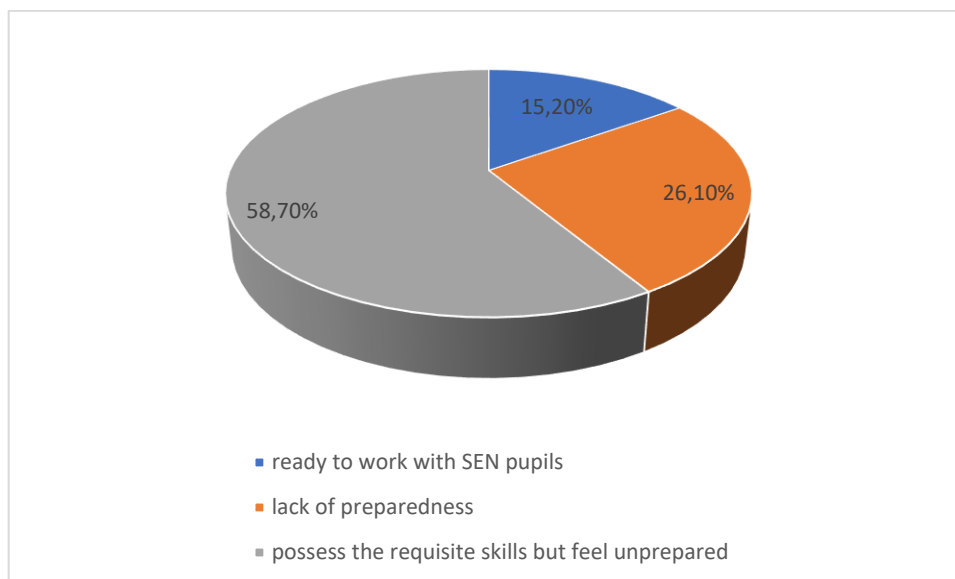
Challenges in working with SEN students



Regarding psychological and professional preparedness for engaging with students with special educational needs, the results suggest that only 15.20% of prospective teachers consider themselves ready to work with such students. In contrast, 26.10% of respondents indicated a lack of preparedness, while 58.70% possess the requisite skills yet feel unprepared to engage with these groups.

Picture 2

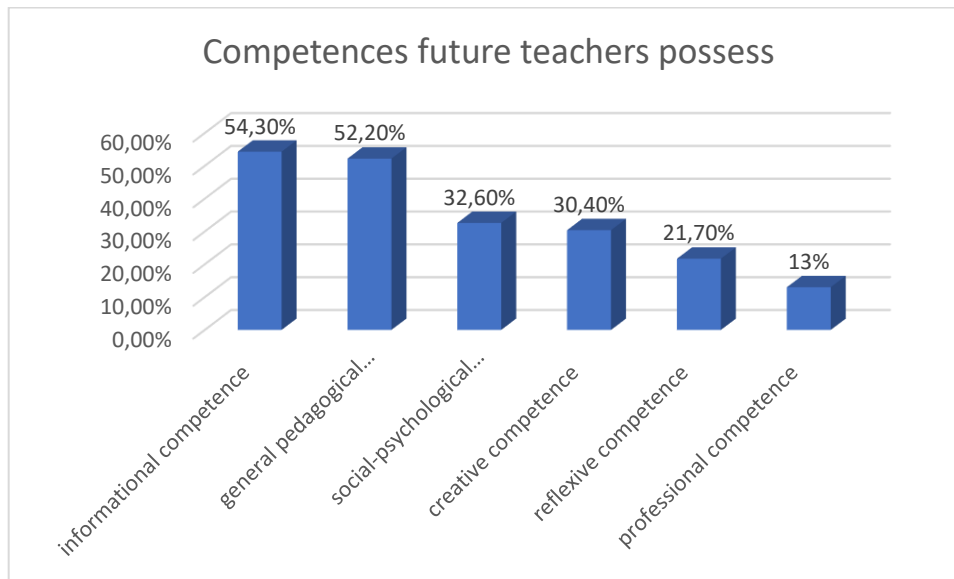
Psychological and professional preparedness for engaging with SEN students



Additionally, the study examined the competencies that students possess in the realm of inclusive education. The results highlight that informational competence is held in the highest regard, with 54.30% of participants recognizing its importance. This is followed by general pedagogical competence at 52.20%, social-psychological competence at 32.60%, creative competence at 30.40%, reflexive competence at 21.70%, and professional competence at 13%.

Diagram 3

Competences future teachers possess



Also, students were interviewed on the inclusion issues to find out the reasons for avoiding working in inclusive classes. Most interviewers mentioned the following basic reasons: lack of practical experience, fear of failure, insufficient number of tasks and exercises for SEN students, and lack of self-confidence.

The obtained results show that more than half of the respondents understand the concept of inclusion, but there are still some gaps that should be filled in. Notably, only a small number of prospective teachers (15.2%) feel psychologically ready to work with students with special educational needs (SEN). This lack of readiness can be attributed to several factors, including insufficient working experience and a fear of failure when engaging with students with disabilities. Additionally, societal attitudes towards the inclusion of ordinary and SEN students in the same classroom contribute to this apprehension, as future teachers often worry about potential conflicts with parents.

Research conducted by Boyle, Anderson, and Allen (2020) highlights the critical role of teachers in inclusive education and their perceptions of inclusion. Their findings indicate that teachers who maintain a positive attitude towards inclusion tend to create a more controlled educational environment compared to those with a negative outlook. However, it is important to note that another study revealed that a positive attitude towards inclusive education is associated with a higher risk of professional burnout (Holmqvist & Lelinge, 2021). This paradox underscores the complexity of teacher experiences in inclusive settings.

Further investigation by Woodcock et al. (2022) into teacher self-efficacy and inclusive education practices in New South Wales, Australia, reveals that both high and low efficacy teachers possess a similar conceptual understanding of inclusion, yet they employ different teaching practices. Teachers with high self-efficacy report greater job satisfaction, lower stress levels, and a more effective approach to managing challenging student behaviors. This suggests that fostering self-efficacy among teachers could be a key factor in enhancing their effectiveness in inclusive classrooms.

In a related study, Resch and Schritteser (2023) examined the benefits of service-learning for inclusive education in Australia. They found that this approach encourages teachers to step outside their comfort zones, bridging the gap between theory and practice. Service-learning not only engages learners in the educational process but also addresses

community needs, develops job-related competencies, and supports learning beyond the classroom. Therefore, integration of service-learning with practice-based learning can greatly enhance teacher preparation for inclusive education.

In recent years, universities in Kazakhstan have significantly expanded their efforts to prepare future educators for inclusive classrooms through a range of practice-oriented training programs. For instance, Sarsen Amanzholov East Kazakhstan University has implemented multiple initiatives, including a 72-hour professional development course titled “Formation of Inclusive Culture,” which blends theoretical knowledge with hands-on exercises to build empathy and pedagogical readiness (East Kazakhstan University, 2025a). The same institution also launched a training program for teacher assistants focused on individualized diagnostics, inclusive program planning, and legal literacy, resulting in over 150 trained professionals since 2021 (East Kazakhstan University, 2025b). In addition, the opening of an on-campus inclusive primary school provides university students with direct teaching experience in diverse classrooms, supporting the practical application of inclusive strategies (East Kazakhstan University, 2024a). Similarly, Al-Farabi Kazakh National University offers bachelor’s and master’s programs in inclusive education that integrate diagnostic tools, assistive technology, art therapy, and inclusive pedagogy, supported by internships and applied research (KazNU, 2024). Furthermore, a national-level forum involving 35 Kazakhstani universities has initiated collaborative curriculum development on inclusive practices and proposed dual-degree programs for training specialists in early support and rehabilitation pedagogy (East Kazakhstan University, 2024b). These efforts mark a significant shift from theoretical to applied models of teacher preparation, aligning Kazakhstan’s higher education institutions with global standards for inclusive education.

Astana IT University (2023) is leading a national study that examines the integration of assistive technologies into Kazakhstani higher education systems. The project includes several practical initiatives: creating multilingual sign-language video lectures for social sciences and humanities courses; conducting a nationwide survey to assess accessibility for students with special educational needs (SEN); preparing comparative brochures on global best practices; and analyzing assistive technology applications across universities in Kazakhstan, the UK, and Scotland to inform policy and institutional strategies. Through evidence-based recommendations and methodological materials, this initiative marks a major step toward embedding inclusive design into the academic infrastructure.

In parallel, empirical research emerging from Nazarbayev-affiliated institutions highlights current strengths and gaps in teacher preparation for inclusive classrooms. Notably, a study titled “Pre-Service English Language Teachers’ Training to Work in Inclusive Educational Environment” involving over 1,000 students across eight universities found high confidence among future teachers in addressing common speech or hearing disorders, yet revealed a lack of readiness to support learners with complex or severe disabilities (Nazarbayev University Graduate School of Education, 2023; Jangeldinova et.al., 2024). These findings align with broader literature emphasizing the need for more hands-on, practice-oriented training and assistive technology familiarity in teacher education programs nationwide.

Kazakhstan’s approach to inclusive education shows both alignment with and divergence from global inclusion trends. Like many countries, Kazakhstan has ratified international frameworks such as the UN Convention on the Rights of Persons with Disabilities and committed to Sustainable Development Goal 4, which advocates for inclusive and equitable quality education. In recent years, the government has introduced inclusive education policies, teacher training programs, and pilot inclusive schools, reflecting a shift toward more systemic and structured implementation, similar to global practices (UNESCO, 2020). However, challenges remain that distinguish Kazakhstan’s context, particularly in terms of cultural attitudes, institutional readiness, and resource limitations. While many Western countries

emphasize co-teaching models, universal design for learning (UDL), and fully integrated classrooms, Kazakhstani schools still face gaps in infrastructure, accessibility, and consistent teacher preparedness (Jardinez, Natividad, 2023; East Kazakhstan University, 2025a). Moreover, while inclusive education in global discourse increasingly includes learners from diverse linguistic, migrant, and socio-economic backgrounds, Kazakhstan's model remains more narrowly focused on students with visible physical or cognitive disabilities. This suggests that while Kazakhstan is progressing toward global inclusion standards, further development is needed to ensure alignment with the broader, multidimensional understanding of inclusion found in international best practices.

The study indicates that teachers who possess theoretical knowledge, practical experience, and sufficient support from colleagues, school administration, and parents, can attain significant success in their work with SEN students. This leads us to propose several recommendations for overcoming existing obstacles in teacher preparation for inclusive education.

- Read and analyze the law of the Republic of Kazakhstan on inclusive education and international documents on the topic;

- Implement more practical tasks in educational program on working with SEN students; Future teachers can practice on giving clear instructions or explanation or create their own practical tasks.

- Organize meeting with SEN students so future teachers will be ready to work with them. They will know about SEN students' specific needs, strength and challenges.

- Evaluate school textbooks in terms of inclusion (content, accessibility, language, assessment, etc.);

- Attend extra courses for professional development can provide future teachers with peer support and opportunities to practice communication with SEN students' parents and caregivers.

While this article highlights the importance of preparing teachers for inclusive education, it is important to acknowledge its limitations. The study primarily focuses on teacher preparation, and university educators were not interviewed regarding the challenges they face in organizing courses on inclusive education or in managing inclusive classrooms. Addressing these gaps in research could further enhance our understanding of effective teacher preparation in this critical area.

Conclusion

The pursuit of inclusive education is a multifaceted endeavor that necessitates a concerted effort from various stakeholders, including educators, institutions, and policymakers. The insights provided by UNICEF, UNESCO, and various researchers underscore the importance of creating supportive environments that cater to the diverse needs of all learners. While significant strides have been made in understanding the principles of inclusion and the factors that contribute to effective inclusive practices, challenges remain, particularly in terms of teacher preparation and institutional readiness. Addressing physical barriers and fostering a culture of support within schools are essential steps toward ensuring that all students, including those with special educational needs, can thrive academically and socially. Ultimately, a commitment to inclusivity not only enhances educational outcomes but also promotes a more equitable and compassionate society.

The literature review and practical aspects of this research underscore the pressing relevance of inclusive education across various countries. The findings of this study highlight significant challenges faced by future teachers in their readiness to implement inclusive education, particularly concerning their insufficient levels of inclusive competence, lack of practical experience, and prevalent fears of failure. These challenges emphasize the urgent need

to equip future educators with comprehensive and updated knowledge on how to engage with students who have special educational needs through implementation of service-learning, practice-based learning, and development practice-oriented educational programs.

Our research findings and the examination of the evaluated materials have allowed us to develop specific suggestions for improving aspiring future teachers' readiness for inclusive classroom. It is imperative that higher education institutions prioritize inclusive education training as a fundamental component of teacher preparation programs. This study provides compelling evidence that such an emphasis is crucial for cultivating a generation of educators who are not only knowledgeable but also confident and capable of fostering inclusive learning environments.

Ultimately, addressing the identified gaps in teacher preparation will contribute significantly to the successful implementation of inclusive education, ensuring that all students, regardless of their individual needs, can thrive in supportive and equitable educational settings. Continued research and practical initiatives in this area are essential to further advance the effectiveness of teacher training programs and to promote inclusive practices in classrooms worldwide.

Conflict of Interest Statement

The author declares no potential conflicts of interest regarding the research, authorship, or publication of this article.

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GAMIFICATION AND INTERACTIVE LEARNING IN SECONDARY AND HIGHER EDUCATION IN KAZAKHSTAN

Abstract. This article examines the implementation of gamification and active learning methods in secondary schools and higher education institutions in Kazakhstan. The purpose of the paper is to analyze the role of gamification in education, its effects across different educational settings, and the primary obstacles to its effective implementation. The first section reviews the educational aspects of gamification, highlighting its role in enhancing student engagement, motivation, and the shift from traditional teaching methods toward active pedagogy. It also discusses institutional barriers, such as rigid educational frameworks that hinder gamification adoption. The second section explores the differences in gamification application between secondary and higher education. Findings indicate that secondary students respond more actively to competitive game elements, such as points and leaderboards, whereas higher education students prefer simulations and project-based learning. The study also highlights challenges, including the lack of adequate resources, underprepared educators, and the absence of effective policies supporting gamification. Finally, the paper proposes key solutions, including strengthening institutional support, developing specialized teacher training programs, increasing access to digital educational materials, and introducing curriculum flexibility to integrate innovative teaching techniques.

Keywords: gamification; interactive learning; student engagement; digital education; Kazakhstan.

Introduction

Increasingly, educators are utilising gamification as a strategy for motivation, enjoyment of learning, and increasing effectiveness. Gamification incorporates elements of games like points, leaderboards, challenges, and even simulations to achieve heightened engagement and participation from learners. Research suggests that gamification influences, for the better, engagement, motivation to learn, and academic success (Miodoński, 2023). Gamification elements, while widely adopted in educational settings, do not yield uniform effects across all learner profiles and educational levels. The effectiveness of such strategies varies depending on factors such as the student's personality, preferred learning style, and cognitive development stage. Competitive features like leaderboards, point systems, and rewards may effectively motivate some students but can trigger disengagement or stress in others, particularly those who are more collaborative or intrinsically motivated. Younger students may be more responsive to immediate, tangible feedback, while older learners often seek deeper, more context-rich learning experiences through simulations or project-based tasks. These observations suggest that the use of a one-size-fits-all model in gamification is inherently flawed and may risk excluding or demotivating certain student groups if applied without adaptation to individual and contextual needs (Qodr et al., 2021).

To ensure that gamification genuinely supports diverse learners, its design must be flexible and responsive to classroom realities. Gamification should not be applied rigidly, but

rather designed to reflect the age-appropriateness and learning preferences of each group. This includes allowing educators to adjust levels of challenge, types of feedback, and forms of interaction according to the learners' characteristics and learning goals. The goal is not only to increase participation but to support long-term cognitive engagement and meaningful learning. Therefore, the design of automated or digital gamified environments should incorporate customizable frameworks that can evolve with learners' developmental stages and classroom dynamics (Kamil Budiarto et al., 2021). Although much of the existing research has centered on gamification in higher education, its use in school settings is becoming increasingly valued for its ability to build sustained learning habits and encourage positive student behaviors over time (Vrcelj et al., 2023).

The implementation of gamification in Kazakhstan's educational system remains fragmented and unsystematic, primarily due to persistent structural and institutional challenges that limit its scalability and sustainability. One of the most significant obstacles is the pronounced digital divide between urban and rural regions, where schools in less developed areas often lack access to basic technological infrastructure such as stable internet connectivity, up-to-date computers, and digital learning platforms. This disparity not only hinders the equitable adoption of gamification tools but also exacerbates existing educational inequalities. Compounding this issue is the limited readiness and capacity of educators to implement gamified strategies effectively. Many teachers and lecturers have not received formal training in instructional design principles related to gamification, leading to inconsistent or overly simplistic applications that fail to exploit its full pedagogical potential. Moreover, there is a conspicuous absence of national or institutional policies that support digital innovation in education, particularly those that integrate gamification into the broader curricular framework. Without such policies to guide and incentivize implementation through funding, training programs, and curricular flexibility gamification remains a localized and often experimental effort rather than a structured component of Kazakhstan's educational reform. This lack of coherence across technological, pedagogical, and regulatory dimensions poses a critical barrier to institutionalizing gamification as a mainstream educational practice. This, therefore approaches, be more comprehensive, integrating pedagogical and technological approaches to optimise the effectiveness of gamification in teaching and learning (Santos-Villalba et al., 2020). Additional research is required to investigate the ideal implementation of gamification across different educational levels in Kazakhstan, considering flexible design elements, educator preparedness, and sufficient regulatory backing.

This research contributes meaningfully to the academic discourse by holistically exploring gamification within the educational system of Kazakhstan. It captures the perspectives of diverse stakeholders like teachers, lecturers, secondary school students, and university students, thereby offering a multidimensional understanding of how gamification is both implemented and experienced across different educational levels. The study does not limit its focus to isolated technological tools or predefined frameworks; rather, it investigates the real-world practices, perceptions, and outcomes of gamification as they occur in classrooms and lecture halls throughout the country. By examining the application of gamified strategies in both secondary and tertiary education, the research provides valuable insights into how contextual variables such as age, institutional infrastructure, and pedagogical readiness influence the effectiveness and acceptance of gamification techniques. Moreover, it identifies and analyzes the distinct challenges encountered in each setting, including technological limitations, insufficient teacher training, and the absence of supportive policy frameworks. Unlike earlier investigations, which have tended to focus narrowly on gamification in higher education or examined only its mechanistic components such as point systems or digital rewards (Vrcelj et al., 2023), this study adopts a more integrative and critical approach. It seeks to address a more fundamental set of questions: how do key actors within the education sector

in Kazakhstan teachers, students, and academic staff, understand and engage with gamification as a pedagogical innovation. What are the structural and pedagogical conditions that constrain or facilitate its use, and how do these intersect with broader institutional and policy frameworks. By situating these questions within the national educational context, the study not only contributes empirical data but also provides practical implications for policymakers and educational leaders. The findings call attention to the need for more adaptive and inclusive strategies to embed gamification meaningfully into curricula, thereby encouraging stakeholders to pursue reforms that enhance its pedagogical impact and long-term viability in Kazakhstan's evolving education landscape.

This study holds practical significance for educators, educational institutions, and policymakers in Kazakhstan by offering evidence-based insights into the effective implementation of gamification in diverse learning environments. For educators, the findings provide concrete guidance on how to tailor gamification strategies to suit the developmental needs, learning preferences, and motivational profiles of students, thereby enhancing both engagement and learning outcomes. The research highlights specific components such as reward systems, simulations, and collaborative tasks that can be selectively applied based on classroom context and educational level. Furthermore, the study equips educational institutions and administrators with a clearer understanding of the institutional support required to sustain gamification initiatives, including teacher training, technological infrastructure, and curricular flexibility. For policymakers, the findings present an opportunity to design and promote more adaptive educational policies that facilitate the systematic integration of gamification into national curricula. By doing so, they can support pedagogical innovation that aligns with contemporary educational goals and prepares students for active participation in an increasingly digital learning landscape.

This study enhances the scientific literature by providing a more comprehensive examination of gamification implementation in Kazakhstan, surpassing previous research that primarily focuses on higher education or the technical facets of gamification. This study aims to: 1) investigate the experiences of educators in implementing gamification, particularly in selecting suitable strategies; 2) assess students' perceptions of the effectiveness of gamification and its influence on motivation and learning outcomes; 3) examine the primary challenges in gamification implementation from technical, pedagogical, and institutional perspectives; 4) elucidate the advantages of gamification for both students and educators, particularly in enhancing engagement and interaction in the learning process; and 5) identify the success factors of gamification within the Kazakh education system, which can inform the development of optimal strategies for educators and policymakers in advancing gamification-based learning innovations more effectively.

Methods and materials

This study adopts a qualitative research design with a case study approach to examine the use of gamification within secondary and higher education contexts in Kazakhstan. The selection of this methodology is based on its ability to provide a deep and contextualized understanding of how various stakeholders including teachers, lecturers, and students experience, interpret, and respond to gamification within their actual educational environments. Unlike quantitative methods that often seek generalizability, the qualitative case study allows for an intensive exploration of complex social and pedagogical processes, capturing the richness of interactions and institutional dynamics that shape the implementation of gamified learning. This approach also facilitates the identification of subtle challenges and success factors that may not be readily observable through standardized measurement tools, making it particularly effective in revealing how educational innovation unfolds in practice. The design is thus well-suited to explore nuanced phenomena within naturalistic settings, where variables such as infrastructure, teacher readiness, and classroom culture interact in

multifaceted ways (Bhangu et al., 2023). At this stage, case study design was chosen because it offers rich, contextual, and dynamic analysis on the phenomenon under study. Education stakeholders involved in this study included teachers, lecturers, and university and secondary school students in Kazakhstan who had used or been exposed to gamification in educational settings. Purposive sampling is recommended because it is believed that participants selected in this manner possess a unique perspective on learning gamification (Miles et al., 2016). The study involved a total of 40 participants, comprising 3 university lecturers or professors, 2 secondary school teachers, 17 school students, and 18 university students, thereby ensuring representation from all key stakeholder groups within the educational system. This balanced sampling approach was deliberately chosen to capture a wide range of perspectives and experiences related to the implementation of gamification across both secondary and tertiary education levels. By including voices from both educators and learners, the study was able to explore not only how gamification is perceived and applied in each context, but also to identify the distinct challenges and advantages inherent to each educational tier. This diversity in participant backgrounds enabled a comparative qualitative analysis that revealed meaningful contrasts such as the greater appeal of competitive game elements at the school level versus the preference for simulation and project-based gamification in higher education. Consequently, the sample structure enhanced the study’s capacity to generate nuanced, context-sensitive insights into how gamification functions within different institutional and pedagogical environments.

Table 1.
Demographic Profile of Research Subjects

Category	Number of Participants	Selection Criteria
Lecturer	3	Teaching at universities that apply gamification in lectures
Teacher	2	Teaching in secondary schools that apply gamification in learning
School Student	17	Follow gamification-based learning at secondary level
College Student	18	Experiencing gamification methods in college lectures
Total	40	Participants were selected based on active involvement in gamification-based learning

The overall data for this study was accrued through the use of separate interviews, observations, and documents, which encompasses the implementation of gamification in the educational context of Kazakhstan (Miles et al., 2018). In order for the respondents to describe their perception or experience concerning the application of gamification in education, along with the benefits and challenges posed by the degree, in-depth interviews were done with teachers, lecturers, school children, and college students. These additionally included classroom observations to assess the actual processes of gamification, the teacher/student relationship, and the various conditions critical for the success or failure of the gamification strategies. Also, in the analysis that supported the findings from the interviews and the observations, the documents that were scrutinized included educational materials, structured modules for gamified learning, and institutional policies. The three methods were used concurrently in order to improve the quality of the data as well as comprehensively understand the context of gamification in secondary and higher education in Kazakhstan.

This study employed a combination of interview guides and observation instruments as its primary data collection tools, allowing for a comprehensive exploration of gamification practices within educational settings. The interviews were designed to elicit detailed insights into participants' experiences, perceptions, perceived benefits, and challenges related to the

implementation of gamification, involving a range of stakeholders, including educators, lecturers, secondary school pupils, and university students. Semi-structured interview formats were selected to provide both consistency across participants and the flexibility to explore emerging themes, thereby enriching the depth of the data collected. Complementing the interviews, systematic classroom observations were conducted using structured observation sheets that documented how gamification was applied as a teaching method, the nature of student-teacher interactions, and the extent to which these interactions influenced student engagement and participation. Additionally, document analysis was conducted to examine institutional materials and relevant policy documents, providing supplementary evidence that triangulated and contextualized the findings obtained through interviews and observations. This multi-method approach ensured a robust and nuanced understanding of the dynamics surrounding gamification in the Kazakhstani educational context. The next grid explains the research instruments, which can be identified in Tables 2 and 3.

Table 2.
Interview Guidelines

Indicators	Example Questions
Teacher/lecturer experience	What is your experience in implementing gamification in the classroom?
Student perception	What do you think about gamification in learning?
Challenges	What are the main difficulties in adopting gamification?
Benefits	What benefits do you experience from using gamification?
Success factors	What do you think makes gamification successful in the classroom?

Table 3.
Observation Sheet

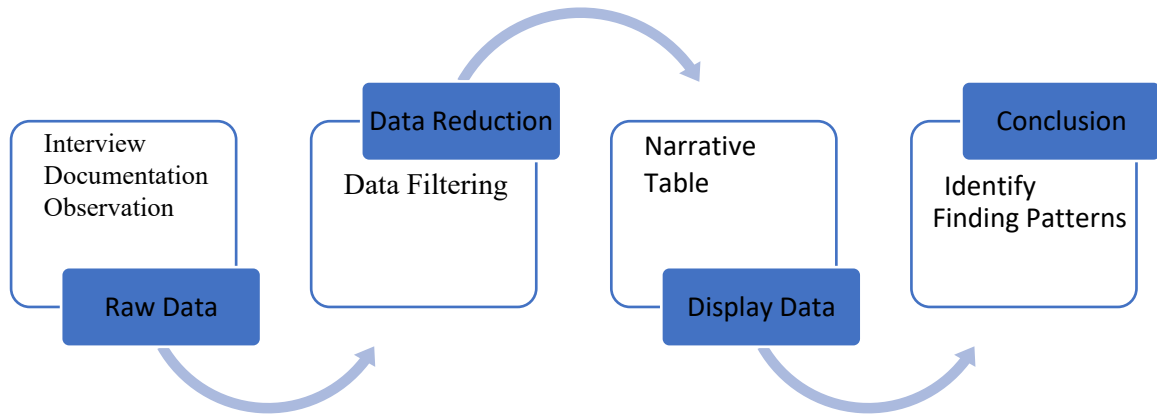
Observation Aspect	Description
Student Engagement	How active are students in participating in gamification activities?
Teacher Response	How do teachers integrate gamification into learning?
Gamification Type	What gamification strategies are used? (e.g., leaderboard, rewards, badges, etc.)

In verifying the credibility of the data, source triangulation, method triangulation, and member checking are used (Miles et al., 2018). Information from different sources that including teachers, lecturers, school children, and university students, is classified as source triangulation. Photography, interviews, and document analysis are combined into one single data collection method to achieve method triangulation. To test the credibility and validity of the research findings, the interview results of the respondents are, in some cases, compared with the respondents' actual accounts and experiences to enhance the interpretations made from the data (Chenail, 2012).

In line with Miles et al. (2018), the analysis of data for this study was conducted through data reduction, data display, and conclusion drawing. In this case, data reduction was achieved through sorting, filtering, and grouping the information obtained through interviews, observations, and documentation, which is needed to meet the objectives of the research. In the data analysis phase, the information gathered from interviews, observations, and document reviews was systematically organized and presented through various forms of visual and narrative representation to facilitate interpretation. Data visualization techniques, including narrative descriptions, tables, and thematic diagrams, were utilized to enhance clarity and coherence, enabling the identification of key patterns and relationships within the dataset. These tools played a crucial role in synthesizing complex qualitative information into accessible and meaningful formats for analysis. The final stage of the analysis process involved

drawing conclusions based on these identified patterns, which provided valuable insights into the effectiveness, challenges, and contextual dynamics of gamification practices within Kazakhstan’s educational system. This stage not only addressed the core research questions but also uncovered broader implications related to pedagogical strategies, institutional readiness, and student engagement in gamified learning environments. The overall analytical process, including its stages and methodologies, is illustrated in Figure 1, offering a comprehensive overview of how the data was systematically examined to derive meaningful conclusions.

Figure 1.
Data Analysis Techniques



Results

Experiences and Perceptions of Gamification in Learning. Educators at both secondary and tertiary levels in Kazakhstan have increasingly adopted gamification as a pedagogical approach to enhance student participation and motivation. Common methods include the use of interactive quizzes, leaderboards, digital badges, and simulation-based activities. At the secondary level, teachers frequently rely on user-friendly platforms such as Kahoot! and Quizizz, which allow them to incorporate competitive elements into classroom instruction with relative ease. In contrast, lecturers at the tertiary level tend to employ more complex forms of gamification, including case-based scenarios and adaptive learning tools that are designed to align more closely with advanced academic content. These tools are particularly effective in promoting active learning and engagement, especially in contexts that require critical thinking and application of theoretical concepts. Despite their growing popularity, these strategies are not without limitations, and their success often hinges on how appropriately they are integrated into the curriculum.

One of the most pressing challenges faced by educators is the lack of adequate technological infrastructure. Many schools, particularly in rural areas, struggle with unstable internet connectivity and limited access to devices, which significantly hampers the seamless implementation of gamified instruction. Beyond these technical constraints, pedagogical issues also emerge. Several teachers express concern that gamification, while engaging, may detract from the core objectives of learning if not properly aligned with curriculum standards. Balancing the entertaining aspects of games with rigorous academic goals presents a significant dilemma, especially when educators must simultaneously convey foundational knowledge and adapt the difficulty level to suit diverse student abilities. Some educators also report that while gamification successfully stimulates enthusiasm in the classroom, it does not always translate into improved comprehension or mastery of subject matter. As such, although gamification has the potential to enrich educational experiences, its application must be carefully designed to ensure it supports learning outcomes.

Research conducted involving both secondary school and tertiary students discovered that a vast majority perceive gamification as a more enthusiastic and motivational learning technique in comparison to traditional methods. Nevertheless, the effectiveness of gamification is dependent on the design used. Secondary school learners are more likely to prefer competition-oriented gamification components like contests and leaderboards because these features foster a higher level of motivation among them by providing a sense of competition. In contrast, college students prefer simulation-based gamification and project-based learning, which allow them to apply theoretical knowledge in real-world scenarios.

Despite the overall positive reception of gamification, several concerns emerged from student interviews that underscore the importance of thoughtful and balanced implementation. Some high school students voiced apprehensions regarding the overly competitive nature of certain gamified activities, noting that the emphasis on rankings, points, and rewards can create pressure and reduce opportunities for meaningful collaboration. For these students, gamification that prioritizes individual achievement may inadvertently undermine cooperative learning dynamics and inclusivity. Similarly, university students expressed that while gamification initially sparked interest, it risked becoming monotonous and less effective when limited to repetitive formats or lacking in instructional diversity. These observations highlight a critical need for educators to design gamification strategies that are not only engaging but also varied, inclusive, and aligned with pedagogical objectives. By ensuring that gamified learning includes both competitive and collaborative elements, and by offering diverse formats that sustain learner interest, educators can mitigate potential drawbacks and enhance the overall educational value of gamification. The detailed findings from these interviews are presented in Tables 4 and 5, which categorize students' and educators' insights across different dimensions of gamification use.

Table 4.

Interview Coding Analysis Results: Students and Teachers

Findings Category	Students (School)	Teachers
Form of Gamification Implemented	Most experienced gamification based on points, leaderboards, and badges.	Using gamification in the form of interactive quizzes, reward systems, and game-based simulations.
Technical Challenges	Unstable internet connection and limited devices were the main obstacles.	Difficulty in selecting and adapting digital platforms for gamification.
Pedagogical Challenges	Some students felt gamification was more competitive than collaborative.	Developing gamification that is in line with the curriculum is quite challenging.
Alignment with Learning Objectives	Gamification made learning more interesting, but was not always related to understanding the material.	Gamification is effective in increasing student engagement, but requires strategies to remain relevant to learning.
Impact on Student Motivation	Increased motivation to learn because of the elements of rewards and challenges.	Seeing increased student engagement, but not all students respond positively.
Preferences for Gamification Elements	Preferred interactive leaderboards and challenges over badges or point systems.	Preferring game-based quizzes and reward systems to increase student engagement.

Table 5.
Interview Coding Analysis Results: Students and Lecturers

Findings Category	Students	Lecturer
Form of Gamification Implemented	Experienced gamification based on project-based learning, simulations, and badges.	Using gamification in the form of game-based case studies and adaptive learning.
Technical Challenges	Some gamification platforms are not user-friendly and require adaptation.	Time constraints in designing effective gamification elements.
Pedagogical Challenges	More interested in gamification that contains aspects of competition and collaboration.	Difficulty adjusting the level of difficulty of gamification to student abilities.
Alignment with Learning Objectives	Helps understand concepts but can feel repetitive if not varied.	Gamification is effective if designed according to student academic competencies.
Impact on Student Motivation	Gamification increases motivation but only if there is an element of challenge.	Increasing student participation, but less effective if there is no clear evaluation.
Preferences for Gamification Elements	Prefer simulations and project-based learning.	Preferring game-based case study methods to support understanding of the material.

Challenges and Obstacles in Implementing Gamification. At both the secondary and tertiary levels of education, technical challenges pose yet another serious limitation to the implementation of gamification. While observing secondary school classrooms, it became obvious that many of them do not have the necessary supporting equipment, such as projectors, computers, or even functional internet connections, which make the application of gamification principles difficult. Rural students to whom I spoke in interviews expressed difficulty in obtaining digital devices on their own for participation in gamified activities.

At the higher education level in Kazakhstan, access to computers, smartphones, and internet connectivity is generally more stable compared to secondary schools, thereby reducing basic infrastructural barriers to gamification. However, this relatively favorable digital environment does not necessarily guarantee the effective use of gamified learning tools. Many students report encountering challenges related to the usability and compatibility of gamification platforms with their personal devices. Specific tools or software introduced by lecturers are sometimes designed without sufficient consideration for user experience, leading to confusion or disengagement. Moreover, while students often have the technical ability to navigate basic educational technologies, they may struggle with applications that are poorly localized, lack clear instructions, or have complex interfaces. These usability issues ultimately diminish the intended motivational and pedagogical benefits of gamification.

From the faculty's perspective, there are significant challenges in adapting existing curricula to accommodate gamified elements in a meaningful way. University lecturers have expressed concern that while gamification has pedagogical potential, its effective integration requires a specific set of digital competencies that many educators have not yet fully developed. In interviews, faculty members noted that the training offered by their institutions is often insufficient, outdated, or narrowly focused on general digital literacy rather than on the pedagogical design of gamified content. As a result, lecturers are left to navigate unfamiliar platforms with little institutional guidance, which can lead to inconsistent or suboptimal implementation. These gaps highlight the pressing need for structured professional development programs that equip university educators with the skills necessary to leverage gamification effectively, aligning digital tools with instructional objectives and diverse student learning needs.

The implementation of gamification encounters both pedagogical and institutional challenges across educational levels. From a pedagogical perspective, secondary school teachers often struggle to design effective gamification strategies, frequently becoming

ensnared in competitive elements such as leaderboards, which may not be suitable for all students and can even generate pressure that detracts from material comprehension. In the context of higher education, while students are more open to simulation and project-based learning, instructors are struggling to balance the academic rigor with the level of integration of these methods. Some students regard these processes as too monotonous (i.e., too much sameness) unless some variation is incorporated. Striking a balance between competitive and collaborative elements presents a unique challenge that demands greater creativity.

Findings from interviews with educators reveal that one of the most persistent barriers to implementing gamification in Kazakhstan’s education system is the lack of institutional support, particularly in terms of training and technological resources. Many teachers and lecturers feel inadequately prepared to design and apply gamified learning strategies due to limited access to targeted professional development opportunities. Although some institutions offer general digital training, these programs often do not address the specific pedagogical principles or technical nuances required for effective gamification. As a result, educators frequently rely on self-initiated learning or trial-and-error approaches, which leads to inconsistent implementation and missed opportunities for maximizing the educational potential of gamification. Compounding this issue is the absence of institutional clarity—most educational organizations lack standardized policies or guidelines on how gamification should be integrated within formal instructional frameworks, leaving educators without a clear mandate or structured support.

This institutional ambiguity is particularly evident in higher education, where rigid academic rules and traditional assessment systems often act as deterrents to pedagogical innovation. Despite the growing recognition of gamification as a tool for enhancing engagement and learning outcomes, its operationalization remains limited and fragmented. Document analysis conducted as part of this study confirms that the majority of universities and secondary schools in Kazakhstan have not yet formalized any policies that explicitly recognize or regulate the use of gamification within teaching and learning processes. The absence of such frameworks results in sporadic, isolated initiatives that struggle to gain traction or institutional legitimacy. To overcome these multifaceted challenges greater collaboration is needed among educators, institutional leaders, and policymakers. This collaboration should focus on improving digital infrastructure, expanding access to specialized training for educators, and crafting more flexible and forward-looking educational policies that support the systematic and sustainable integration of gamification across all levels of education.

Table 6.
Thematic Observation and Interview Findings

Challenge Categories	Main Findings	Sources
Technical and Infrastructure Challenges		
- Barriers to technology use	Unstable internet connection, inadequate devices, difficult to access platforms.	Observation in schools and universities, Interview with Teachers/Lecturers
- Barriers to device access	Students in rural areas have less access to digital devices.	Interview with School Students
- Adaptation of technology in higher education	Students have difficulty accessing gamification platforms that are not user-friendly.	Interview with University Students
Pedagogical Challenges		
- Difficulty in designing strategies	Teachers and lecturers struggle to design effective and balanced gamification.	Interview with Teacher/Lecturer

- Mismatch of learning styles	Some school students are more comfortable with conventional methods.	Interview with School Students
- Competitive-collaborative balance	It is challenging to balance competitive and collaborative elements in gamification.	Classroom observations in schools and universities.
Institutional and Policy Challenges		
- Lack of institutional support	Schools and universities do not provide adequate training or budgets.	Interview with Teacher/Lecturer
- Regulation and policy	Rigid curricula in higher education hinder innovation in learning.	Document Analysis, Interview with Lecturer

Benefits and Success Factors of Gamification in Learning. The integration of gamification into the learning process has demonstrated a range of pedagogical benefits for both students and teachers across educational levels. Interviews with secondary school students revealed a notable increase in learning motivation when gamified elements such as leaderboards, rewards, and interactive tasks—were introduced. Students who were previously disengaged or hesitant to participate in classroom activities became more active, responsive, and confident. In particular, the competitive elements of gamification appeared to stimulate a sense of achievement and urgency among younger learners, which translated into higher classroom energy and involvement. Similarly, students in higher education responded positively to gamification, particularly in forms such as simulations and project-based tasks that allowed them to engage with academic content in more applied and contextualized ways. These methods were seen to enhance comprehension of abstract theoretical concepts by placing them within scenarios that mirrored real-world challenges.

From the perspective of educators, gamification not only improved classroom dynamics but also encouraged greater participation and discipline. Teachers observed that students were more willing to interact, ask questions, and engage in peer discussions, leading to a more dynamic and student-centered learning environment. Instructors in university settings reported similar trends, particularly in terms of heightened collaboration during game-based assignments and discussions—practices that are often difficult to cultivate in conventional lecture formats. However, while the benefits of gamification are evident, several educators expressed concern regarding its equitable impact. There is a risk that gamification may disproportionately benefit students who are naturally competitive or extroverted, while potentially alienating those who are less inclined toward competition or more anxious in group settings. Moreover, without thoughtful instructional design, gamified activities may prioritize entertainment over depth of learning, leading to superficial engagement rather than sustained academic growth. These insights highlight the importance of implementing gamification in a balanced and inclusive manner, ensuring that it complements pedagogical goals and addresses the diverse motivational profiles of all learners.

Furthermore, while students and teachers alike acknowledged the motivational potential of gamification, its sustainability over time remains a matter of concern. Some students reported that repetitive or overly simplistic gamified activities gradually lost their appeal, leading to a decline in engagement and diminishing returns in learning outcomes. In higher education, the use of simulations and project-based tasks was perceived as more intellectually stimulating, yet these approaches are also more resource-intensive and time-consuming to design and assess. Educators emphasized that without sufficient institutional support, there is a risk that gamification efforts may stagnate or fail to scale effectively. As a result, what begins as an innovative instructional strategy may revert to surface-level adoption if not continuously adapted to align with evolving learning objectives and student expectations.

Equally important is the issue of assessment and academic rigor. Interviews and observations indicated that while gamification can foster greater student interaction and

enthusiasm, it does not inherently guarantee deeper understanding or improved academic performance. Teachers noted that certain gamified tasks lacked clear alignment with learning outcomes or failed to assess higher-order thinking skills. In some cases, students were more focused on earning points or badges than on engaging meaningfully with the subject matter. This finding underscores the necessity for careful instructional design in which gamification is integrated not merely as a motivational tool but as a method that reinforces critical content and learning competencies. Therefore, for gamification to move beyond novelty and become a meaningful pedagogical innovation, educators must adopt a strategic, evidence-based approach that includes differentiated task design, ongoing evaluation of effectiveness, and intentional links to curriculum standards and assessment practices.

The success of gamification implementation in education is determined by institutional support, freedom in their teaching style, and evidence from other institutions that clearly define their technology integration policies that make them more successful. In summary, interviews with students indicate that there is a need for variety in the forms of gamification because there is a tendency to fail to achieve desired outcomes due to the overuse of certain methods when trying to implement gamification (e.g., game-based assessments, storytelling, or role-playing). The effectiveness of gamification in educational settings is closely tied to both the technological infrastructure available and, more critically, the digital competencies and pedagogical skills of teachers. When educators possess a solid understanding of gamification principles and the technical proficiency to apply them, they are more likely to implement these methods in ways that are pedagogically meaningful and aligned with curriculum goals. The findings of this study align with and reinforce existing literature, which consistently shows that teachers who have received formal training in gamification demonstrate higher levels of confidence and creativity in integrating game-based elements into their instruction. This preparedness not only enhances the quality and consistency of gamification implementation but also leads to greater student engagement, deeper interaction with the learning content, and improved conceptual understanding. In contrast, educators lacking such training may either misuse gamification or abandon it altogether due to uncertainty or perceived ineffectiveness. Therefore, targeted professional development remains a critical enabling factor for the successful integration of gamified strategies into mainstream education.

In general, the findings regarding the benefits and success factors of implementing gamification in schools and universities are summarized in the following analysis results Table 7.

Table 7.
Results of Analysis of Benefits and Success Factors of Gamification

Category	Middle School	Higher Education	Sources
Increased learning motivation	Students are more engaged and motivated in gamification-based learning.	-	Interview with School Students, Classroom Observation
More dynamic interactions	Teachers see increased student participation in class discussions.	-	Observation at School
Better understanding of concepts	Scenario-based gamification helps students understand difficult concepts.	-	Documentation Analysis
Increased student engagement	-	Students are more active in gamification-based discussions and projects.	Interview with Students, Classroom Observation
More collaborative interactions	-	Simulation-based gamification increases collaboration among students.	Observation at College

Strengthening critical thinking skills	-	Gamification-based case studies help students solve problems.	Analysis of Academic Documentation
Institutional support	Schools with supportive policies for gamification are more successful in implementing it.	Universities with flexible curricula are more likely to implement gamification.	Interview with Teachers/Lecturers
Challenge-based gamification strategies	Students are more engaged when gamification is combined with storytelling or group-based challenges.	Students are more engaged in game-based learning that includes real-world scenarios.	Interview with Students, Classroom Observation
Technology readiness and educator competency	Classrooms with good access to technology are more effective in implementing gamification.	Lecturers who are more skilled in technology tend to be more successful in implementing gamification.	Interview with Lecturers, Classroom Observation

Discussion

The findings suggest that educators in Kazakhstan adopt differentiated gamification strategies depending on the educational level and the learning profiles of their students, reflecting a growing awareness of pedagogical diversity. In secondary schools, the prevalent use of leaderboards, reward systems, and quiz-based tools caters well to students who are motivated by competition and instant feedback; however, these same techniques may inadvertently marginalize learners who are less responsive to extrinsic motivators or who experience anxiety in competitive settings. In higher education, the shift toward more sophisticated approaches demonstrates a conscious effort to promote deeper cognitive engagement and real-world application of knowledge. Yet, these methods demand significant preparation, including the design of contextually relevant scenarios and continuous facilitation by educators, which can be resource-intensive and difficult to sustain without institutional backing. Moreover, the lack of integration between game elements and specific learning outcomes in both settings points to a broader issue: many gamification practices remain more focused on engagement mechanics than on fostering authentic, transferable learning. Thus, while the diversity of gamification strategies is encouraging, their long-term pedagogical value depends on the development of more inclusive, context-sensitive, and outcome-aligned game-based designs that are supported by adequate training and policy frameworks. These results conform with research findings that show that gamification increases motivation or gamified learning experience; however, the effectiveness is based on consideration of learner characteristics (Park & Kim, 2021). Another study notes that in secondary education, competition elements work much better (Alsadoon et al., 2022), while at the higher level, simulations and project-based learning are better at improving understanding of the units of study (Ferriz-Valero et al., 2020). However, their success will depend on institutional backing, technical readiness, and curricular flexibility. As a result, gamification needs to be designed in a flexible way, that incorporates competition and collaboration and it needs to be supported by more adaptable educational policies to help with implementation at various educational stages.

The findings reveal a nuanced awareness among both high school and college students regarding the differentiated impact of gamification strategies at their respective educational levels, underscoring the importance of age-appropriate and context-sensitive design. High school students generally respond positively to competitive gamified features such as points, badges, and leaderboards which introduce an element of challenge and excitement that can increase engagement and short-term motivation. However, these same features may inadvertently contribute to academic stress or burnout, particularly for students who do not thrive in high-pressure, performance-oriented environments. This highlights the risk of over-reliance on extrinsic motivators without sufficient attention to individual emotional and

cognitive needs. In contrast, college students exhibit a clear preference for collaborative and applied forms of gamification, such as project-based learning, simulations, and group challenges. These methods are valued not only for their relevance to real-world contexts but also for their potential to foster teamwork, critical thinking, and the transfer of theoretical knowledge into practice. The divergence in preferences between these two groups suggests that a one-size-fits-all approach to gamification is inherently flawed. Instead, effective implementation requires a differentiated strategy that aligns with learners' developmental stages, cognitive maturity, and motivational orientations, ensuring that gamification enhances rather than hinders the educational experience. These findings support other studies that have shown how the effectiveness of gamification is influenced by learner profile, initial motivation, and the gamification elements used (Reyssier et al., 2022). While competitive elements are more effective for school students, challenge-based approaches, especially those set in real-world contexts, are more useful for college students, and also other studies have shown that systematizing gamification based on intrinsic motivation and learner type is effective in increasing their persistence and sense of achievement in educational activities (Kian et al., 2022). Consequently, educators must integrate competitive and collaborative components in gamification to ensure that learning is both engaging and yields a more effective and enduring experience.

Research findings indicate that the implementation of gamification in Kazakhstan is hindered by a range of interrelated technical, pedagogical, and institutional challenges that limit its effectiveness and scalability. In schools with underdeveloped infrastructure, persistent issues such as unstable internet connections, limited access to digital devices, and outdated hardware significantly constrain the ability of educators to integrate gamified tools into classroom instruction. Beyond these logistical barriers, teachers often lack formal training in the pedagogical and technical aspects of gamification, leaving them to navigate complex digital platforms without sufficient support or guidance. This gap in professional development results in uneven application of gamification practices and, in some cases, the abandonment of potentially beneficial tools due to implementation difficulties. On the pedagogical front, a major concern arises from the tension between designing competitive and collaborative learning environments. While game elements such as leaderboards and reward systems can serve as powerful motivators, they may also generate stress or disengagement among students who do not thrive in competitive settings, potentially undermining inclusivity and emotional well-being in the classroom (Kian et al., 2022). These challenges point to the need for a more systemic approach that addresses not only the technological prerequisites but also the pedagogical strategies and institutional frameworks necessary to support sustainable gamification in education. Although university teachers tend to use simulation- and project-based teaching, they often fail to ensure that students' academic needs are met when designing gamification elements. Teachers are also constrained by rigid curricula, as well as a failure to recognize gamification as a teaching technique, which hinders the use of this approach (Montenegro-Rueda et al., 2023). Other studies have shown that there is a lack of teacher training in other countries; together with the lack of digital infrastructure, they serve as barriers to the implementation of gamification. Although gamification has been shown to enhance student motivation and engagement, its effectiveness remains contingent upon designs that align with learner profiles and initial motivational factors (Gasnov, 2024). Several countries, such as Finland and South Korea, have addressed these challenges by increasing access to technology and adjusting educational policies to better support gamification-based learning innovations (Prokopenko & Sapinski, 2024). Therefore, to improve the effectiveness of gamification in Kazakhstan, strengthening the technology infrastructure, training for teachers and lecturers, and more flexible policies to support learning innovations are needed.

The findings of this study provide compelling evidence that gamification serves as a powerful catalyst for improving student motivation, engagement, and classroom interaction across both secondary and tertiary education contexts. At the secondary level, gamified elements such as leaderboards, point systems, and rewards appear to stimulate active participation by introducing a sense of constructive competition among learners, thereby transforming traditionally passive learning environments into more dynamic and participatory spaces. These mechanisms are particularly effective in capturing the attention of younger students, encouraging them to engage with content through challenge-based tasks that align with their developmental needs. In contrast, at the tertiary level, the implementation of gamification is more conceptually grounded, with a stronger emphasis on enhancing students' understanding of academic material and fostering higher-order thinking skills. Strategies such as simulations, role-playing, and project-based activities not only allow university students to apply theoretical knowledge in practical scenarios but also promote collaborative learning and problem-solving competencies essential for real-world application. Nevertheless, while these outcomes are promising, they underscore the need for continued refinement in the alignment of gamified practices with curricular goals, ensuring that the motivational appeal of gamification does not overshadow the pursuit of deep and sustained learning. These findings align with the meta-analyses conducted by (Zhang & Yu, 2022), which demonstrated that gamification exerts a moderate to substantial positive impact on academic attainment, exceeding traditional techniques. Additional research indicates that gamification can alleviate anxiety while enhancing students' autonomy and motivation (Parra-González et al., 2020). The impact, however, differs notably between pupils acquainted with game-based learning and those lacking gaming expertise.

Other components such as institutional support, technological readiness, and teacher competence that correspond with the design aspect must also be analyzed while appreciating the effectiveness of gamification in education. Supportive infrastructure and policies enhance the probability of efficient gamification integration (Zainuddin et al., 2020). Furthermore, effective gamification design must achieve a balance between learning goals and the active participation of students (Zhang & Yu, 2022). Consequently, gamification elements should be designed to be adaptive and flexible, integrated with other teaching methods, and data-driven to align with student preferences, learning objectives, and to balance intrinsic and extrinsic motivation, thereby enhancing its effectiveness.

The findings of this study underscore the critical importance of a coordinated and multi-stakeholder approach to effectively implement gamification within Kazakhstan's education system. Teachers, as the primary agents of classroom innovation, require sustained and targeted professional development that equips them not only with technical proficiency in using gamified platforms but also with pedagogical strategies to integrate competition and collaboration in a balanced and inclusive manner. Given the diversity of student learning styles and motivational profiles, educators must be trained to design adaptive gamification approaches that foster engagement without alienating less competitive learners. Simultaneously, educational institutions must take an active role in facilitating this transformation by providing the necessary technological infrastructure such as access to reliable devices, internet connectivity, and gamified learning management systems, as well as crafting flexible curriculum policies that encourage experimentation and innovation. Without these structural supports, gamification risks remaining a fragmented and superficial intervention rather than a sustained pedagogical advancement.

Equally essential is the role of government in shaping a policy environment that legitimizes and enables gamification-based innovation. This includes developing national education strategies that incorporate digital pedagogy, allocating funding for technological upgrades in underserved schools, and instituting evaluation mechanisms that measure the long-

term impact of gamification on student outcomes. However, the scope of this study is inherently limited by its geographic and methodological focus. By concentrating exclusively on Kazakhstan and employing a qualitative design, the findings provide rich, context-specific insights but lack the generalizability required to make broad claims applicable to other educational systems or to establish causal relationships between gamification and academic achievement. Despite these limitations, the research highlights gamification's transformative potential in reconfiguring how students learn and engage with content. When supported by coherent institutional frameworks and inclusive policies, gamification can become a cornerstone of pedagogical renewal in both secondary and higher education, promoting not only motivation and participation but also deeper cognitive and social learning outcomes.

Conclusion

The findings of this research indicate that gamification in education within Kazakhstan holds significant potential for enhancing motivation, engagement, and learning effectiveness at both the secondary and higher education levels. Educators predominantly implement competitive elements, such as leaderboards and reward systems, while university instructors tend to favor simulations and project-based learning to deepen students' academic understanding. Despite the demonstrated benefits of gamification, its implementation still encounters challenges, particularly regarding institutional support, technological readiness, and the flexibility of educational policies. Consequently, future research is recommended to adopt quantitative or mixed-method approaches to more objectively assess the impact of gamification and to explore optimal strategies that can be applied across various disciplines. For policymakers, there is a need for more adaptive regulatory support and digital infrastructure, including the development of training programs for educators and policies that facilitate the systematic integration of gamification into the national education curriculum.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

Sardarova E.: Data curation, Writing - Original draft preparation, Software, Supervision, Writing - Reviewing and Editing, Investigation, Project administration. Baigunakova A.: Conceptualization, Methodology, Resources. Shubayeva G.: Validation, Formal analysis, Visualization.

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AI AS A TOOL FOR TEACHING LEGAL ARGUMENTATION IN LAW SCHOOLS

Abstract. The use of artificial intelligence in the study of law offers an opportunity for creative applications in the teaching of legal argumentation and legal reasoning skills. This paper explores the potential of AI as a learning resource for law schools, including the prospect of advanced systems, such as automatic legal reasoners, simulation programs, and chatbots, being used to teach argumentative generation. By reviewing the literature and examining practices, the study anticipates the potential of AI technology according to which students will be able to write legal documents with the use of an AI in a virtual context, be involved in an argumentation of legal reasoning in real time, and have a technology respond to their arguments. While AI is in no possible certain position to replace the role of a lecturer in teaching the skill of critical analysis, it could certainly be viewed as a technology that enhances the learning experience, cultivates more student interaction, and connects theory to practice. The paper also recognises a range of challenges, including ethics, data security, and increasing reliance on technology-based resources in a professional preparation capacity.

Keywords: pedagogical tools, educational technology, legal education, law students, argumentation skills, legal reasoning, artificial intelligence

Introduction

In the educational process, artificial intelligence technologies are expected to find increasing use, as they enhance efficiency, cost-effectiveness, and save valuable time (Temirbekov, 2021). Legal argumentation, or the skill of crafting compelling and logically tenable legal arguments in both written and oral communication, is a primary skill for law students. Conventionally, education in the area involves a range of composition drills, including the composition of complaints or legal memos, as well as mock trial work, moot court activities, and in-class debating. However, traditional pedagogical methods offer certain shortcomings. Namely, students are often provided with limited opportunities to receive individualised commentary and real-world practice before exposure to real-world legal settings. Artificial intelligence, generated by computers, has recently become a practical resource to improve legal education with various new methods of engaging students in active argumentation skills and competencies. For example, chatbot systems can reproduce some elements of the technique in which lawyers argue a case and offer opportunities for immediate practice – debate opportunities that can be utilised for formative commentary. This is manifested by a growing inclusion of AI in law school curricula. In fact, a recent study by the American Bar Association showed that 55% of law schools currently offer law-focused courses on AI, while 83% offer opportunities for students with legal AI tool experience (*How Law Students Are Using AI to Improve Legal Skills*, n.d.). The purpose of the paper is to explore how AI could be applied as a pedagogical tool in legal argumentation. It has been examined how conversational robots (including chatbots) and smart tutoring systems can support law students in legal document preparation practices (such as pleadings or legal memoranda) and argumentative exercises (such as legal debates or moot court), and summarise recent evidence on their effectiveness. Through a discussion of existing literature and foreign experiences, there is an attempt to shed light on both the pedagogical potential benefits and pitfalls of AI application in legal argumentation pedagogy.

Materials and Methods

This study employs a literature review, complemented by an examination of experiences with AI-enabled legal pedagogy. The literature relating to recent research on applying AI and chatbots to argumentation teaching has been examined, comprising peer-reviewed research, conference papers, and academic debates. Secondly, it has been reviewed case studies and reports from some countries to consider how law schools and teachers were implementing it in practice. The overview included reported tools (projects) in the USA (such as AI-powered negotiating simulators and moot court judges), and citations of deployments outside (chatbot-based writing tutors and adaptive learning environments). By mapping research study findings to cases of AI deployment in legal training initiatives, the discourse around prevailing themes has been organised. The results are constructed to react to: (1) AI-assisted legal writing and argumentation draft, (2) AI-aided simulations for oral arguments and debate, (3) observed growth in student learning (any skill or motivation improvement included), and (4) potential problems and constraints.

Results and Discussion

AI-Assisted Legal Writing and Argument Drafting

Perhaps the most obvious application of AI in law school is as a writing assistant to aid students in drafting and editing legal documents. Generative models of AI – like large language model chatbots like ChatGPT – can produce readable text from a prompt, and this is what law students are using to produce first drafts of memos, briefs, or even statements of claim. This has truly changed the draft process for the majority of students (*How Law Students Are Using AI to Improve Legal Skills*, n.d.). Instead of staring blankly at a page, a student can type in an assignment (e.g., ‘draft a legal text for a motion to dismiss in a contract dispute on these facts’) and receive a draft from the AI that is sloppy but coherent. This is a good beginning, with clean paragraphs and sentences that the student can then refine and improve upon. Legal writing teachers have noted that writing generated by artificial intelligence will not necessarily replace original thought. Still, it can imitate effective sentence structure and paragraphing, providing students with examples of clear language (Guo et al., 2022). The pedagogical emphasis, therefore, shifts toward higher-order editing skills: students must analyse the AI’s output, verify the legal accuracy of assertions, insert or correct references, and refine the argument’s persuasiveness. Educators note that this process can strengthen a student’s critical eye – the key is that students are not simply submitting AI-written work, but learning to identify weaknesses or errors in it and improve upon it (*How Law Students Are Using AI to Improve Legal Skills*, n.d.).

Recent studies confirm the pedagogical effectiveness of AI-supported writing when used in this way. For instance, Guo et al. (2022) designed a chatbot system to support students’ argumentative writing. They found that law students who used AI comments made improved arguments and received better revisions than those relying only on peer feedback. AI would engage in a conversational exchange about the student’s draft, posing questions for further consideration and suggesting changes based on aspects such as clarity of argument, use of evidence, countering other arguments, and overall organisation. Such immediate and iterative feedback is difficult to provide within the usually short time available in a traditional face-to-face class, but it certainly supports learning by allowing for the scaffolding that encourages reflection and revision of thinking that students undertake. For instance, in one study, when seeded with specific writing goals that it could act upon, AI-initiated feedback was equally effective as teacher feedback in improving argumentative writing (Guo et al., 2022). These findings indicate that well-designed AI systems can be employed as a scalable adjunct to human feedback so that each student will receive individualised suggestions regarding their writing. It is essential to note, nonetheless, that the quality of the results depends on how one interacts with the AI. Best practices to arise from initial trials are to train students in creating

targeted prompts (e.g., having the AI perform as an expert legal editor about logical coherence or omitted counterarguments) and teaching them to fact-check the AI content against sources (as AI text generators can occasionally generate inaccurate legal citations or hallucinate facts). In total, AI writing assistants can serve as unbending tutors of legal argumentation: they provide frameworks and ideas with the click of a button, which students can then analyse and refine, thereby improving their legal thinking and writing skills in the process.

Chatbot Tutors and the Socratic Method

Another use of AI in legal argumentation teaching is through intelligent tutoring systems and chatbots that simulate the question-and-answer approach of a human instructor or the Socratic method. AI-powered tutors have been introduced in law schools, engaging students in discussions on legal topics by asking questions that stimulate critical thinking. These AI tutors typically consist of chat windows where the student's input is analysed and responded to by the system. Interestingly, some AI tutors are actually modelled to emulate the Socratic method, a hallmark of legal education in which the 'teacher' responds to a student's answer with more questions. For example, an AI law tutor can ask a student to state the rule for a scenario, then query 'But what if we change this fact? Would the outcome differ?', thereby encouraging the student to critically consider the application of the rule. According to recent studies, the current intelligent tutoring chatbots in law can even 'answer legal inquiries, clarify complex concepts, and even imitate the Socratic method by asking probing questions that encourage students to think critically and build their legal arguments' (Adegbite & Suleiman, 2025). This type of on-demand dialogue enables students to practice framing arguments and responding to hypothetical scenarios in a low-pressure environment outside of class. It also helps students identify areas where they have gaps in their understanding. If the AI's questions reveal confusion or weak reasoning, the student can recognise those issues and address them (either through further study or by asking a human lecturer). While AI tutors and different types of software that enhance learning will not replace the nuanced feedback of a professor, these tools provide additive practice that may support learning and improve understanding. Significantly, these systems can be made available 24/7. For example, at 1 a.m., a student could engage in an interactive Q&A about cases or get clarification on legal principles. Early perspectives from users suggest that when these tools are appropriately situated in the context of course material, students value the immediate feedback as well as the chance to practice argument building repeatedly. By simulating a tireless "devil's advocate," AI tutors help students internalise the habit of challenging and justifying their legal arguments incessantly – a fundamental skill for any lawyer.

AI Simulations for Debates and Oral Arguments

AI is also used to simulate interactive oral argument contexts, such as debates, negotiations, and court argumentation. Chatbot use falls under one of the active activities that include impersonating an opposing debater or a judge, where students can use live argumentation. The chatbot could provide a counterargument to a student's position and expose them to potential counterarguments, allowing students to practice refuting them (Huang et al., 2025). Essentially, the AI serves as a plug-and-play replacement for a debate opponent. Empirical results of such experiments have been positive. The introduction of a chatbot into classroom debates led to observable improvements in students' argumentation skills – task motivation was improved, which they expressed by getting more involved in the interactive challenge (Guo et al., 2022). It applies very well in legal education since moot debating on burning issues forms a regular exercise. Hence, a chatbot throws piercing questioning or reasoning to the law student, making the student think on his feet, justify his reasoning, and even sharpen his arguments – similar to what he might be required to do against a live opponent in court or before a judge.

In moot court and oral advocacy, new AI tools are emerging that enable students to rehearse arguing in front of a virtual judge. For instance, at Suffolk University Law School (US), the Legal Practice Skills program piloted a customised ChatGPT-based tool that mimics a moot court judge (*AI for Oral Advocacy*, n.d.). Students upload their case files (briefs, the record, etc.) into the system, and the AI – preloaded with the facts and law of the case – acts as a judge. The student then rehearses an oral argument: the AI judge asks questions about the student’s case, pinches pennies on doubtful points, and even quizzes them on hypotheticals. This allows the student to road-test their arguments in an authentic conversation. According to reports from the faculty, the 1L students who utilised the AI judge tool responded very well (*AI for Oral Advocacy*, n.d.). They reported that the experience relieved them of anxiety and made them better prepared, as they were able to practice responding to challenging questions before the actual graded moot court exercise. The AI is not necessarily simulating the full physicality of a courtroom, but is maintaining the intellectual exchange aspect of oral advocacy. The added advantage is that students can rehearse on it more than once: each session may present various questions from the AI, exposing the student to a range of potential issues. Other law teachers have created such tools. For example, legal tech instructor David Colarusso built an AI robot called ‘Moot a Case’ that enables students to ‘play the part of an attorney arguing one side of a case before an AI-simulated judge’ (Colarusso, n.d.). These kinds of AI simulations are essentially virtual practice – they fill in for the sparse opportunities students have historically had to plead before experts.

Law schools are also turning to AI to help prepare for negotiation and dispute resolution training. Negotiation is a critical lawyering skill that involves argument, persuasion, and strategy; yet, students traditionally have had few opportunities to practice with feedback. In 2025, Suffolk Law School launched an experimental website that allows students (and the general public) to practice negotiating with an AI bot (*Digital Dealmakers: Suffolk Law’s New AI Platform Challenges Student Negotiators - Suffolk University*, n.d.). Unlike simple chatbots that might always concede, these AI negotiators are programmed to behave like seasoned lawyers – employing various ploys, sometimes soft and sometimes hard, depending on the circumstances (*Digital Dealmakers: Suffolk Law’s New AI Platform Challenges Student Negotiators - Suffolk University*, n.d.). In one case on the site, a land disagreement exists between a mining company and an owner, where the AI will negotiate aggressively on core issues, such as rights to land and compensation (*Digital Dealmakers: Suffolk Law’s New AI Platform Challenges Student Negotiators - Suffolk University*, n.d.). Students will need to adjust their approach on the fly, feeling what it’s like to negotiate with an opponent who will not just give in. This is a realistic test that simulates real-life legal negotiations, including the need to balance legal argumentation with pragmatic interests. As Professor Dwight Golann, the initiator of the project, noted, instruments like these present important questions about the future of AI in law, while providing students with practical experience in different bargaining styles (*Digital Dealmakers: Suffolk Law’s New AI Platform Challenges Student Negotiators - Suffolk University*, n.d.). Initial experiences suggest that students learn by watching how – through stylistic adjustments (e.g., through more cooperative vs. competitive bidding) – they bring about different reactions from the AI. Essentially, the AI is a virtual adversarial attorney played as often as the student desires until they feel they have developed the best approach. Skills and confidence accrue through such repeated practice. It is worth noting that the AI simulation does not completely replace human role-plays, but rather supplements conventional training. By integrating AI scenarios and live role-play practice, educators can offer more diverse practice scenarios – ensuring that students are subjected to both the uncertainty of human players and the predictability (and unlimited availability) of AI players.

Benefits for Student Learning

The incorporation of AI in legal argumentation training has several self-evident benefits that have been witnessed through these applications. To start with, AI technology bridges the theory-to-practice gap by subjecting students to animated, realistic simulations. Instead of learning argumentation in the abstract, students who use AI simulations have the opportunity to apply legal doctrine to concrete problems – such as drafting actual court filings, arguing a case (albeit virtually), or negotiating a contract – that reinforces their understanding and retention of the material (Adegbite & Suleiman, 2025). Experiential learning is essential in law, where hands-on experience complements doctrine-based education. Second, AI offers a level of personalised and timely feedback that is difficult to replicate in traditional classroom teaching. A chatbot tutor can give immediate replies 24/7, and generative AI can give personalised advice on a student’s written argument almost as soon as it has been written. It keeps the learners engaged by allowing them to learn from their mistakes in real-time. The use of AI practice increases learners’ confidence and motivation because, since the systems are non-judgmental and never running low on patience, it provides a learning environment where learners feel at liberty to try out their wings or ask ‘dumb’ questions. For instance, research based on chatbot-assisted discussion found not only better competence in argumentation but higher motivation towards the task because students were challenged interactively and felt they were themselves more responsible for their learning process (Guo et al., 2022; Huang et al., 2025). Similarly, the Suffolk moot court project found that participants experienced decreased anxiety, indicating that working with an AI judge prepared them better to be confident when dealing with actual judges (*AI for Oral Advocacy*, n.d.). Another related advantage is the uniformity and diversity AI can provide. Consistency in the form that an AI is perpetually prepared with a challenge (never going to cancel office hours or become fatigued with giving feedback), and variety in the form that AI can be programmed to present various styles or levels of difficulty. For instance, an AI negotiation bot can switch between cooperative and assertive strategies, introducing students to a variety of negotiation approaches in a manner that one human role-play partner might not (*Digital Dealmakers: Suffolk Law’s New AI Platform Challenges Student Negotiators - Suffolk University*, n.d.). These advantages enable students to develop critical thinking skills. In struggling to refute the arguments generated by AI and complex hypotheticals, students engage in thinking on their feet about issues from multiple sides and honing their positions, which enriches their analysis. A well-designed AI learning environment can encourage students to identify salient legal issues and construct sound arguments by exposing them to the kinds of multifaceted problems they will encounter in real-world practice (Adegbite & Suleiman, 2025).

Above all, AI is most effective as a pedagogical tool when it is integrated intelligently into a broader educational plan. Implemented well, as the literature describes, are hybrid models of learning – using AI to augment, not replace, human instruction. For example, learners compose an argument from inception with the help of AI and turn it in for either a peer review or faculty feedback. By this time, the AI would have completed much of the preliminary heavy lifting and iteration that typically falls on the instructor to provide basic write exercises rather than higher-order feedback. Others have used a ‘flipped’ model wherein students use AI tools to prepare (research, outline, or practice) before class and use class time for further discussion and mentoring. AI can provide pre-class preparation (e.g., quizzes or simulated scenarios) and post-class practice for reinforcement (Adegbite & Suleiman, 2025). The net effect is often an overall richer learning experience. Students get more repetitions of core skills than they might otherwise, and instructors can concentrate their teaching in those areas where human expertise and judgment cannot be replicated – such as advanced legal analysis, ethical reflection, and professional ethics.

Challenges and Ethical Considerations

The hope that AI will teach legal argument is exciting but comes with some challenges and dire warnings. Implementing AI in education about the law also ‘brings ethical, practical, and access-related challenges that must be addressed to ensure equitable implementation and effective educational outcomes’ (Adegbite & Suleiman, 2025). In a list of concerns, is the credibility and accuracy of AI-generated content. Large language models can sometimes produce inaccurate information or create citations with high confidence. Students, if not wary, may accept AI output or get used to accepting answers without confirming them. This shows a need for educators to encourage students to fact-check the facts in an AI-generated response and treat its suggestions as ideas rather than as truth. A similar concern is overdependence: if students are overly reliant on AI to do their thinking for them, they can short-circuit the process of learning to think critically. For example, a chatbot can generate a persuasive argument, but if the student simply accepts it, they may not be learning to create persuasive arguments independently. Some law professors have noted concern that tools like ChatGPT could become a crutch, doing the ‘easy’ work of writing and thus leading students to skip the struggle that results in more meaningful learning (Guo et al., 2022). To avoid this situation, assignments can be designed so that students have to defend or explain any AI-generated content. As a result, students will have to engage with the content more critically.

Moreover, privacy and ethics emerge. Legal arguments often include confidential or sensitive information. Disclosing client facts or case details to a third-party AI service may breach privacy obligations or honour codes in academia. Law schools must teach students what is appropriate to reveal to AI systems and possibly utilise self-hosted or privacy-compliant AI tools for particular exercises. And then there is the larger ethical issue of unauthorised practice of law: AI can produce legal arguments, but students could incorrectly assume AI advice to be accurate legal advice. Teachers must stress the limitations of AI – it lacks actual understanding or responsibility, and its ‘legal advice’ is not screened for accuracy or ethics. As part of professional training, students should be educated that AI is a tool in the lawyer’s control and that the lawyer has the ultimate responsibility for the work product.

From a practical standpoint, implementing AI into the classroom requires resources and training for faculty. Not all schools have equal access to these technologies, which raises issues of accessibility and equity. A law school with greater funding can design their own AI platform (this is the case with Suffolk) and provide students with subscriptions to a top-tier AI service, while another law school would fall behind. If this is not managed, this will exacerbate the skills disparity. Additionally, current faculty need to receive training in AI competencies in order to be able to apply them, which involves training and modifications to the curriculum. Resistance will arise from faculty who are sceptical or who feel AI diminishes traditional teaching; in order to mitigate this, it may be useful to have transparent and open discussions along with demonstrations of effectiveness. Last, the human element of legal education cannot be replicated. AI is not able to truly replicate mentorship, moral judgment, or the interpersonal aspects of lawyering (e.g., empathy and persuasion) (*A Chat with ChatGPT: The Uniquely Human Aspects of Lawyering – Holloran Center Professional Identity Implementation Blog*, n.d.). A great balance has to be found where AI assumes some repetitive or simulative tasks, but professors continue to guide the formation of judgment, ethics, and professional identity in students. As one researcher has put it, the greater utilisation of AI in law means that future lawyers must be great at the uniquely human aspects of lawyering – empathy, creativity, ethical judgment – precisely because the technical and repetitive aspects will be heavily assisted by AI (*A Chat with ChatGPT: The Uniquely Human Aspects of Lawyering – Holloran Center Professional Identity Implementation Blog*, n.d.). With this in mind, the majority of legal educators recommend using AI to augment learning (by providing additional practice and feedback) but not to replace the fundamental teaching of legal reasoning. Overall, the potential

of integrating AI into legal argument instruction is clear. Nonetheless, supervision and regulations must accompany its integration, and critical thinking should frame the discussion of whether it ultimately enhances student learning.

Conclusions

AI is rapidly redefining how legal argumentation is taught, providing state-of-the-art tools that augment traditional methods of teaching law. In their study, the researchers discovered that chatbots and AI systems could serve as meaningful pedagogical partners for law students by aiding in the writing and revising of written arguments; playing the role of opponents in debates and negotiations; and offering personalised feedback and questioning, which helps to nurture critical thinking. These technologies have been found to increase the extent to which students get involved, provide more practice opportunities, and even boost measurable skills, such as argument quality and learning task motivation. By bridging the divide between the classroom theory and the practice of the real world, AI technologies allow students to learn by doing – writing briefs with the assistance of AI, arguing in front of an AI judge, or negotiating against an AI adversary all mimic aspects of legal practice within a limited, reproducible environment. While this provides students with experience and confidence in real-world skills, it also allows students to experience scenarios that would be difficult to arrange otherwise.

However, the introduction of AI as a mode of teaching and learning must be done carefully. Teachers, as well as law schools, must consider a range of concerns related to the validation of AI-generated content, over-reliance (which compromises actual skill development), ethical considerations (including confidentiality and honesty), and the equitable availability of these technologies to everyone. AI must be framed as a help – an ‘intelligent assistant’ that can learn the drudgery and provide instant feedback – not a clever shortcut to avoid the toil of legal analysis. When students use AI to generate an argument, they should be directed to critically evaluate it, rather than blindly adopting it. When they practice with AI simulations, human instructors can follow up with reflection and debriefing to consolidate the lessons. The instructor’s role remains significant in formulating AI-integrated assignments, as well as in imparting meta-skills such as judgment, ethics, and empathy that AI cannot teach.

Generally speaking, AI as a tool of education in the aspect of legal argumentation helps to teach future lawyers who are technically sound and, at the same time, reasoning-oriented. The international experiences being considered show that if properly utilised, AI can be advantageous to legal education by improving aspects of engagement, personalisation, and making the practice relevant. Those law schools that take advantage of these technologies, together with sound professional values, are likely to better prepare their students for a legal environment where collaboration with AI will be the norm. Finally, the addition of AI to legal argument training is not a matter of surrendering the art of lawyering to machines; it’s a matter of using smart systems to train better lawyers – lawyers who can leverage technology for efficiency and perspective, yet continue to practice uniquely human creativity that the practice of law will constantly require.

Conflict of Interest Statement

The author declares no potential conflicts of interest regarding the research, authorship, or publication of this article.

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ASSESSING THE READINESS OF FUTURE TEACHERS IN KAZAKHSTAN FOR TRANSDISCIPLINARY EDUCATION IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

Abstract. This study explores the readiness of future teachers in Kazakhstan for transdisciplinary education within the context of underutilized STEM/STEAM frameworks. Using a quantitative approach, survey data were collected from 166 students across five Kazakhstani universities: Korkyt Ata Kyzylorda University, Kyzylorda Bolashak university, Alikhan Bokeikhan University in Semey, Karaganda Buketov university and Eurasian National University named after L.N.Gumilyov in Astana. The survey instrument, based on transdisciplinary frameworks by Piaget and Nicolescu, demonstrated high reliability (Cronbach's Alpha = 0.978). Transdisciplinarity refers to a holistic approach that transcends disciplinary boundaries, aiming to integrate knowledge into a unified system of understanding. Data was analyzed by the statistic program SPSS 29.02.0. Results showed a moderately high overall level of readiness for transdisciplinary approach (M = 3.82), with higher scores among students who had completed internships (M = 3.92) and taken interdisciplinary courses (M = 3.94). Although graduate students exhibited higher competence than first-year students, the difference was not statistically significant. These findings show the need for integrating hands-on experience and interdisciplinary courses into teacher education programs to foster transdisciplinary skills. The study recommends early integration of such practices, faculty development, and alignment with international models to improve educational outcomes in Kazakhstan.

Keywords: transdisciplinary education, teacher preparation, STEM, STEAM, Kazakhstan, interdisciplinary learning.

Introduction

The increasing complexity of global challenges such as climate change, technological disruption, and evolving workforce demands, necessitates an education system that goes beyond traditional disciplinary boundaries. To deal with real-world challenges, future teachers need to combine knowledge from different subjects and develop skills such as critical thinking, creativity, and systems thinking (Morze & Strutynska, 2021). These competencies are closely aligned with the principles of STEM and STEAM education, which aim to enhance both intellectual and practical abilities while fostering innovation and problem-solving skills essential for the 21st century (Widodo W., 2019). Ultimately, this interconnected skill set supports the development of a transdisciplinary learning approach (Holbrook et al., 2020). Transdisciplinary education helps students connect ideas from different subjects and use them together in practice. For example: science, technology, engineering, arts, and mathematics through collaborative projects that utilize these technologies. For example, students can use STEM and STEAM tools to solve real-life problems, which helps them think more critically and creatively. The integration of scientific and artistic perspectives show how they stimulate innovative thinking and develop a nuanced understanding of content and real-world applications (Burnard & Colucci-Gray, 2021). Despite the global emphasis on interdisciplinary and transdisciplinary methods, many teacher preparation programs still focus primarily on

subject-specific content without offering sufficient opportunities for integrated, hands-on learning. In Kazakhstan, there is a pressing need to modernize teacher education by embedding interdisciplinary pedagogies and real-world problem-solving experiences. Introducing future teachers to project-based and inquiry-driven models can significantly enhance their ability to design engaging, cross-disciplinary lessons. Furthermore, fostering collaboration among students from various fields during training can simulate the type of teamwork required in contemporary education environments. This shift is vital for preparing educators who can lead transformative learning experiences in increasingly complex classrooms. However, despite its growing importance, its implementation within teacher training programs remains underexplored in Kazakhstan (Abdrakhmanova et al., 2025).

Jean Piaget introduced the term "transdisciplinarity" in 1970 and provided its first definition. He envisioned it as a stage beyond interdisciplinarity, where knowledge transcends disciplinary boundaries and forms a global, integrated system (Cohen & Waite-Stupiansky, 2023). As Basarab Nicolescu stated, "Transdisciplinarity is a way of being, thinking, and acting that goes beyond disciplines and seeks unity of knowledge". In his exploration of transdisciplinarity, Basarab Nicolescu delineates this approach in contrast to other methodologies such as multidisciplinary and interdisciplinarity. He notes that multidisciplinary involves examining a research topic through multiple disciplines simultaneously, contributing an additional perspective to the primary discipline while operating within its established framework. Interdisciplinarity, on the other hand, focuses on the transfer of methods from one discipline to another, which can lead to the creation of new fields, yet it remains contained within the overarching structure of disciplinary research (Nicolescu, 2014). Today, the transdisciplinary approach goes beyond theoretical part and is actively implemented in the educational process, particularly in the training of future teachers. Researchers argue that future teachers need to learn how to work with complex, real-world problems that cannot be addressed within a single discipline, especially in the field of sustainable development (McGregor, 2022). This shift reflects the growing demand for educational models that connect knowledge with practice and encourage students to integrate perspectives from different domains.

Research shows that STEM and STEAM approaches help students think critically, collaborate, and apply what they learn in real-life situations. However, these approaches often remain difficult to implement in practice, as many teachers lack the necessary training and methodological support (Herro & Quigley, 2017). As a result, there is still a noticeable gap between theoretical models of transdisciplinary education and their application in real educational settings. Recent empirical studies also highlight the importance of innovative pedagogical approaches, including inquiry-based and technology-enhanced learning. These methods support deeper student engagement and make it easier to connect abstract concepts with real-life contexts. In particular, the use of digital and AI-supported tools creates new opportunities for interactive and collaborative learning, which are essential for the development of transdisciplinary competence (Holmes et al., 2019).

Both inter- and transdisciplinarity aim to cross traditional disciplinary boundaries. However, while interdisciplinary research seeks to coordinate and combine insights from various academic fields into a unified perspective, transdisciplinary research extends beyond academia by integrating scholarly knowledge with non-academic or practical forms of understanding (Popa et al., 2015).

Current research in Kazakhstan's education system focuses primarily on disciplinary and interdisciplinary approaches, with limited studies assessing the readiness of future teachers for transdisciplinary education. Moreover, while transdisciplinary education has been successfully integrated into teacher training programs in countries such as Finland, Canada, and Singapore, Kazakhstan lacks empirical studies evaluating its teacher education system

through a transdisciplinary lens (Zhumabay et al., 2024). Despite significant scientific and practical interest in STEM education in the international community, this model is underused in educational institutions in Kazakhstan (Ibraeva & Shaushekova, 2023). Given the underuse of STEM education in Kazakhstan, it is crucial to explore how transdisciplinary approaches can enhance teacher preparedness.

Research aim of this study to assess future teachers' readiness for transdisciplinary education.

Research tasks: to design a scientific survey instrument using proven theoretical frameworks; to conduct survey among students of pedagogical field in the universities of Kazakhstan; to analyze and give results.

Research Questions:

1) How well are future teachers in Kazakhstan prepared for transdisciplinary education in terms of interdisciplinary integration, systems thinking, creativity, collaboration, and critical thinking?

2) What challenges do future teachers face in developing transdisciplinary competencies, and how do these challenges relate to their current educational training?

3) How can teacher education programs in Kazakhstan be adapted to better integrate transdisciplinary approaches, based on Piaget's constructivist learning theory and Nicolescu's concept of knowledge unity?

This study is grounded in the premise that the integration of transdisciplinary education within teacher training in Kazakhstan remains underexplored and under-implemented. The research advances the idea that future educators must be equipped with a blend of interdisciplinary thinking, systems analysis, creativity, and collaboration skills to meet the complex challenges of modern education. Unlike prior research which primarily emphasized subject knowledge or STEM content delivery, this study takes a holistic approach assessing the readiness of teacher candidates to operate across disciplines using validated frameworks by Piaget and Nicolescu. The findings aim to contribute evidence for reforming teacher education policies in Kazakhstan and aligning them with international standards for 21st-century teaching competencies.

Materials and Methods

To examine students' skills and their readiness to solve complex tasks that require knowledge from different areas, we conducted a quantitative study with 166 participants. It covered 5 universities across Kazakhstan, selected based on their relevance to teacher education programs especially: Korkyt Ata Kyzylorda State University, Kyzylorda Bolashak university, Alikhan Bokeikhan University in Semey, Karaganda Buketov university and L.N.Gumilyov Eurasian National university in Astana. Participants were 1-4 academic year students. The demographic part includes the age of students, academic year, their major and information about attending internship.

In this study we used a survey made based on J.Piaget's and B.Nicolescu's theories. The survey consists of 5 parts: educational integration and interdisciplinary connections; system thinking; innovation and creativity in pedagogy; collaboration and teamwork and critical thinking and reflection. The first part educational integration and interdisciplinary connections consists of 10 questions which assess interdisciplinary and transdisciplinary competencies, particularly in an educational context. They measure a student's ability to integrate knowledge across disciplines and apply it to real-world situations: Interdisciplinary Thinking; Problem-Solving Approach; Holistic Understanding; Application to Teaching Practices; Confidence in Interdisciplinary Instruction.

The second part of survey assess systems thinking, analytical skills, and interdisciplinary awareness, particularly in the context of education and problem-solving. They help determine an individual's ability to see connections between different factors and predict broader

implications of decisions: Systems Thinking and Holistic Analysis; Multifaceted Problem-Solving; Critical and Predictive Thinking; Interdisciplinary Connections; Use of Visual and Conceptual Tools.

The third part questions assess creativity, interdisciplinary innovation, and flexible thinking in educational and problem-solving contexts. They measure an individual’s ability to integrate diverse knowledge sources and explore unconventional solutions: Interdisciplinary Innovation & Integration; Creativity & Open-Mindedness; Application of Interdisciplinary Thinking in Teaching; Problem-Solving Flexibility; Exploration of Diverse Knowledge Sources.

The fourth part questions assess collaboration, interdisciplinary communication, and teamwork skills, particularly in educational and academic settings. They help determine how well an individual engages with experts from different disciplines and integrates diverse knowledge sources into collective work: Interdisciplinary Communication Skills; Collaboration & Teamwork; Cross-Disciplinary Knowledge Exchange; Integration of Multiple Perspectives; Application of Interdisciplinary Knowledge in Problem-Solving.

The fifth part questions assess interdisciplinary reflection, critical thinking, and self-assessment skills, particularly in education and problem-solving. They help determine how well an individual integrates knowledge from multiple disciplines and evaluates their own learning and decision-making processes: Interdisciplinary Reflection & Self-Assessment; Integration of Cross-Disciplinary Knowledge; Critical Thinking & Problem Analysis; Recognition of Knowledge Limitations; Pedagogical Innovation & Complexity Awareness.

Statistics of validity

Cronbach’s Alpha	Number of items
,978	50

The reliability of the survey instrument was assessed using Cronbach’s Alpha. The result showed an alpha value of 0.978 across 50 items, indicating excellent internal consistency. According to widely accepted benchmarks, a Cronbach’s Alpha above 0.9 demonstrates that the items are highly correlated and consistently measure the same underlying construct—in this case, transdisciplinary competence. These results confirm that the instrument is statistically reliable and suitable for further analysis.

The collected data was analyzed using the SPSS 29.02.0 program. We used statistical t-tests to define impact of Practical Experience on Transdisciplinary Competence and ANOVA + Tukey HSD to define Competence Differences among students of 1-4 academic years.

Results and Discussion

Internships play a significant role in future career of students because at the time of practice they develop essential skills in order to force and manage with real problems. It helps to integrate theoretical knowledge with practical application (Shethiya et al., 2025). Skills that enhance employability, commonly known as "soft skills," encompass a wide array of abilities, including effective communication, collaboration, problem-solving, managing time efficiently, and critical thinking (Bridgstock, 2009). Many of these competencies also align with the foundational elements of transdisciplinary competence.

Based on this, the following hypothesis is proposed:

Hypothesis 1. *Students who have completed an internship have higher transdisciplinary competence than students who have not completed an internship.*

According to the results, individuals who completed an internship reported a higher average level of transdisciplinary competence ($M \approx 3.91$) compared to those who did not complete an internship ($M \approx 3.67$). This suggests that internship participation may be positively associated with greater development of skills that span across disciplinary boundaries.

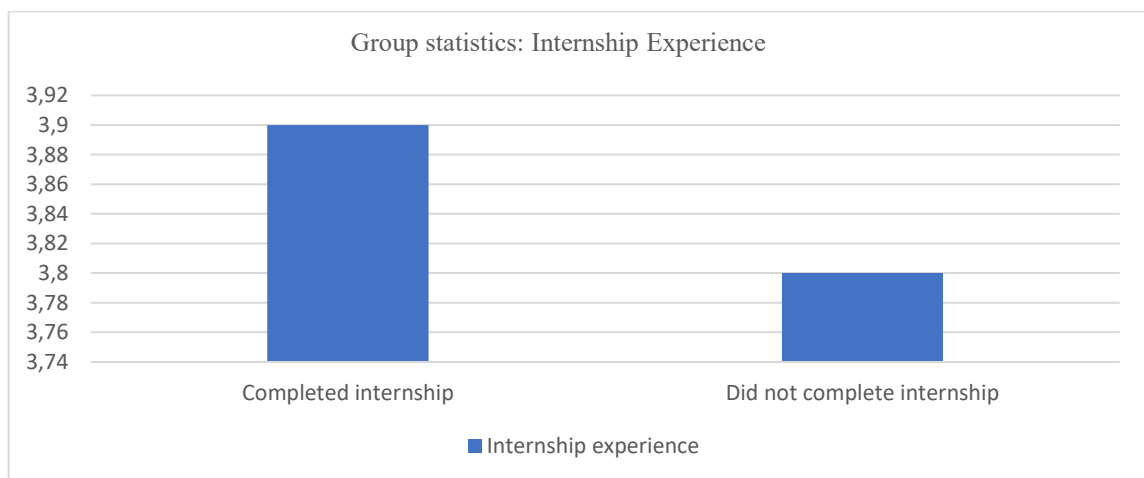
Transdisciplinary competence, often understood as the ability to integrate and apply knowledge across various domains in collaborative and innovative ways, is evidently more developed among participants who have undergone practical, hands-on experiences such as internships.

The bar graph titled “Group Statistics: Internship Experience” presents the mean scores of transdisciplinary competence among two groups of participants: those who completed an internship and those who did not. This visual representation is based on descriptive statistical analysis conducted using the SPSS 29.02.0. The mean scores are used to compare perceived levels of transdisciplinary competence between the two categories of internship experience (Figure 1).

The visual comparison also includes vertical error bars, which likely represent standard deviations or standard errors, highlighting the variability within each group. The figure does not show exact statistical indicators such as p-values or effect sizes, but the difference in mean scores is clearly visible. Students who completed internships demonstrate higher levels of transdisciplinary competence, which points to the importance of practical experience in their training.

Internships help students face real situations, work with complex tasks, and apply knowledge from different areas. This makes their learning more meaningful and closer to professional practice. The results show that including internships in teacher education programs can strengthen students’ readiness for multidisciplinary work. At the same time, additional statistical analysis is needed to confirm these differences and better understand what factors influence the development of transdisciplinary competence.

Figure 1
Internship experience



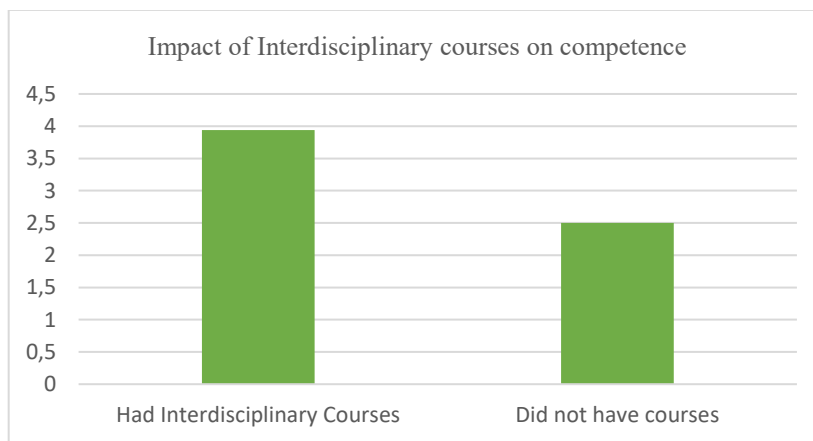
Higher education institutions are adopting new educational strategies to prepare graduates with the skills needed to address complex, real-world challenges. These strategies include interdisciplinary courses and problem-based learning experiences that promote collaboration across disciplines (Amelink et al., 2024). These evolving educational strategies reflect a growing emphasis on interdisciplinary and transdisciplinary learning, particularly through courses designed to foster problem-solving, collaboration, and innovation across fields. Such courses give students the opportunity to look at problems from different perspectives and work with more complex ways of thinking. This experience plays an important role in the development of transdisciplinary competence.

Based on this, the following hypothesis was formulated:

Hypothesis 2. Students who take interdisciplinary courses show higher levels of transdisciplinary competence than those who do not.

The results support this assumption. Students who participated in interdisciplinary courses demonstrated a higher average score ($M = 3.94$) compared to those who did not ($M = 3.72$) (Figure 2). Although the difference is not large, it still shows a clear tendency. Learning in interdisciplinary settings helps students combine knowledge from different fields, think more broadly, and find solutions to complex problems. These results align with previous studies that highlight the importance of cross-disciplinary learning for developing flexible thinking and problem-solving skills. Therefore, this result supports the hypothesis that interdisciplinary course participation enhances transdisciplinary competence, underlining the importance of curricular reform to incorporate more interdisciplinary content in teacher education programs.

Figure 2
Impact of Interdisciplinary courses on competence



The findings from longitudinal research emphasize that structured transdisciplinary training at the graduate level can significantly enhance students' ability to engage in collaborative research and apply complex conceptual frameworks. As students progress through their academic journey, their exposure to diverse learning experiences and higher-level problem solving may contribute to stronger transdisciplinary competencies (Liechty et al., 2022).

Accordingly, the third hypothesis is proposed:

Hypothesis 3. *Graduate students have more developed transdisciplinary competence than the students of the beginning courses.*

As shown in table 1, an analysis using Tukey's HSD post-hoc test was conducted to compare transdisciplinary competence across different academic years. The results indicated a gradual increase in competence scores as students progressed through their academic programs. First-year students reported the lowest mean score ($M = 3.71$), while fourth-year students exhibited the highest ($M = 4.09$). Intermediate scores were observed for third-year ($M = 3.92$) and second-year students ($M = 4.05$).

Although the observed trend suggests that transdisciplinary competence tends to develop over time and with academic experience, the differences among the groups were not statistically significant at the 0.05 level ($p = 0.142$). This implies that while graduate students (particularly those in their fourth year) demonstrate higher levels of transdisciplinary competence than their junior counterparts, the variation is not sufficient to conclusively confirm the hypothesis based on this sample.

Nonetheless, the increasing trend provides empirical support for the pedagogical assumption that transdisciplinary skills are strengthened through continued exposure to higher education, practical experience, and interdisciplinary learning.

Table 1.

Differences of results among 1-4 academic year students

Transdisciplinary_competence
Tukey HSD^{a,b}

Academic years	N	Subset for alpha = 0.05
1 year	103	3,7085
3 year	31	3,9174
2 year	19	4,0465
4 year	13	4,0877
significance		,142

a. Uses the harmonic mean sample size = 23.321.

b. Group sizes are unequal. The harmonic mean of group sizes is used.

Type I error levels are not guaranteed under these conditions.

Despite global advancements in STEM education, Kazakhstan continues to face structural and systemic challenges in its implementation. As highlighted in recent comparative analyses, the absence of a unified national approach to STEM and STEAM integration in teacher education, along with a gap between university-level pedagogical training and the realities of school instruction, limits the development of essential competencies among future educators. These limitations directly impact the cultivation of transdisciplinary skills, which rely heavily on interdisciplinary exposure and real-world application (Zholymbayev et al., 2021).

Based on this, the fourth hypothesis is proposed:

Hypothesis 4. *Students of the pedagogical direction of Kazakhstan have a low level of transdisciplinary education. Due to the fact that the system of transdisciplinary Education STEM STEAM is not implemented at the state level, teachers have a low level of transdisciplinary education.*

Table 2 offers descriptive statistics from the study (N = 166) reveal that the overall transdisciplinary competence among pedagogical students in Kazakhstan is moderate, with a mean score of 3.82 (SD = 0.61) on a 5-point scale. The range of scores, spanning from 1.00 to 5.00, indicates a substantial variation in competence levels among participants.

These results show that some students reach a high level of knowledge, while many others still do not have basic understandings about transdisciplinarity. The standard deviation further supports the presence of variability in preparedness among respondents.

The findings partially support the hypothesis, indicating that while future teachers in Kazakhstan demonstrate a moderate level of transdisciplinary competence (M = 3.82), the absence of a nationally implemented STEM/STEAM framework likely contributes to the inconsistency and overall underdevelopment of these competencies.

Table 2.*The level of readiness of students for transdisciplinary education*

Descriptive statistics							
	N	Mini- mum	Maxim- um	Mean (Average)	Standard Deviation		
Transdisciplinary_compete nce	166	1,00	5,00	3,815	,61444		
N valid	166						

These findings align with global literature that emphasizes the impact of experiential learning and interdisciplinary exposure on transdisciplinary competence. For instance, studies in Finland and Canada have demonstrated that practical experiences, combined with reflective, project-based learning, significantly enhance teachers' ability to integrate knowledge across domains and foster innovation in the classroom. Similarly, the observed increase in competence scores among students who participated in interdisciplinary courses supports claims that such exposure improves not only theoretical understanding but also flexible thinking and problem-solving capacity.

Although the differences across academic years were not statistically significant, the upward trend suggests that sustained exposure to complex educational tasks over time contributes to the gradual development of transdisciplinary competence. This trend shows that early support and targeted learning activities can help students develop these skills faster and reduce differences in competence levels.

The findings also reveal systemic gaps: despite a moderate overall level of competence, the lack of a national STEM/STEAM implementation strategy likely contributes to uneven training quality and preparedness. This suggests that transdisciplinary education in Kazakhstan still relies heavily on institutional initiative rather than policy alignment.

In response, teacher education programs should incorporate structured opportunities for interdisciplinary collaboration, critical reflection, and real-world problem-solving from the first year of study. Faculty development is also essential, as instructors must be trained not only to deliver integrated content but also to model the cognitive flexibility and cross-disciplinary thinking required for transdisciplinary teaching.

Future research should explore longitudinal impacts of such interventions and include qualitative measures (e.g., interviews or reflection journals) to deepen understanding of how transdisciplinary competence develops across time and context.

Conclusion

This study examined the readiness of future teachers in Kazakhstan for transdisciplinary education across five universities using a quantitative approach with 166 students from different academic years. Overall, students demonstrated a moderately high level of readiness to transdisciplinary approach ($M = 3.82$). The findings revealed that practical experience through internships ($M = 3.92$) and participation in interdisciplinary courses ($M = 3.94$) were associated with higher levels compared to those without such experiences. Although an upward trend was observed in competence from the 1st to the 4th year of study, the differences were not statistically significant. These results highlight the importance of integrating hands-on experiences and interdisciplinary coursework into teacher education programs to enhance transdisciplinary skills from early stages of academic training.

The findings of this study point to several actionable strategies for enhancing transdisciplinary competence among future teachers in Kazakhstan. First, increasing opportunities for practical experience, such as internships, appears essential, as students with such experience demonstrated higher competence levels. Second, the expansion of

interdisciplinary courses within teacher education curricula could foster broader and deeper integration of knowledge, given their positive association with competence development.

Moreover, the study highlights the importance of early integration of transdisciplinary concepts, suggesting that introducing interdisciplinary and hands-on learning experiences from the first year may accelerate skill acquisition. Targeted development of specific competencies such as systems thinking, creativity, collaboration, critical reflection, and integrative thinking is also recommended to build a strong foundation for transdisciplinary practice (Wall & Shankar, 2008).

In addition, embedding real-world problem-solving tasks that require the application of knowledge from multiple domains can help simulate the complex challenges educators face. It is important to regularly assess how students develop transdisciplinary competence during their studies in order to track their progress and improve teaching approaches over time (Steiner, 2011).

Teachers also play a key role in this process. They need support and training to use transdisciplinary methods in their teaching. When instructors feel confident in these approaches, they can better guide students and model the skills needed for real professional situations. These steps can help bring teacher education closer to the current demands of the education system and prepare future teachers for complex and interdisciplinary work.

Today, many countries focus on flexibility, innovation, and collaboration in education. Transdisciplinary learning supports these directions. If teacher education programs in Kazakhstan start developing these skills from the early stages, graduates will be better prepared to respond to changing conditions in schools and society. Over time, this can strengthen the education system and help it meet both local needs and global development goals. Encouraging institutional support, policy alignment, and continued research into effective transdisciplinary strategies will be essential to sustaining this transformation and ensuring its long-term impact.

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Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

Arystankyzy G.: Conceptualization, Methodology, Investigation, Data curation, Writing - Original draft preparation. Nagymzhanova K.: Supervision, Writing - Reviewing and Editing.

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KAZAKHSTAN'S PATH IN HIGHER EDUCATION RECOGNITION: FROM BOTTOM-UP INITIATIVES TO GLOBAL CONVENTIONS

Abstract. Since achieving independence in 1991, Kazakhstan has undertaken extensive reforms in its higher education system, with the recognition of qualifications becoming an integral aspect of internationalization and academic mobility. This article investigates the evolution of Kazakhstan's recognition system, from nostrification procedures to engagement in European, regional, and global recognition frameworks. Employing document analysis and historical institutionalism, the study examines how recognition reforms have been shaped by interactions among academic stakeholders, government policies, and international organizations such as UNESCO, the European Higher Education Area (EHEA), and the ENIC/NARIC networks. The results indicate that Kazakhstan has established a hybrid, multi-tiered recognition model that integrates the Lisbon Recognition Convention framework with regional accords and global instruments, including the Tokyo and UNESCO Global Conventions. Although there has been early adoption of European standards, notable disparities persist between formal commitments and actual implementation, particularly concerning automatic recognition and the acknowledgment of non-formal learning and micro-credentials. The article contends that recognition in Kazakhstan serves not merely as a legal procedure but also as an instrument of multi-level governance within the context of global higher education.

Key words: Recognition of qualifications; Bologna Process; Lisbon Recognition Convention; Tokyo Convention; UNESCO Global Convention; multi-level governance.

Introduction

Since gaining independence in 1991, Kazakhstan has undergone a lengthy and intricate process of reforming its higher education system, aiming to align national practices with international standards while maintaining its own educational priorities. A key aspect of this transformation has been the gradual development of mechanisms for the recognition of foreign qualifications and ensuring the recognition of Kazakhstani diplomas abroad. In the early 1990s, these processes largely inherited the Soviet model and were carried out through fragmented and ad hoc nostrification practices. The lack of unified national rules, continued reliance on Soviet equivalence criteria, and limited collaboration with international partners often led to inconsistent recognition decisions that lacked transparency. Nonetheless, these early institutional practices laid the groundwork for more organized approaches that emerged later.

Over time, Kazakhstan became more engaged in major international and regional frameworks that influence higher education and recognition policies. Participation in UNESCO, the European Higher Education Area (EHEA), the Asia–Europe Meeting (ASEM), the Asia-Pacific Network of National Information Centres (APNNIC), and the ENIC/NARIC network significantly affected the development of national recognition reforms. This multi-level engagement positioned Kazakhstan at the intersection of European and Asia-Pacific recognition systems, providing access to diverse regulatory and expert approaches.

A significant milestone in Kazakhstan's recognition system was the ratification of the Lisbon Recognition Convention in 1997, which officially confirmed the country's commitment to principles of fair, transparent, and learning-outcomes-based recognition. Although implementing these obligations took time, ratification marked the beginning of a gradual shift away from strict nostrification toward recognition procedures aligned with international standards. The progress of these changes was supported through phased structural and instrumental reforms, including the transition to credit-based learning, strengthening quality assurance mechanisms, and expanding institutional forms of academic mobility. These developments created conditions for aligning the national higher education system with international approaches to the recognition of qualifications. The Taraz Declaration (2007) and active university engagement demonstrated that recognition reforms in Kazakhstan progressed not only through top-down government decisions but also through bottom-up initiatives promoted by the academic community, which aimed at regional cooperation and increased academic mobility. Together, these factors paved the way for Kazakhstan's accession to the Bologna Process and entry into the European Higher Education Area in 2010, marking its formal integration into European recognition frameworks.

Currently, Kazakhstan is entering a new phase in its recognition policy by expanding and institutionalizing international cooperation within the framework of the Tokyo Convention and steadily developing the legal and institutional foundation for joining UNESCO's Global Convention on the Recognition of Qualifications in Higher Education. Examining this path reveals the hybrid nature of reforms and the strategic decisions that have enabled Kazakhstan to position itself as a bridge between Europe and Asia.

Within Kazakhstan's strategic agenda, the internationalization of higher education is highlighted as a key national policy priority. According to the Concept for the Development of Higher Education and Science in Kazakhstan for 2023–2029 (Resolution, 2023), the national education strategy aims to improve the system's global competitiveness, build international partnerships, and attract international students. These goals present new challenges for recognition of qualifications: ensuring the comparability and legitimacy of foreign graduates' diplomas amid the ongoing alignment of international standards and domestic institutional practices.

This article explores the development of qualification recognition in Kazakhstan by focusing on government policy priorities. It also looks at recognition as a tool of multi-level governance that influences academic mobility, international students' access to educational and career opportunities, and the credibility of the higher education system.

Methodology

The study's theoretical framework is based on historical institutionalism and interpretive policy analysis. Additionally, the theory of norm localization (Acharya, 2004) is used to help understand internationalization and the recognition of qualifications not just as technical processes of policy borrowing, but as adaptations of international standards within national institutional practices. In the context of the Concept for the Development of Higher Education and Science for 2023–2029, which emphasizes strengthening international cooperation and attracting international students, this theoretical approach provides a deeper understanding of how global commitments on recognition are reinterpreted and localized in Kazakhstan.

The article uses a qualitative research design based on document analysis and historical-institutional tracing of public policy. The study explores the development of Kazakhstan's qualification recognition system through a systematic review of legal and regulatory acts, international agreements, strategic and program documents, ministerial orders, intergovernmental declarations, and archival materials from the early 1990s to today. The primary sources include national education legislation, recognition and nostrification rules, bilateral and multilateral agreements, and Kazakhstan's official materials and reports within

the Bologna Process. These are complemented by international normative instruments such as the Lisbon Recognition Convention (LRC) and UNESCO's Tokyo Convention on the Recognition of Qualifications.

The methodological approach draws on the analytical toolkit of historical institutionalism, which helps identify both continuity and change across different stages of reform, as well as on interpretive policy analysis, which uncovers how global norms were translated, adapted, and localized in the Kazakhstani context. The article also uses the concepts of norm localization, policy transfer, and "bottom-up regionalism" to interpret how national and regional actors influenced recognition practices both before and after Kazakhstan's accession to the Bologna Process.

Secondary sources, such as academic publications, European Union reports, and country-specific data on Kazakhstan, provide contextual grounding for primary documents and enable tracking the influence of international organizations on shaping national policy. Combining different types of sources ensures the validity of the research and enhances the reliability of the analytical results. The proposed methodological framework facilitates a comprehensive reconstruction of Kazakhstan's recognition system and assesses how national reforms, institutional initiatives, and global recognition regimes interact.

Materials

The main international legal instrument regulating the recognition of qualifications and periods of study obtained abroad in Europe is the Convention on the Recognition of Qualifications concerning Higher Education in the European Region (Council of Europe, a), more commonly known as the Lisbon Recognition Convention. Adopted in 1997, it predates the Bologna Process and currently has 57 Contracting Parties (Council of Europe, b).

Before the adoption of the Lisbon Recognition Convention, recognition in the European region was regulated by the Convention on the Recognition of Studies, Diplomas and Degrees concerning Higher Education in the States belonging to the European Region, adopted in Paris in 1979 under the auspices of UNESCO. In contrast to the Paris Convention, the Lisbon Recognition Convention shifted the focus from equivalence to the comparability of qualifications (Bergan, 2013), established a procedure based on the rights of the applicant, and created the ENIC-NARIC network to promote coherent recognition practices across Europe.

With the launch of the Bologna Process in 1999, the Lisbon Recognition Convention was immediately integrated as one of its key foundations, as the promotion of student and graduate mobility was defined as a central objective of the process. The Convention remains the only legally binding agreement in the field of higher education in Europe and introduced a fundamental conceptual shift: recognition should be based on comparability rather than strict equivalence.

The system for the recognition of foreign educational documents in the Republic of Kazakhstan is based on a multi-level legal framework encompassing international conventions, regional agreements, and bilateral treaties. At its core lies a combination of legal simplification procedures, mutual recognition, and academic comparability of qualifications.

Regarding the general circulation of documents, Kazakhstan is a party to the Hague Convention (Law, 1999a), which eliminates the need to legalise foreign official documents. This greatly simplifies the cross-border exchange of educational documents and reduces administrative hurdles. Additional importance is placed on agreements in the field of legal assistance, most notably the Minsk Convention (Resolution, 1993) and related regulatory acts, which ensure the mutual recognition of official documents among post-Soviet states within civil-law relations.

The specifically academic pathway of qualification recognition began with the ratification of the Lisbon Recognition Convention in 1997 (Law, 1997). This step demonstrated the country's early readiness to integrate into the European recognition regime long before

most post-Soviet states considered assuming such obligations. For Kazakhstan, ratification had a dual significance: both as a political declaration of openness and as a legal foundation for aligning national recognition practices with European norms.

Ratification became an important step on the path towards integration into the European Higher Education Area. By acceding to the Convention, Kazakhstan officially assumed the obligation to ensure transparent, fair, and comparable procedures for the recognition of foreign qualifications, which significantly facilitated the academic and professional mobility of its citizens. As a result, Kazakhstani diplomas gained international recognition in the Convention's member states, expanding opportunities for further education and employment abroad. Previously, Kazakhstani students had faced difficulties gaining admission to Western universities due to the non-recognition of their diplomas (OECD, 2017).

Ratification also entailed introducing appeal mechanisms for cases of refusal of recognition, developing a national information system for academic recognition, and participating in the ENIC/NARIC network, which ensures coordination and trust among countries regarding the mutual recognition of qualifications. In a broader context, the ratification of the Lisbon Recognition Convention laid the foundation for Kazakhstan's subsequent entry into the Bologna Process. It confirmed the state's commitment to modernising the higher education system in line with international norms and standards.

Kazakhstan began aligning with the principles of the Bologna Process even before its formal launch, by deciding to transition to a two-tier higher education system in 1999 (Nurmagambetov, 2003). These early structural changes created the preconditions for the subsequent introduction of mechanisms of academic recognition and the comparability of qualifications. For the first time in Kazakhstan, the term "nostrification of educational documents" is defined as a procedure carried out for the purpose of determining the equivalence of documents issued to citizens who received education in other states, in international or foreign educational institutions (their branches) established in 1999 in the Law On Education (Law, 1999b).

In the early 2000s, the basic elements of the institutional architecture were established, including national classifiers (Order, 2001), accreditation procedures (Resolution, 2001 (a)), and later the credit-based learning system (Order, 2007) and PhD programmes (Law, 2007), which ensured formal compatibility with European educational frameworks.

Academic initiatives played an important role in shaping the recognition agenda. The Taraz Declaration of 2007 (Bekturganov, 2007) became an early example of a "bottom-up" orientation toward mutual recognition, mobility, and regional cooperation, anticipating key principles of the Bologna Process. This step provided subsequent reforms with a clearer political rationale and formalised the regional dimension of recognition policy. This academic impulse was later reinforced by state actions and culminated in Kazakhstan's official accession to the European Higher Education Area in 2010.

The ratification of the European Cultural Convention in 2010 created the legal conditions for Kazakhstan's formal entry into the European Higher Education Area, formalised through the signing of the Budapest-Vienna Declaration (EHEA, b), and consolidated the country's international commitments in the field of qualification recognition.

As a result, Kazakhstan's trajectory demonstrates that the development of the recognition system was not solely the outcome of external borrowing of Bologna instruments, but also the product of early domestic reforms and academic initiatives. Despite persistent gaps between formal commitments and recognition practices, accession to the EHEA became a key milestone in establishing frameworks of comparability and trust underpinning academic mobility and international cooperation. Kazakhstan demonstrated regional leadership, built sustainable European networks, and developed mechanisms of international collaboration.

In 2005, the National Accreditation Center was established (Resolution, 2005) and entrusted with conducting institutional and specialised accreditation, developing harmonised accreditation criteria and procedures to align quality assessment with the requirements of the Bologna Process, and carrying out procedures for the recognition and nostrification of educational documents issued by foreign education providers (Decree, 2004).

By 2010, although the national ENIC/NARIC centre, in accordance with the Lisbon Recognition Convention, had not yet been fully institutionalised, progress had been made in formalising transparent and consistent recognition procedures. Since 2012, the National Center for Higher Education Development (News, 2023) (formerly the Bologna Process and Academic Mobility Centre (News, 2012) (hereinafter – the Center) has supported and facilitated the practical implementation of the Convention in Kazakhstan and has been responsible for providing the public service of “Recognition of Educational Documents.”

The early stages of qualification reforms in Kazakhstan were primarily oriented toward aligning workforce training with labour market requirements and the objectives of industrial and innovative development, rather than toward developing academic recognition as an instrument of international mobility. As shown by Kalieva et al. (2015), priority was given to establishing a national qualifications system, professional standards, and mechanisms for competency assessment, thereby entrenching the dominance of the professional rather than the academic dimension of recognition.

In 2012, Kazakhstan developed and approved the National Qualifications Framework, consisting of eight levels and providing a unified description of qualifications based on learning outcomes. The framework was designed to link academic qualifications with labour market requirements and lifelong learning pathways.

To ensure the recognition of qualifications of Kazakhstani higher education in the countries of the Bologna Process, an attempt was made to prepare a self-certification report aimed at establishing the comparability of descriptors of levels 6–8 of the National Qualifications Framework of the Republic of Kazakhstan (NQF RK) with the Qualifications Framework of the European Higher Education Area (QF-EHEA). However, international experts provided substantial comments on the draft report, highlighting insufficient comparability between the NQF RK descriptors and those of the QF-EHEA.

In 2019, an interministerial working group, including representatives of the Ministry of Education and Science, the Ministry of Labour and Social Protection, the National Chamber of Entrepreneurs “Atameken”, sectoral associations, and higher education institutions, reviewed the identified shortcomings and decided to develop a separate National Qualifications Framework for Higher Education (NQF-HE), taking into account its comparability with the QF-EHEA. Similar practices had already been adopted in several European countries.

The working group developed descriptors for the NQF-HE for higher and postgraduate education levels, including bachelor’s, master’s, and doctoral programmes. The self-certification report for the NQF-HE was presented and approved on 19 February 2020 at the final meeting of the Bologna Process Working Group on Qualifications Frameworks Self-Certification and ECTS, with the participation of representatives of the European Commission, the Council of Europe, and the Bologna Process Secretariat (Self-Certification Report, 2020).

The compatibility and comparability of Kazakhstan’s NQF-HE with the QF-EHEA provided evidence of the successful harmonisation of the national system of higher and postgraduate education with the education systems of countries participating in the Bologna Process.

In 2023, the Law on Professional Qualifications was adopted, representing an important step toward strengthening the link between education and the labour market. The law regulates the recognition and validation of professional qualifications within the National Qualifications Framework. Its main objective is to ensure that qualifications acquired through education

correspond to actual labour market requirements. Sectoral ministries, in cooperation with business representatives, develop professional standards that define the competencies, skills, and knowledge required for specific professions. Based on these standards, universities and other higher education institutions design educational programmes, thereby enhancing the practical orientation of graduate training.

In 2025, with the participation of the expert community, an updated version of the National Qualifications Framework was approved, grounded in the principles of the European Qualifications Framework and oriented toward the needs of the modern economy (News, 2025). Unlike the previous version, the revised NQF covers eight qualification levels and incorporates outcomes of formal, non-formal, and informal learning, as well as practical experience. For the first time at the national level, official recognition of competencies acquired outside formal education programmes was established, increasing the flexibility of the qualifications system, supporting lifelong learning, and contributing to the international comparability of qualifications.

The significance of the recognition procedure is viewed as a key factor in enabling academic and professional mobility. In essence, it involves granting holders of foreign diplomas the same rights and opportunities for continuing education or professional activity as those available to holders of national diplomas of an equivalent level.

The recognition process comprises two main stages: verifying document authenticity and identifying substantial differences. Verification of the issuance of an educational document is carried out through foreign databases of issued educational credentials or by sending an official request to a foreign educational institution, research centre, or laboratory to obtain confirmation of the document's issuance and the legal status of the institution that awarded it. The Center maintains an extensive database of contact and address information for foreign educational institutions and authorised bodies, enabling effective interaction and the provision of relevant public services.

The Center represents Kazakhstan within the international network of national information centres for academic recognition and mobility (ENIC/NARIC). It provides information on the authenticity of documents, the accreditation status of universities or educational programmes, and related matters. Between 2010 and 2025, more than 2,000 responses were provided to inquiries from foreign universities, organisations, and employers.

An analysis of international practice in the field of qualification recognition shows that many countries employ a centralised system in which all recognition decisions, for both academic and professional purposes, are taken by a single central authority. Examples include:

- France: ENIC-NARIC France, National Information Centre;
- Italy: CIMEA-NARIC Italia, Information Centre for Academic Mobility and Equivalence;
- United Kingdom: UK ENIC, National Information Centre for International Qualifications and Skills;
- Ukraine: ENIC Ukraine, National Information Centre for Academic Mobility.

Since 2012, the Center has actively cooperated with international and relevant foreign organisations and has participated in international projects in the field of qualification recognition.

Between 2010 and 2025, more than 250,000 foreign educational documents were recognised (table 1). The number of applications has steadily increased, reflecting the growth of overseas education among Kazakhstani citizens and the rising inflow of international students.

Recognition (nostrification) is carried out in accordance with established rules. It may result in a reasoned refusal in cases where the authenticity of a document cannot be confirmed, the awarding institution is not recognised, or the educational programme does not comply with

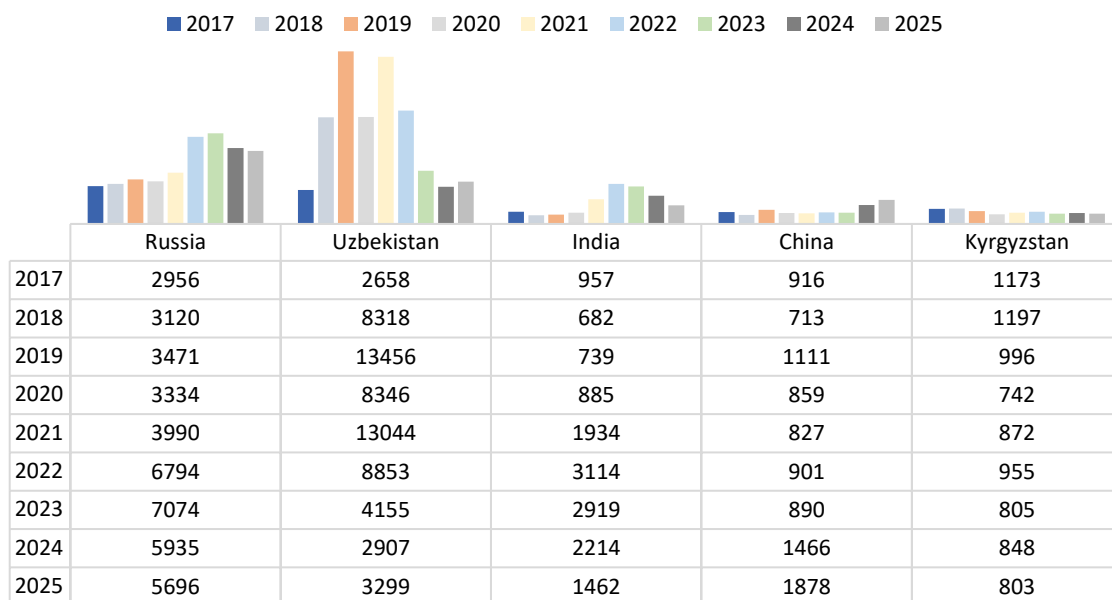
the state educational standards of the Republic of Kazakhstan. During the period 2010–2025, approximately 500 fraudulent documents were identified, along with 140 cases of non-compliance with state educational standards.

Table 1.
Statistics on documents undergoing recognition/nostrification, 2017–2025

№	Years	Received applications	Recognised	Fake	Non-compliance with the State Educational Standards of the Republic of Kazakhstan
1.	2017	10524	11974	53	3
2.	2018	16003	12335	29	25
3.	2019	22180	14697	34	13
4.	2020	15386	11931	25	2
5.	2021	22228	19288	34	5
6.	2022	23372	18505	26	12
7.	2023	18717	15892	23	13
8.	2024	15855	15505	59	11
9.	2025	18557	16757	44	7

An analysis of applications for recognition of educational documents presented in Table 2 shows a stable concentration of applications from five countries (Russia, Uzbekistan, India, China, and Kyrgyzstan), reflecting the main areas of educational and labor mobility associated with Kazakhstan.

Table 2
Information on recognition by country



Throughout the entire period, the largest number of applications originated from Uzbekistan and Russia, reflecting close historical, linguistic, and migration ties, as well as active cross-border mobility of students and workers. Applications from India and China display a more uneven dynamic, with noticeable increases in certain years, which may be

associated with the growing inflow of international students into Kazakhstan's higher and postgraduate education institutions. Kyrgyzstan consistently ranks among the top five countries, although the volume of applications remains relatively moderate, indicating stable but less extensive mobility.

The presented data confirm that Kazakhstan's recognition system operates under sustained migration pressure and plays a key role in facilitating access to education and the labour market for mobile population groups.

Recognition within the Bologna Process extends beyond formal academic qualifications. Since the Berlin Communiqué (2003) (EHEA, c), ministers have encouraged the recognition of prior non-formal and informal learning (RPL) as an instrument for promoting lifelong learning. RPL enables the validation of knowledge and skills acquired outside formal education, either for access to higher education or through the allocation of credits within a qualification.

Since the Bucharest Communiqué (2012) (EHEA, d), ministers have repeatedly emphasised the recognition of comparable academic degrees as one of the "key commitments" of the Bologna Process, expressing the intention to move towards the automatic recognition of comparable academic degrees. To support this objective, instruments such as the European Area of Recognition Manual, the Database of External Quality Assurance Results, and new interoperable digital solutions have been promoted.

The Tirana Communiqué (2024) (EHEA, e) reaffirmed this agenda by confirming the continuation of the mutual support approach through Thematic Peer Group B (TPG B) on the Lisbon Recognition Convention, originally established by the Paris Communiqué (2018) (EHEA, f). TPG B plays a central role in translating political commitments into practice. Its activities include developing appropriate legal frameworks, clarifying institutional responsibilities, supporting the recognition of non-traditional learning pathways and prior learning, ensuring fair treatment of refugee qualifications, and using digital technologies to simplify recognition procedures and strengthen the role of the Diploma Supplement.

Recognition has become one of the most dynamically developing areas of Bologna cooperation. It is grounded in the legally binding framework of the Lisbon Recognition Convention, reinforced by Bologna instruments and peer-support mechanisms, and complemented by global initiatives such as UNESCO's Global Convention on the Recognition of Qualifications (UNESCO, 2019), as well as humanitarian instruments, including the European Qualifications Passport for Refugees (Council of Europe, c). Today, recognition is not only a prerequisite for academic mobility but also a means of strengthening trust, transparency, and inclusiveness across diverse higher education systems.

At present, the Center also carries out the apostille procedure for official documents issued by higher and postgraduate education institutions of the Republic of Kazakhstan (Order, 2023 (a)). Under the Order, the Center acts as the operator of this public service. It is responsible for the initial receipt of applications, their processing (verification, affixing the apostille stamp, and compiling documentation), as well as the subsequent submission of the processed materials to the Non-Profit Joint-Stock Company "State Corporation 'Government for Citizens'".

The apostille service is required for the following purposes:

- use of educational documents (diplomas, transcripts, certificates, etc.) issued by higher and postgraduate education institutions outside the Republic of Kazakhstan;
- admission to foreign higher education institutions;
- employment abroad;
- continuation of studies, confirmation of qualifications, or academic mobility;
- submission of documents to foreign public authorities.

Results and discussion

The recognition procedure performs not only an administrative but also a systemic function, facilitating academic and labour mobility, access to the labour market, and the fulfilment of Kazakhstan's international obligations under the Bologna Process and the Lisbon Recognition Convention.

Kazakhstan's experience in implementing the Bologna Process demonstrates a selective and uneven application of its principles, particularly in the recognition of qualifications. This can be interpreted through the lens of norm localisation theory (Acharya, 2004), which holds that international norms are not implemented mechanically but are reinterpreted and adapted to local institutional practices, political priorities, and power configurations.

Within the national strategy for 2023–2029, internationalisation functions not merely as a declarative goal but as an instrument for shaping a competitive educational environment, in which the recognition of qualifications becomes a central mechanism for international graduates' access to academic mobility and the labour market. However, current recognition practices in Kazakhstan remain selective and fragmented, indicating a systemic divergence between state policy objectives and routine recognition procedures. This divergence is explained not by technical constraints, but by an institutional process of selective norm localisation, whereby international commitments are transformed into conditions conducive to national governance of educational mobility and qualification markets. Consequently, qualification recognition in Kazakhstan operates as a mechanism of multi-level governance, shaping access to educational and professional resources, rather than as a universal right for all international graduates.

Fair and transparent recognition of foreign qualifications is one of the key principles of the Bologna Process and a fundamental value of the European Higher Education Area. Despite ratifying the Lisbon Recognition Convention as early as 1997, Kazakhstan remains among the EHEA countries in which the principle of automatic recognition has not yet been fully institutionalised.

In practice, automatic recognition of qualifications in Kazakhstan remains fragmented and conditional. Formally, national legislation and international agreements provide for exemptions from the general procedures of recognition and nostrification of educational documents (Yelyubayev, 2022). These include agreements within the framework of the Commonwealth of Independent States (Agreement, 1992), provisions of the Treaty on the Eurasian Economic Union (Law, 2014), as well as special regimes for graduates of state-sponsored programmes – most notably the Bolashak programme (Law, 2007, Article 39(8)), and for graduates of certain foreign educational institutions, including the branch of Lomonosov Moscow State University in Kazakhstan (Law, 2019).

However, none of the mechanisms outlined above implements the principle of automatic recognition in the form envisaged by EHEA instruments. Exemptions from recognition procedures are applied selectively, extend only to clearly defined categories of individuals and qualifications, and are accompanied by significant professional and sectoral exclusions. In particular, within the framework of the Eurasian Economic Union, automatic recognition does not apply to regulated professions, including teaching, law, medicine, and pharmacy (Molovtseva & Fyodorov, 2021).

A study by Kuzhabekova (2024) demonstrates that the reintegration of PhD graduates who obtained their education abroad in Kazakhstan is determined less by individual competencies and more by a state-applied “legitimacy sorting mechanism.” Graduates of Western universities, often educated with the support of the Bolashak programme, are automatically recognised and absorbed into leading research universities, where they gain access to superior resources, academic networks, and career advancement opportunities. In contrast, graduates of post-Soviet or non-Western institutions face significant barriers,

including difficulties in diploma recognition, heavy teaching loads, and limited opportunities for research and academic leadership.

As a result, a two-tier system emerges: graduates of Western universities enter the academic system “through the front door,” enjoying institutional legitimacy and career prospects, whereas graduates of non-Western institutions find themselves “at the back door,” frequently confined to teaching positions with limited recognition of their qualifications.

Thus, automatic recognition in Kazakhstan functions not as a universal principle, but as an exception embedded within regional and programme-based mechanisms. This confirms the existence of a gap between formal international commitments and their practical implementation (Ospanov & Mukhtarova). Transitioning toward automatic recognition of qualifications in Kazakhstan requires both technical modernisation of state procedures and the political will to expand international commitments.

The recognition of qualifications became one of the key motivations for Kazakhstan’s participation in the Bologna Process, as the issue of international diploma recognition inherited from the Soviet system was regarded as a significant barrier to academic mobility and global integration (Lodhi & Ilyassova-Schoenfeld, 2023). As the authors note, the Bologna Process in Kazakhstan was initially perceived primarily as an instrument of external recognition and symbolic integration, while its core objective, mobility based on trust and the comparability of qualifications, was implemented to a limited extent.

Such a gap between the formal adoption of Bologna principles and their practical implementation is not unique to non-EU countries. However, it is also characteristic of European Union member states, where the recognition of qualifications remains an institutionally complex, fragmented, and uneven process within the EHEA (Sticchi Damiani, 2019). This demonstrates that recognition constitutes not merely a technical procedure, but a deeply institutionalised process shaped by political, regulatory, and normative constraints (Agbo et al., 2023).

Alongside pan-European instruments, regional and bilateral agreements continue to play an important role in the recognition system, primarily within the framework of the Commonwealth of Independent States (Resolution, 1999), as well as agreements with individual countries, including China (Resolution, 2007), Turkmenistan (Resolution, 2001 (b)), Ukraine (Resolution, 2001 (c)), Mongolia (Agreement, 2019), and others. These agreements provide simplified recognition regimes and reflect the high intensity of educational and labour mobility within the Eurasian space.

As a result, Kazakhstan’s recognition model is hybrid, combining the European normative framework of the Lisbon Recognition Convention with the regional logic of mutual recognition characteristic of the post-Soviet and Eurasian context. This approach confirms that Bologna principles have been formally adopted, while their practical implementation is adapted to national and regional priorities.

At an early stage, recognition in Kazakhstan continued to rely on nostrification procedures (Order, 2003), reflecting the post-Soviet system’s administrative, control-oriented logic. Gradually, with the introduction of Bologna instruments, the credit system, qualifications frameworks, and quality assurance mechanisms, recognition (Order, 2021) came to be understood not as an exception, but as the standard procedure in the absence of substantial differences.

International experience indicates that recognition of qualifications is increasingly moving beyond formal diplomas to encompass outcomes of non-formal and informal learning, assessed based on achieved learning outcomes rather than educational pathways (Satdykov & Sazonov, 2020). In UNESCO and EU policy documents, recognition is viewed as an instrument for supporting lifelong learning, mobility, and access to the labour market. Against this backdrop, Kazakhstan’s recognition system remains predominantly oriented toward formal

education, thereby reinforcing the gap between international normative approaches and national practice.

In this context, the recognition of micro-credentials is particularly significant. In European and international approaches, micro-credentials are understood as certified learning outcomes that are recognized for employment, further education, and mobility, as reflected in UNESCO's Global Convention on the Recognition of Qualifications. In Kazakhstan, micro-credentials are recognised either through the recognition of learning outcomes within educational programmes or through separate certificates, emerging as an element of a broader lifelong learning policy oriented toward flexibility, transparency, and alignment with labour market needs, while preserving the principles of trust and comparability enshrined in the EHEA framework and global conventions.

At present, the procedure for recognising foreign educational documents in Kazakhstan is carried out in accordance with the Rules for the Recognition of Documents on Higher and Postgraduate Education (Order, 2023b) and the Rules for the Recognition of Documents on Secondary, Technical, and Vocational Education (Order, 2023c).

One important innovation has been the introduction of “digital recognition certificates.” Applicants who have completed the recognition procedure can now obtain the relevant certificate in electronic format through their personal accounts on the Egov.kz portal, via the Egov Mobile application, or through the Kaspi.kz application.

On 15 January 2026, Kazakhstan ratified UNESCO's Regional Convention on the Recognition of Qualifications in Higher Education in the Asia-Pacific Region (the Tokyo Convention) (News, 2026). This step strengthened Kazakhstan's position in the international education arena by complementing its commitments under the Bologna Process and opening new opportunities for academic mobility, diploma recognition, and integration within the Asia-Pacific region.

For Kazakhstan, the ratification of the Tokyo Convention represents a timely and well-founded step within its internationalisation strategy. It does not require amendments to domestic legislation, builds on the institutional and expert capacities developed through the implementation of the Lisbon Recognition Convention, and provides access to the high-potential education and labour markets of the Asia-Pacific region through a shared legal and conceptual recognition framework (Nurmagambetov et al., 2023).

In this context, Kazakhstan's membership in the Asia–Europe Meeting (ASEM) since 2014 and its participation in ASEM education ministerial processes have created an additional and complementary channel for advancing priorities related to the recognition of qualifications, quality assurance, balanced academic mobility, the interaction between education and the labour market, and lifelong learning. The Europe–Asia dialogue within ASEM builds on accumulated experience in applying the Bologna instruments and their Asia-Pacific counterparts, thereby creating a favourable environment for aligning approaches and for the practical implementation of the Tokyo Convention's principles.

A pronounced dual orientation in higher education reforms characterises Kazakhstan's experience. On the one hand, national policy draws on initiatives of European origin, primarily the Bologna Process and its associated instruments for recognition and quality assurance. On the other hand, Kazakhstan actively develops engagement with the Asia-Pacific and interregional space through UNESCO's Tokyo Convention on the Recognition of Qualifications, specialised mechanisms of the Council of Europe in the field of higher education and research, and the European Commission's external internationalisation agenda. This combination of European and Asia-Pacific frameworks provides access to policy expertise, technical support, and institutional resources, while simultaneously embedding Kazakhstan in multi-level networks of global higher education governance.

UNESCO's Global Convention expands the scope of international qualification recognition and academic mobility beyond the European Higher Education Area, complementing the European model based on the Lisbon Recognition Convention. At the same time, the Council of Europe's normative approaches, which emphasise academic freedom, inclusiveness, and institutional trust, provide a value-based foundation for fair and transparent recognition procedures. Taken together, these frameworks reflect the multi-level nature of governance in qualification recognition and demonstrate the adaptation of Bologna principles in non-European contexts.

For Kazakhstan, the convergence of European, regional, and global recognition regimes creates opportunities to simplify cross-border recognition of qualifications and enhance the international comparability of national diplomas, while simultaneously increasing demands for policy coherence and institutional accountability. In this context, the ratification of UNESCO's Global Convention on the Recognition of Qualifications represents a strategic policy choice to strengthen trust in Kazakhstan's higher education system and expand the normative basis for academic mobility.

Conclusion

The analysis demonstrates that, despite the Republic of Kazakhstan's strategic commitment to internationalisation and the attraction of international students, institutional mechanisms for the recognition of qualifications remain only partially aligned with international norms. The challenges of recognition in Kazakhstan are related not only to procedural shortcomings but also to deeper processes of institutional adaptation of international commitments to national priorities, as reflected in the Concept for the Development of Higher Education and Science for 2023–2029. Understanding recognition as a selective governance mechanism enables not only the explanation of existing practices but also the outlining of directions for future policy aimed at enhancing the transparency, fairness, and effectiveness of qualification recognition procedures in the context of global academic mobility.

Kazakhstan's trajectory in the field of higher education qualification recognition illustrates the hybrid and multi-level nature of reforms. On the one hand, the country adopted the legal framework of the Lisbon Recognition Convention early and has integrated into the European Higher Education Area. At the same time, in recent years, it has expanded its international engagement through the ratification of UNESCO's Tokyo Convention. On the other hand, the persistence of nostrification elements, the absence of universal automatic recognition, and the fragmented implementation of recognition of prior learning indicate a gap between formal international commitments and their practical implementation.

This gap reflects a broader logic of reform in the post-Soviet context, where internationalisation often performs a performative function of external legitimation. At the same time, substantive institutional change progresses gradually and selectively. In Kazakhstan, the recognition of qualifications operates not as a neutral technical procedure, but as an instrument for allocating access to academic mobility, the labour market, and institutional resources, embedded within regional and programme-based mechanisms.

In this context, the ratification of the Tokyo Convention represents a pragmatic, strategically calibrated step that complements the European recognition model and strengthens Kazakhstan's position as a bridge between Europe and the Asia-Pacific region. The prospect of accession to UNESCO's Global Convention on the Recognition of Qualifications may further expand the normative basis of recognition and enhance trust in the national higher education system. However, the realisation of the potential of these instruments will depend on Kazakhstan's capacity to ensure policy coherence, institutional accountability, and a shift from selective exemptions toward a more systematic and equitable recognition regime.

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BLENDING AI AND VR TECHNOLOGIES FOR CREATING A FOREIGN LANGUAGE LEARNING ENVIRONMENT AND DEVELOPING COMMUNICATIVE COMPETENCE

Abstract. This study investigates the integration of artificial intelligence (and virtual reality technologies as pedagogical tools for enhancing communicative competence and creating a foreign language learning environment. Conducted with 35 university students, the research employed a pre- and post-test design to measure progress across four criteria: fluency, accuracy, lexical range, and communication. The blended use of ChatGPT, structured through the AUTOMAT framework and immersive VR resources provided the simulation of real-life communication experiences. The results revealed a significant improvement in overall performance, with the mean score increasing from 12.14 to 15.50 out of 20. The findings prove that combining AI and VR technologies offers effective conditions for creating a foreign language learning environment and serves as a promising approach for communicative language teaching in higher education.

Keywords: foreign language learning environment, communicative competence, artificial intelligence, virtual reality, educational process.

Introduction

The English language plays a vital role in education and has become essential in developing a shared understanding of global cultures and perspectives (Chaiyasat & Intakaew, 2023). In Kazakhstan, effective English language education serves as a foundation for fostering cross-cultural understanding, facilitating international cooperation and enhancing a nation's competitiveness in the global arena (Kunanbayeva, 2013). Thus, English serves as both a medium of academic communication and an instrument for accessing international knowledge, research, and professional mobility. The State Compulsory Standard of Higher and Postgraduate Education outlines clear expectations for the development of students' functional level of communicative competence across academic, professional, interpersonal, and intercultural domains (MoSHE RK, 2022).

However, despite these clearly formulated requirements, one of the most persistent challenges in non-English-speaking countries is the limited exposure to an authentic language environment, resulting in restricted opportunities for students to engage in the target language. Consequently, the creation of a pedagogically modelled foreign language learning environment (FLLE) becomes essential for supporting communicative competence development, especially in contexts where interaction with native speakers is scarce.

As noted by Furmanova (2014), the language environment consists of two key components: the instructional and illustrative materials used by the teacher to immerse students in the linguistic and cultural reality of the target language and communicative interaction carried out in the target language during classroom activities.

Poholkov and Goryanova (2022) conceptualize the language environment as a didactic system of pedagogically organized conditions that stimulate communicative competence development and compensate for the absence of natural linguistic surroundings.

Kazakhstani scholars similarly emphasize that such an environment does not arise spontaneously and must therefore be intentionally designed. Ermekbayeva (2020) argues that limited exposure to authentic linguistic context slows learners' transition from reproductive to productive language use, making it necessary to design an environment enriched with meaningful communicative tasks, multimodal resources and opportunities for dialogic interaction. Akhmedova (2014) likewise maintains that modelling a realistically functioning information and linguistic space is one that ensures continuous immersion both during classroom instruction and in extracurricular contexts and serves as a crucial mechanism for mastering a non-native language.

Overall, these theoretical perspectives demonstrate that the creation of a pedagogically grounded FLLE is a necessary precondition for developing communicative competence in contexts where natural immersion is limited or absent.

Building on this understanding, blending AI and VR technologies offers a particularly promising solution. AI-powered conversational tools can simulate the main elements of real communication by offering context relevant interaction, helpful guidance, and ongoing feedback that adapts to each student's level. VR technologies, in turn, provide immersive and realistic settings that mirror everyday, academic, and professional communication. When combined, AI and VR create a learning space that closely resembles natural language immersion, encourages active participation and supports the sustained development of communicative competence.

Therefore, the integration of AI and VR technologies represents a theoretically grounded and practically significant approach to addressing the challenge of limited linguistic exposure in the Kazakhstani educational context. This study aims to examine how AI-driven interaction and VR-based immersion can support the creation of an effective FLLE and contribute to the development of students' communicative competence.

Literature Review

The theoretical framework of communicative competence proposed by Canale and Swain (1980) encompasses not only grammatical accuracy but also includes the ability to choose appropriate language in different situations, understand connected speech and apply strategies when communication becomes difficult. As Richards (2006) points out, learners need to be engaged in communicative activities that help them practice speaking, listening, reading, writing and even thinking in a natural way so that these components can develop together.

Developing these skills, however, can be difficult in traditional classroom settings. Nunan (1991) notes that, although teachers try to create activities that feel authentic, the classroom itself is never fully "real" because genuine communication is unpredictable and cannot be completely recreated in a controlled learning environment. As a result, students often receive only limited opportunities to practice language in situations that resemble real communication.

A similar idea is supported by Lou (2025), who argues that traditional methods lack the immersive and interactive qualities necessary for developing real-world communicative skills. These limitations highlight the need for tools and approaches that can offer more realistic, interactive and meaningful practice. Such conditions can be simulated with the help of well-designed AI-based learning and VR environments.

Ma (2021) believes that VR technology can be a useful tool for teachers implementing immersive teaching. It creates a genuine, immersive learning environment that transcends time and space, allowing students to acquire new knowledge in a new "real" setting.

Additional support was seen in the research of Ayasheva and Nurkenova (2025). According to them, VR technologies create opportunities for modeling real speech situations, which contributes to the development of practical communication skills.

According to Lou (2025), VR has become an influential tool in language education because it creates immersive and engaging conditions that support real communication practice. The study examined how students develop English language skills in VR environments and found that immersive tasks helped to improve learners' listening, speaking and overall communication ability.

Another advantage of VR technology is its engaging nature and interactive features that make the learning process more appealing for students, which result in better speaking skills (Lu, 2025).

Similarly, Devitska (2019) notes that one of the most valuable uses of VR technology is its ability to imitate the socio-cultural reality of the target language. The scholar highlights the importance of virtual presence, explaining that VR creates an immediate, interactive setting in which learners feel connected to both the moment and the surrounding environment. The author also emphasizes that AI tools enhance these VR environments by influencing not only audio and visual perception but also enabling interaction, which contributes to more effective language and culture acquisition.

The learning process may now be interactively organized and students' communicative competences can be developed with the help of AI technologies (Perez & Roberts, 2021). In this regard, AI, particularly in the form of voice recognition software and automated dialogue-generating models like ChatGPT, presents a new frontier in addressing the communicative gap in language education. Conversational AI tools can function as interactive agents, capable of engaging in contextually relevant conversation, correcting learners' errors, modelling nativelike responses and adapting to learners' levels.

Both technologies have demonstrated considerable potential for enhancing learners' engagement and linguistic performance. However, the blending of AI and VR holds the greatest promise for creating effective FLLE conducive to the development of communicative competence. For instance, in the study of Tobias et al. (2025), the experimental group students were offered training through Meta Quest 3 headsets and the Virtual Speech platform. Criteria such as speaking speed, eye contact, listenability, filler words, substance and body language were used to assess communication abilities. Significant progress was made by the experimental group, demonstrating the effectiveness of the created learning environment. According to these findings, AI and VR can improve learning outcomes by providing engaging experiences and real-time feedback.

Another research work describes an AI-powered language learning system that blends gamification and immersive VR technology to investigate different methods in language instruction. The system was created for learners of Japanese and recreates a virtual version of Tokyo, where users can communicate with AI-driven characters, buy items in shops and ask for directions. By placing students in everyday situations, it helps them to develop practical communication skills and provides useful vocabulary support and immediate feedback. The program also strengthens language learning by offering contextualized conversations and adjusting the difficulty of tasks and vocabulary depending on the learner's progress. The study showed that students became more motivated and demonstrated noticeable improvements in their language proficiency (Zhang, 2025).

Moreover, Godwin-Jones (2025) states that AI-powered VR is probably going to have a significant impact on language acquisition in the long run, offering learners fascinating new options and encouraging educators to reconsider conventional methods of instruction. Such prospects provide a compelling rationale for further research into the pedagogical applications of these technologies.

Despite the growing interest in AI and VR technologies in language education, their effectiveness is not always consistent and remains subject to ongoing debate. For example, Makransky et al. (2021) demonstrated that while immersive VR environments significantly increase learners' engagement, motivation, and sense of presence, they do not necessarily lead to improved learning outcomes compared to less immersive formats. Similarly, Yu et al. (2025) found that higher levels of immersion do not automatically result in better knowledge acquisition, as the effectiveness of VR depends on instructional design and the type of learning outcomes targeted.

In addition to VR-related limitations, the use of AI in education also raises important concerns. Klimova and Pikhart (2025) emphasize that although AI tools offer opportunities for personalized and interactive learning, their excessive use may lead to digital fatigue, technostress and reduced face-to-face communication. Such tendencies may negatively affect students' interpersonal skills and emotional intelligence, potentially resulting in social isolation.

All these findings suggest that the pedagogical value of AI and VR technologies is not determined solely by their technological capabilities but largely depends on how they are integrated into the learning process. This highlights the need for structured and pedagogically grounded approaches to their implementation.

In this regard, beyond its theoretical contribution, this study offers important practical implications for language education. The proposed AI-VR framework can be applied to design authentic, context-rich learning experiences that replicate real-life scenarios, which will be particularly useful for educators and scholars involved in advancing foreign language education in Kazakhstan and worldwide.

Materials and Methods

The study employed a pre-test–post-test design with a single group of 35 participants. All students were exposed to the AI- and VR-enhanced instructional intervention, and their communicative performance was assessed at two stages: prior to and following the intervention.

The intervention was conducted over a 15-week instructional period. During this time, students regularly engaged in AI-mediated communicative activities, including constructing dialogues and participating in interactive tasks using ChatGPT (GPT-4 model, OpenAI). To enhance contextualization and support deeper engagement, immersive virtual environments were integrated into the learning process. These environments provided situational contexts that encouraged more meaningful interaction and facilitated the development of communicative competence. This design made it possible to track the dynamics of students' performance over time and to identify measurable progress in communicative skills as a result of the implemented instructional approach.

Research design. The study employed a pre-test–post-test design with a single group of participants. All students were exposed to the AI- and VR-enhanced instructional intervention, and their performance before and after the intervention was compared. Such a design allows for clearly tracking the dynamics of students' communicative competence and identifying measurable progress within the group over time. The chosen methodology prioritizes accessibility, using widely available digital tools that do not require specialized equipment, thereby facilitating practical implementation in diverse educational contexts, including tertiary education institutions in Kazakhstan. In this study, VR is understood in a broader pedagogical sense as the use of interactive virtual environments that simulate real-life communicative contexts. The tools employed (e.g., Google Earth, 360 Cities, and The Secret Door) provide visual and situational immersion without the use of specialized hardware such as head-mounted displays.

Accordingly, the study focuses on accessible forms of virtual immersion that support communicative practice, rather than fully immersive VR systems.

Objectives. The primary aim of this research is to assess the effectiveness of AI- and VR-enhanced learning activities in fostering communicative competence among university students and determine their role in creating an FLLE in university classrooms.

Participants. The study involved a group of students of Pavlodar Pedagogical University named after Alkey Margulan, with a total of 35 participants. The experimental group received instruction integrating AI and VR technologies. All participants were comparable in terms of their general English proficiency level, academic background, and age range, ensuring the reliability of the results. The participation in the experiment was voluntary, and students were informed about the research objectives prior to data collection.

Instruments. To carry out the intervention, particular attention was given to the use of the AUTOMAT framework, which served as the foundation for designing structured prompts provided to students. Within this framework, ChatGPT was employed to facilitate dialogic interaction and conversational practice, enabling students to engage in simulated real-life communication even in the absence of native speakers. At the same time, immersive technologies such as Google Earth, 360 cities and the Secret Door were utilized to create authentic environments. Additionally, to evaluate the students' communicative abilities, a grading rubric was adapted and modified on the basis of earlier rubrics (Vercellotti & McCormick, 2021; Kanoksilpatham & Takrudkaew, 2025). The 20-point rubric evaluates four elements: fluency, accuracy, lexical range and communication. Each is scored on a five-band scale (table 1).

Table 1
Scoring rubric to evaluate student' interaction

Criteria	5	4	3	2	1
Fluency	Speaks smoothly, with no pauses and/or hesitations.	Speaks with one or two pauses and/or hesitations which do not affect understanding.	Speaks with some pauses and/or hesitations which sometimes affect understanding.	Speaks with frequent pauses and/or hesitations which often affect understanding.	Speaks with many pauses and/or hesitations which severely affect understanding.
Accuracy	Accurate grammar with no errors. Sentences are well-structured and correct.	Accurate grammar with only minor errors, which do not impede communication.	Fairly accurate grammar with some noticeable errors, which sometimes impede communication	Inaccurate grammar with frequent mistakes, which often impede communication	Major inaccuracies in grammar that severely impede communication
Lexical range	Uses a wide range of vocabulary, including most of the recently introduced words/phrase from the unit. Vocabulary fits the context.	Uses a good range of vocabulary, including several recently introduced words/phrase from the unit. Vocabulary generally fits the context.	Uses a limited range of vocabulary, including some of the recently introduced words/phrase from the unit. Vocabulary sometimes fits the context.	Uses a limited range of vocabulary, including a few or no recently introduced words/phrase from the unit. Vocabulary often does not fit the context.	Uses only basic vocabulary, with no evidence of recently introduced words/phrase from the unit. Vocabulary does not fit the context.
Communication	Actively keeps the	Mostly keeps the	Sometimes keeps the	Rarely keeps the	Cannot keep the

	conversation going by asking and answering questions. Speaks with a natural and fluent rhythm. Demonstrates interest in the interlocutor's responses and maintains good eye contact.	conversation going by answering questions and sometimes asking back. Speaks quite naturally. Demonstrates interest in the interlocutor's responses and maintains good eye contact.	conversation going, but often gives short answers. Eye contact and interest in the interlocutor's responses are inconsistent.	conversation going; gives very short answers, avoids eye contact and hardly demonstrates interest in the interlocutor's responses.	conversation going; gives one-word answers or stays silent, avoids eye contact and doesn't demonstrate interest in the interlocutor's responses.
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Procedure. The experimental procedure was organized in three consecutive stages (pre-test, intervention, post-test) to ensure systematic evaluation of students' communicative competence.

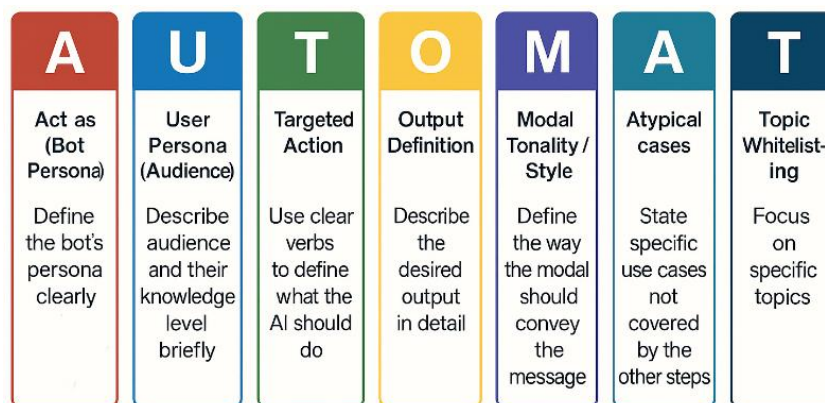
Pre-test stage. At the beginning of the experiment, students' communicative competence was measured through an oral interaction task. Each participant engaged in a structured dialogue that was evaluated according to predetermined criteria (fluency, accuracy, lexical range and the ability to maintain interaction). This assessment established the baseline level of communicative skills prior to the intervention.

Intervention stage. In the second stage, students participated in a series of instructional sessions designed to enhance their communicative competence. During these classes, they were introduced to the AUTOMAT framework as a guiding structure for generating prompts in ChatGPT. This framework allowed students to create coherent dialogues and polylogues while engaging in conversational practice with AI.

The AUTOMAT framework, originally introduced and popularized by M. Vogel (2024) in his practical guide on prompt engineering, allows a structured approach to designing effective prompts. Its application in the present study ensured consistency in prompt formulation and provided students with a step-by-step guide for engaging in authentic, goal-oriented conversations with ChatGPT. The detailed breakdown of the acronym AUTOMAT is illustrated in Figure 1.

Figure 1

The description of the AUTOMAT acronym components



In practice, this involves defining the assistant's role (A), who it's interacting with (U), the purpose of the interaction (T), what information it should deliver (O), how it should communicate (M), how to handle unusual situations (A), and what topics are relevant (T). Such

a structure guarantees clarity, consistency, and pedagogical efficiency when using ChatGPT as a tool for language learning.

Following the introduction of the AUTOMAT framework, the experimental activities were designed to integrate its application into practical classroom sessions. Within the thematic unit, the students were provided with a set of vocabulary words and key phrases directly related to the topic. Prior to the experimental task, systematic preparatory work was conducted: the target vocabulary was introduced, practiced, and reinforced through a range of lexical, grammatical and pronunciation exercises. This ensured that students acquired not only the semantic understanding of the terms but also the ability to apply them in communicative contexts. For instance, as part of the “Health and Medicine” module, students were required to construct a dialogue with ChatGPT on the topic “At the Doctor’s Office” employing the previously practiced vocabulary such as *to feel unwell*, *to have a fever*, *to examine*, *symptoms*, *to take one’s pulse and temperature*, *to take one’s blood pressure*, *to ache*, *to prescribe medication*, *side-effects*, *tablets/pills*, *treatment options*, *to have some more tests*, *get better*, *(to have) a check-up*. The example of the prompt is given in table 2:

Table 2

A sample prompt constructed on the basis of the AUTOMAT framework

You should act as a family doctor in a medical consultation (A). The student will act as a patient describing his/her health problems (U). Generate a role-play dialogue between a doctor and a patient, help the student to practice vocabulary related to Health and Medicine such as *to feel unwell*, *to have a fever*, *to examine*, *symptoms*, *to take one’s pulse and temperature*, *to take one’s blood pressure*, *to ache*, *to prescribe medication*, *side-effects*, *tablets/pills*, *treatment options*, *to have some more tests*, *get better*, *(to have) a check-up* (but not necessarily in this order). Check if the student uses medical vocabulary correctly, applies proper grammar, and keeps the dialogue coherent (T). The doctor should ask questions, provide advice, and simulate an authentic medical interaction (O). The doctor is polite, professional, empathetic, and supportive (M). If the student struggles to continue the dialogue, help him/her to move forward (A). ChatGPT must pause after each turn and wait for the student’s real-time response before proceeding. All speakers should have about the same contribution to the conversation. Talk only about Health and Medicine contents, nothing else (T).

Table 3 presents one of the variants of a dialogue generated on the basis of the above-mentioned prompt. This dialogue illustrates how the prompt can be operationalized in practice.

Table 3

A sample dialogue generated by ChatGPT

ChatGPT (doctor): Good morning. What brings you here today?
 Student (patient): Good morning, doctor. I *feel unwell*. I have tiredness and sometimes feel dizzy.
 ChatGPT (doctor): Could you describe your *symptoms* more precisely?
 Student (patient): Yes, I have a cough, a sore throat, and I *had a fever* last night.
 ChatGPT: I see. Let me *take your temperature*... It is 38.5°C. I will also *take your pulse and blood pressure*. Your pulse is a bit fast, and your blood pressure is slightly low.
 Student: Oh, that sounds serious. Could you *examine* my throat? It *aches*.
 ChatGPT: Please open your mouth and say “ah”.
 Student: Ah.
 ChatGPT: Your throat looks inflamed. I think it may be a viral infection. To confirm, I suggest to *have some more tests*.
 Student: A blood test or something?
 ChatGPT: Yes, I recommend you get some blood tests done.
 Student: Will you *prescribe any medication*?
 ChatGPT: You should take these *tablets* after meals.
 Student: Ok. Are there any *side-effects*?
 ChatGPT: Good question. Yes, there might be some mild *side-effects*, such as drowsiness and stomach upset. If you experience them, please let me know.

Student: All right, doctor. How long is the *treatment*?
 ChatGPT: For about 5 days. After that, I would like you to come back for a *check-up*.
 Student: And if I don't *get better*?
 ChatGPT: Then we will discuss other *treatment options*, such as antibiotics or additional tests.
 Student: Thank you, doctor!
 ChatGPT: You're welcome! Follow the treatment carefully, rest, and I'm sure you will *get better* soon.
 Student: Ok. Good bye!

Additionally, in order to enhance the realism of dialogues, virtual resources were incorporated into the classroom activities. These tools allowed students to immerse themselves in authentic contexts and engage in more natural interactions. A variety of immersive platforms were employed, each providing unique opportunities for exploring the world without leaving the classroom. Among them was “The Secret Door”, which is a platform that transports the user to a random location through a virtual “secret door”, enabling spontaneous exploration and virtual walks in unpredictable environments.

“Google Earth” offers detailed satellite images of the earth that can be rotated, navigated, and zoomed in, giving users the opportunity to explore various places around the globe as if travelling virtually. In addition, Google Earth allows access to panoramic 360-degree images of numerous locations, which significantly enriches the experience of virtual presence.

Another educational product developed by Google is “Google Arts & Culture” (formerly Google Expeditions), which provides access to diverse forms of virtual excursions, enabling learners to explore cultural and historical environments through immersive digital experiences. In the research of Ebadi & Ebadijalal (2022), “Google Expeditions” was introduced as the component of the LLE that enhances the learners’ general knowledge, motivation, cultural awareness, willingness to communicate and overall confidence in speaking.

Finally, the “360 cities” provides high-quality panoramic photographs and videos of various places and objects, creating opportunities for interactive exploration of diverse environments.

The integration of these resources not only increased the situational authenticity of the conversations but also encouraged students to apply newly acquired vocabulary in contexts that closely resembled real-life experiences. Some samples of communicative activities for fostering communicative competence are given in table 4:

Table 4
Samples of classroom activities using VR tools

VR technology	Objective	Example of activity	Blending with AI
“The Secret Door”	Develop descriptive and monologic speaking.	Students explore a random virtual location and describe what they see and feel in a short monologue (2-3 minutes). They describe the place to a peer who hasn't seen it.	AI acts as an idea generator, helps students to expand their descriptions, and organize thoughts. AI acts as a speech evaluator, provides corrective feedback. If necessary, acts as a personal language tutor, explains grammar, vocabulary, pronunciation and usage with examples.
“Google Earth”	Develop dialogic/polylogic and situational speaking.	Students “travel” to a chosen place and engage in dialogues based on the situational context that emerges.	AI acts as a communication partner, helps to simulate realistic dialogues/polylogues and maintains turn-taking. AI acts as a speech evaluator, provides corrective feedback.

“Google Arts & Culture”	Develop monologic/dialogic speech. Enhance analytical and argumentative speaking.	Students explore virtual museums, places of interest, select an artwork or a museum exhibit and speak about its meaning, background and emotions. They exchange opinions with partners, expressing agreement and disagreement. Students conduct a structured debate, defend viewpoints and respond to counterarguments.	AI acts as an idea generator, helps students to expand their descriptions and organize thoughts. AI acts as a communication partner, helps to simulate realistic dialogues and maintains turn-taking. AI acts as a debate judge, evaluates the quality of arguments, coherence of reasoning, use of evidence, determines which team presented a more persuasive and well-structured position. AI acts as a speech evaluator, provides corrective feedback.
“360 cities”	Develop dialogic and situational speaking.	Students select a 360° scene (e.g., restaurant, airport or hospital etc.) and perform a dialogue relevant to the setting (e.g., ordering food, checking-in, describing symptoms etc.)	AI acts as a communication partner, helps to simulate realistic dialogues and maintains turn-taking. AI acts as a speech evaluator, provides corrective feedback.

Post-test stage. The final stage involved reassessing students’ communicative competence through a repeated oral task similar to the initial one. Students were asked to conduct dialogues with ChatGPT, where AI served as an interlocutor. Their performance was evaluated using a specially developed rubric tailored for this experiment. The comparison of pre- and post-test results enabled the identification of changes in communicative competence attributable to the intervention.

Results and discussions

The primary aim of this study was to evaluate the effectiveness of AI- and VR-enhanced learning activities in fostering communicative competence among university students. The performance of 35 participants was assessed through a pre- and post-intervention evaluation, using a rubric based on four key criteria: fluency, accuracy, lexical range and communication. Each criterion was scored on a scale of 1 to 5, resulting in a maximum total of 20 points. The quantitative data of pre- and post-intervention assessment are given in table 5:

Table 5

The results of pre- and post-intervention assessment

Assessment	Fluency (max.5)	Accuracy (max.5)	Lexical range (max.5)	Communication (max.5)	Total (max.20)
Pre-test	3,02	2,98	3,10	2,85	12,14
Post-test	3,87	3,79	3,92	3,92	15,50

A closer look at each criterion reveals positive development across all four areas. As for fluency, before the intervention, students demonstrated an average score of 3.02 points out of 5, while after the intervention the mean rose to 3.87, indicating a gain of 0.85 points. This improvement reflects a reduction in long pauses and fillers. However, some students struggled with maintaining fluency when attempting to express more complex ideas.

Accuracy improved from a pre-test mean of 2.98 to a post-test mean of 3.79, yielding a gain of 0.81 points. The primary source of improvement was a decrease in recurrent grammatical mistakes, such as tense inconsistency and article usage.

In terms of lexical range, there was a gain of 0.82 points, the mean score increased from 3.10 to 3.92 points. The data indicate that students were more successful in integrating recently

introduced vocabulary into their speech and in choosing appropriate words/phrases according to the context. Despite this progress, the problem of reliance on familiar, high-frequency words was evident in the speech of several participants, suggesting that the transition of words/phrases from passive vocabulary to active vocabulary requires ongoing reinforcement.

The most substantial improvement was recorded in the communication criterion. The mean rose from 2.85 to 3.92, which shows 1.07 points increase in the students' results after the experiment. This result highlights a shift in the students' ability to sustain interaction. For instance, they asked more follow-up questions, responded more spontaneously and demonstrated higher levels of engagement during conversations. The lower standard deviation (SD) after the intervention also suggests that these gains were evenly distributed across the group. This fact indicates that nearly all participants benefited from the instructional lessons.

Overall, the comparative analysis of the pre- and post-test data revealed that the performance of 35 participants demonstrated a notable improvement following the intervention. If the pre-test score was 12.14 (SD = 1.45) out of 20, the post-test score increased to 15.50 (SD = 1.22), representing a mean difference of 3.36 points. A paired sample t-test indicated that this improvement was statistically significant, which sums $t(34) = -10.27$, $p < .001$, confirming measurable gains in students' communicative skills following the intervention.

However, the results should be interpreted with consideration of several pedagogical and technological challenges. First, although AI-based interaction provides continuous conversational practice, some students initially relied on AI support excessively, which may limit the development of independent speech production. This indicates the need for balanced instructional design where AI functions as scaffolding rather than a substitute for active language use.

Second, the integration of multiple technologies may increase cognitive load, particularly for students with lower levels of digital literacy. Learners are required to simultaneously manage linguistic output, task requirements, and technological interfaces, which may affect performance, especially at early stages of the intervention.

In comparison with existing studies, the present research contributes by demonstrating not only the individual effectiveness of AI or VR, but also their combined pedagogical value within a structured instructional AUTOMAT framework. This integrated approach allows for both interaction (AI) and contextual immersion (VR), addressing key limitations of traditional classroom environments.

Overall, the results suggest that AI-VR integration can serve as a viable alternative to natural language immersion, particularly in contexts where authentic communicative environments are not available.

Conclusion

The findings of this study demonstrate that the integration of immersive VR technologies with AI technologies, particularly ChatGPT, had a significant positive impact on the development of students' communicative competence. The blending of VR immersion with AI-mediated interaction, the study created conditions that closely simulated authentic contexts, thereby compensating for the lack of real-life exposure to the target language and enabling the creation of a foreign language learning environment.

The study has several limitations that should be taken into account. First, the relatively small sample size and its restriction to a single higher education institution may limit the generalizability of the findings. In addition, the duration of the intervention was relatively short, which does not allow for assessing the long-term impact of AI- and VR-enhanced learning. Therefore, future research should involve a larger and more diverse sample, as well as extended timeframes to examine the sustainability of learning outcomes.

Overall, the study provides empirical evidence that blending of VR technologies with AI-driven practice can serve as an effective pedagogical tool for enhancing communicative competence and creating an LLE in the foreign language teaching process. The comparison of pre- and post-test assessments revealed an improvement with a mean difference of 3.36 points, which was confirmed as statistically significant by the paired sample t-test. These statistical results reinforce the study's primary aim of demonstrating that immersive and AI-driven tools can effectively substitute for the absence of natural language environments, offering both theoretical and practical contributions to the field of language education.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

Assel Karimova: Conceptualization, Methodology, Data curation, Writing – Original draft preparation. Nataliia Fominykh: Conceptualization, Data curation, Reviewing. Kundyz Mukatayeva: Data curation, Reviewing and Editing. Gulmira Tulekova: Reviewing and Editing.

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INNOVATIONS AND EVALUATION OF TEACHER EDUCATION PROGRAMS: FROM ANALYSIS TO PRACTICAL RECOMMENDATIONS

Abstract. Contemporary socio-economic and technological transformations underscore the need to develop and refine models of teacher education and continuous professional development. This article explores key factors influencing the innovative activity of university teachers in the context of digitalization, inclusion, and practice-oriented education. Based on a survey of teachers, students, and external stakeholders, the study identifies major drivers and barriers to innovative activity and examines the relationships between individual motivation, professional interaction, and institutional support. Differences in innovation profiles between teachers of natural science programs and those of non-specialized programs are also revealed. An algorithm for monitoring educational programs is proposed to systematically identify competency gaps and areas for professional growth. The findings inform practical recommendations for improving educational programs through the integration of digital, research-based, and inclusive modules, differentiated incentives for innovation, and strengthened institutional support. These measures ensure the practical relevance, methodological value, and adaptability of the proposed approach to contemporary educational challenges.

Keywords: monitoring, innovative activity, teacher education, educational programs, motivation, professional standard, digitalization, inclusive education, institutional support.

Introduction

Socio-economic and technological transformations, the development of digital technologies, and changing professional requirements have had a significant impact on the higher education system, leading to the restructuring of educational processes, increasing the need for personalized learning, influencing the renewal of teaching methods, educational design, and management approaches, and raising the requirements for the quality of teacher training (Al-Raqab, 2022; IGI Global, 2021; Karstina, 2022; Momani et al., 2026). At the same time, universities have become key centers for innovation. The effectiveness of universities' innovation activities is largely determined by how successfully digital and technological solutions are integrated into key areas of work, the availability of resources for staff, faculty, and students, and conditions that support innovation, including effective management, institutional culture, functional infrastructure, and sustainable professional development mechanisms (ISTE, 2019; Karstina, 2023; Karstina et al., 2024a). At the same time, teachers are key figures in innovative transformations at universities. To implement these transformations, modern teachers need digital, methodological, and communication skills, the ability to engage in interdisciplinary interaction, analytical thinking, and the ability to design educational solutions. This set of competencies enables teachers to successfully integrate modern technologies into their professional activities and adapt them to the needs of learners (Karstina et al., 2024b; Kazempour, et al., 2014; Mahmoud, 2022; Shkutina et al., 2025; Yusof et al., 2019), introduce innovative practices, and support the development of differentiated learning environments (Kazempour, et al., 2014). To develop and improve teacher competencies, it is necessary to ensure the effectiveness of training and professional development systems, the effectiveness of professional growth models, and access to high-

quality educational resources and information (Gut et al., 2024; Karstina et al., 2025; Khusainova et al., 2022; Slambekov et al., 2025), as well as the integration of inclusive practices, excluding the fragmented implementation of best practices and innovative solutions (Angelo Mark et al., 2025; Islyamova et al., 2025; Kottmann et al., 2024; Lambriex-Schmitz et al., 2020; Li et al., 2025; Oancea et al., 2021; Palmira et al., 2023; Yulin and Danquah, 2025). At the same time, it is important to ensure regular monitoring and comprehensive analysis of the content of training and professional development programs for teachers, which will allow for the timely identification of training gaps, the updating of curricula, and the assessment of the compliance of learning outcomes with professional standards and modern challenges (Garcia, 2025; Order of the Minister of Science and Education of the Republic of Kazakhstan, 2023), identify barriers and incentives for innovative activity, and regularly apply practice-oriented forms of training (Anderson et al., 2022; Asmayawati, 2024; Elsayary, 2023; Hommey et al., 2020; Karlen et al., 2020; Narayansany et al., 2021; Salleh et al., 2025; Sihinbaeva et al., 2023; Siri et al., 2020; van der Baan NA et al., 2025), and interact with the professional community (Fil'chenkova, 2017; Lambriex-Schmitz et al., 2020; Li et al., 2025).

Thus, contemporary transformations necessitate the development of flexible models for teacher training and continuous professional development based on the integration of digital resources, modern educational solutions, and inclusive approaches, as well as regular monitoring of educational programs and analysis of factors influencing teachers' innovative activity. This allows for the creation of a sustainable foundation for improving the quality of teacher education and ensuring its relevance to current challenges.

Purpose and Tasks of the Present Study

The purpose of this study was to examine the factors and mechanisms that determine the innovative activity of university teachers, as well as to develop approaches to monitoring teacher training programs, taking into account the digital, inclusive, and practice-oriented components required by professional standards.

To achieve this purpose, the following tasks were identified: 1) assessing the perception of factors influencing innovative activity among teachers, students, and external stakeholders; 2) identifying key barriers and incentives for the development of innovative activity among teachers; 3) developing a multi-level algorithm for monitoring teacher training programs, including indicators of motivational, organizational, resource, and institutional conditions; 4) conducting a comparative analysis of survey data from different target groups to assess the effectiveness of teacher training programs and identify areas for improvement; 5) developing recommendations for optimizing training programs and ensuring their practical orientation, as well as strengthening institutional support for teachers' innovative activity.

Method

The research method was based on the initial assumption that the innovative activity of teachers is shaped by digital, institutional, and personal factors and is determined by the nature of their interaction with key participants in the educational process. To empirically test this assumption, questionnaires were developed for three target groups: teachers, students, and external stakeholders.

The study involved 148 teachers and 718 students from the educational programs "Training of Teachers in Natural Sciences" and "Training of Teachers without Subject Specialization." This ensured the representativeness of the data for analyzing innovative activity in the context of teacher education. An additional survey was conducted with 739 external stakeholders, including school teachers, methodologists, and specialists from education management departments. This allowed us to broaden the context of the study and evaluate the innovative activities of teachers in the system of interprofessional interactions. Taken together, the sample provided sufficient grounds for generalizations in the field of teacher education and humanities education.

The objectives of the survey included 1) assessing perceptions of innovation activities from various professional perspectives, 2) assessing the level of innovation activity among teachers, 3) determining the awareness of respondents from all target groups about the forms and methods of innovation activity, 4) analyzing the degree of involvement in innovation-oriented activities, and 5) identifying factors that stimulate or limit the development of innovation activity. The results of the survey were used to describe the current state of teachers' innovative activity and to develop an algorithm for monitoring teacher training programs.

The questionnaires included open-ended and closed-ended questions. Closed-ended questions used a five-point Likert scale to assess attitudes, engagement, and perceptions of factors influencing teachers' innovative activity, nominal categories to describe socio-demographic characteristics, and multiple choice to identify the main motives and constraints of innovative activity. Open-ended questions allowed respondents to express their own opinions on the issues under study, which enhanced the depth of the analysis and allowed for the context of the professional environment to be taken into account. Thus, the questionnaire format used made it possible to obtain both quantitative and qualitative data for a comprehensive study of teachers' innovative activity in the context of a synergistic model that includes cognitive, behavioral, and institutional components. To comprehensively assess the impact of conditions on the innovative activity of teachers, a progress factor index was calculated based on average values for nine key areas: access to resources, management support, participation in professional communities, grant opportunities, personal motivation, use of inclusive practices, opportunities for professional development, collaborative environment, and fair reward system. The index values obtained were compared with respondents' answers to open-ended questions related to factors motivating innovative activity. At the same time, the study conducted a comparative analysis of the results of a survey of external stakeholders, teachers, and students enrolled in the educational programs "Training of Teachers in Natural Sciences" and "Training of Teachers without Subject Specialization," an analysis of factors limiting innovative activity, a calculation of correlations between the level of awareness and actions to introduce innovations, and a ranking of factors by degree of influence. A wide range of methods used to analyze the survey results ensured the reliability of the conclusions and a multidimensional interpretation of the data.

A special place in the study was given to the development of an algorithm for monitoring teacher training programs and the formulation of recommendations for their optimization and practical orientation, strengthening institutional support for teachers' innovative activity, and applying effective mechanisms for improving the quality of teacher training.

Overall, the methodology used in the study made it possible to conduct a comprehensive study of teachers' innovative activity as a result of the interaction of individual characteristics, institutional conditions, and external professional influences.

Results and Discussion

In the context of global transformations and challenges outlined in the introduction, the teacher training system faces the need to update program content and mechanisms for developing contemporary professional competencies. At the same time, the integration of digital, inclusive, and practice-oriented approaches into the educational environment increases the demands on fostering innovative activity among teachers as an integrative form of professional engagement, which emerges through the interaction of individual professional characteristics, organizational and resource conditions, and the specific features of the educational environment. This, in turn, underscores the key role of institutional support. In this context, an urgent task is the development of more effective approaches to monitoring teacher training programs for compliance with professional standards and the dynamically changing requirements of the educational environment, as well as the use of comprehensive analytical

tools to objectively assess teachers' innovative activity and their readiness to implement and scale up innovative practices.

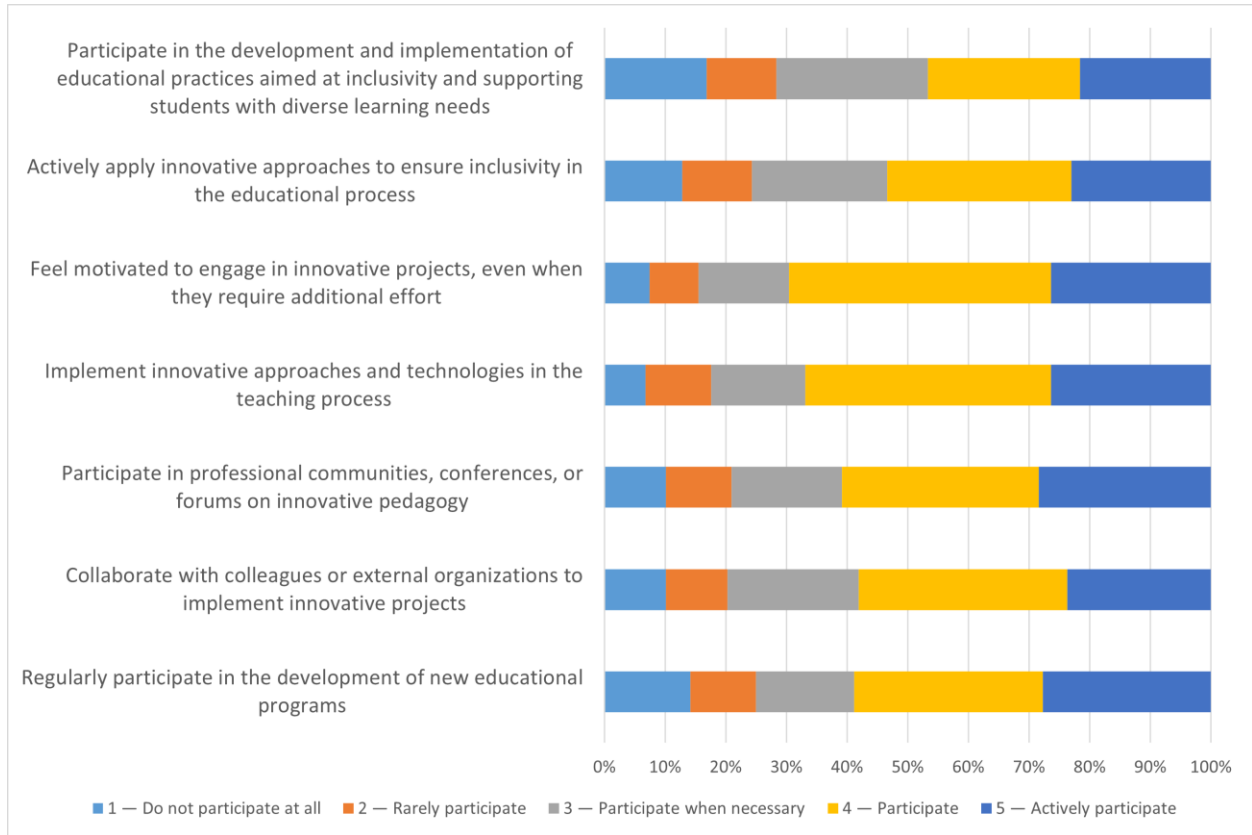
The studies conducted in this work showed that the main incentives for teachers' innovative activity are opportunities to participate in grant programs and professional development programs (4.25 out of 5), as well as personal motivation for professional growth (4.25 out of 5). Institutional conditions, including access to professionally relevant resources (3.95 out of 5), participation in professional communities (4.03 out of 5), and support from leadership (3.75 out of 5), generally facilitate the manifestation of innovative activity but do not constitute its determining factor. When these conditions are insufficiently developed or lack a systematic character, they transform from supporting factors into limiting ones, creating barriers to the realization of teachers' innovative potential. This is confirmed by survey results, in which teachers identified the most significant barriers to innovative activity as high teaching workload (3.33 out of 5), lack of resources (3.35 out of 5), and limited administrative support (2.78 out of 5).

A comparative analysis of the responses of teachers from the educational programs "Training of teachers in natural science subjects" and "Training of teachers without subject specialization" revealed some features in the assessment of the significance of factors influencing the innovative activity of teachers. For example, teachers of natural sciences rate resource provision higher (3.95 points, compared to 3.81 points for teachers without subject specialization). They also attach greater importance to opportunities to participate in grant programs (4.25 vs. 3.95) and in the work of professional communities. For teachers of programs without subject specialization, personal motivation and administrative support were found to be more significant factors influencing their innovative activity. These differences allow us to identify two profiles of innovative teachers: 1) resource-oriented, 2) motivation-oriented. The results of the survey of students and external stakeholders confirmed the identified trends.

An analysis of teachers' involvement in innovative activities revealed its heterogeneity. As can be seen in Figure 1, the highest level of participation is observed in innovative projects (69.69% of teachers participate or actively participate), in the development and implementation of innovative approaches and technologies in the educational process (66.89%), as well as in the activities of professional communities, conferences, and forums on innovative pedagogy (60.81%) and the development of new educational programs (58.78%). At the same time, a lower level of involvement is characteristic of areas related to ensuring the inclusiveness of the educational process (53.37%) and the implementation of teaching practices for students with different educational needs (46.62%). The data obtained underscore the need to strengthen methodological and institutional support for these areas. Overall, the results indicate that the participation of a significant proportion of teachers in innovative activities is selective, while a smaller proportion of respondents demonstrate a high level of activity. In addition, the study revealed inconsistencies between individual, professional, institutional, and public engagement. The highest levels of engagement in innovative activities are observed at the individual and professional levels (63.51% and 67.57%, respectively), reflecting the leading role of personal initiative. Institutional and social engagement remain lower (53.38% and 55.41%). More than 80% of respondents note a mismatch between personal motivation and institutional support opportunities, which hinders the scaling up of innovative practices.

Figure 1

Assessment of teachers' involvement in various types of innovative activities



An analysis of the survey data in terms of length of service and professional experience revealed a number of dynamic trends. For example, novice teachers with up to five years of teaching experience are more likely to feel the need for external methodological and organizational support. Teachers with 5 to 10 years of experience are more focused on using innovative tools as a resource for professional growth. More experienced teachers with 16 or more years of teaching experience focus primarily on resource availability and the presence of a developed research infrastructure in the development of innovative activity. Against the backdrop of these trends, teachers emphasize the need for practice-oriented professional development programs, especially in the areas of modern digital technologies, project-based learning, and stakeholder engagement. At the same time, experienced teachers focus on professional development programs aimed at developing strategic and research competencies, while novice teachers focus on mastering digital tools. The results indicate the advisability of a differentiated approach to the development of professional development programs, including the introduction of modular formats that combine digital, inclusive, and humanities components, which contributes to their adaptability to the current requirements of professional activity.

The correlation analysis conducted in this study revealed consistent relationships between teachers' awareness of innovative practices and the extent of their implementation in professional activities. A moderate positive correlation ($r \approx 0.6$) was observed between general awareness of innovative methods and their practical application. Stronger associations were found between teachers' awareness of digital technologies and project-based learning and the active implementation of these practices in the educational process ($r \approx 0.75$), highlighting the

importance of targeted information provision to promote the adoption of innovative teaching practices.

At the same time, the relationship between teachers’ level of awareness and collaboration with external organizations was relatively weak ($r \leq 0.4$), suggesting the presence of additional institutional barriers. Further analysis indicated that general awareness of innovative methods was more strongly linked to the willingness to implement them, whereas knowledge of grant opportunities showed less stable correlations, pointing to a deficit in project-related competencies. Moreover, the study did not reveal statistically significant differences between teachers of natural science programs and those of non-specialized programs, supporting the view that these trends are universal and can be considered typical patterns in broader pedagogical practice.

The analysis of interrelations among actions that foster innovative activity revealed strong correlations ($r = 0.68–0.89$), as illustrated in Figure 2, forming a stable pattern of behavior: increased activity in one area was accompanied by growth in others. The strongest associations were observed between the implementation of digital technologies, the enhancement of pedagogical practices ($r = 0.88$), and the willingness to experiment. These findings indicate that innovative activity is not a collection of isolated actions but a coherent, interconnected system shaped by teachers’ level of awareness, access to resources, and individual motivation.

Figure 2

Correlation analysis of teachers' activities in implementing measures that promote innovative activity

	Actively seek new teaching methods to improve the quality of the educational process	Independently initiate projects or research initiatives	Strive to integrate digital and other innovative technologies into teaching	Regularly evaluate and improve my pedagogical practices	Willing to experiment with new teaching formats and methodological approaches
Actively seek new teaching methods to improve the quality of the educational process	1				
Independently initiate projects or research initiatives	0,771018044	1			
Strive to integrate digital and other innovative technologies into teaching	0,888070906	0,770317439	1		
Regularly evaluate and improve my pedagogical practices	0,885040954	0,75028134	0,882159051	1	
Willing to experiment with new teaching formats and methodological approaches	0,88427143	0,680896351	0,862044579	0,880000141	1

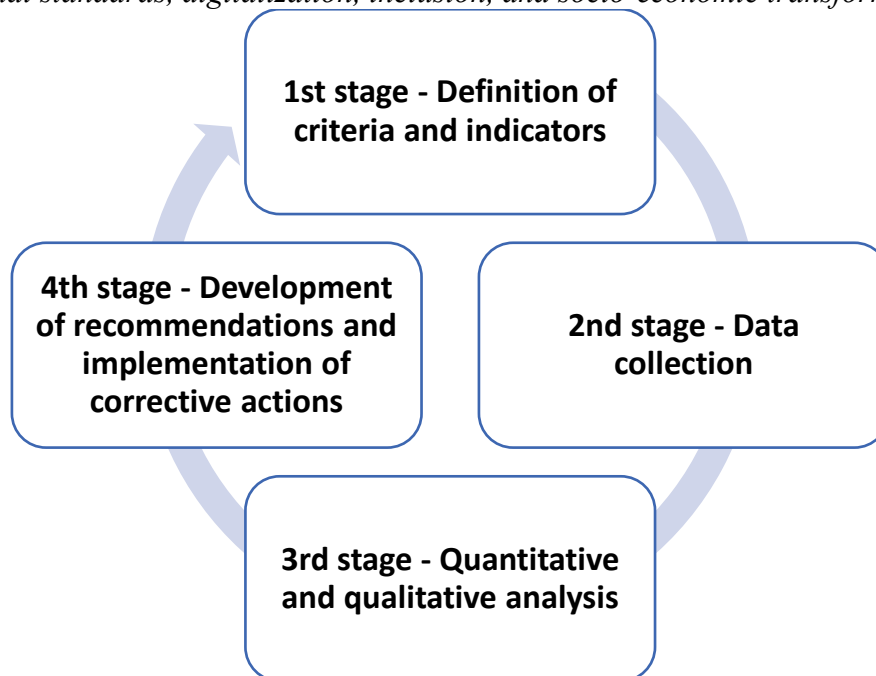
Thus, the results of the study suggest that teachers’ innovative activity can be regarded as an integrated professional characteristic, formed through the interaction of individual motivation, professional experience, and institutional conditions. The observed heterogeneity of incentives, barriers, and forms of engagement, as well as differences in teachers’ responsiveness to resource- and management-related factors, underscores the need for a comprehensive and differentiated approach to evaluating the quality of teacher training. In this context, indicators of innovative activity may serve as analytical tools for monitoring educational programs, reflecting the alignment of their content, organizational mechanisms,

and practice-oriented components with professional standards and the evolving requirements of the educational environment.

At the same time, when developing key indicators, procedures, and algorithms for monitoring educational programs, it is advisable to use tools that allow identifying their compliance with changes in professional standards and the educational environment, the degree of integration of competency modules, connection with practice, and the consistency of expected learning outcomes with the actual competencies of graduates. Accordingly, this paper proposes a monitoring algorithm covering the full cycle of educational program analysis, from setting goals and forming criteria to implementing corrective measures (Figure 3). The criteria and indicators of the monitoring algorithm include motivational, organizational and resource, professional, and institutional and cultural indicators, as well as the degree of integration of digital, inclusive, and practice-oriented components into educational programs.

Figure 3

Stages of the algorithm for monitoring teacher training programs, taking into account professional standards, digitalization, inclusion, and socio-economic transformations



Data collection is expected to involve faculty, students, and external stakeholders, allowing for the measurement of awareness, engagement, participation in innovative practices, and perceptions of institutional support. The data obtained should be subjected to comprehensive quantitative and qualitative analysis using descriptive statistics, correlation analysis, and analysis of respondents' open-ended answers. This approach makes it possible to identify both the key drivers and barriers to the innovative activity of participants in the educational process, as well as the inconsistencies between educational programs and real professional tasks. Based on the results of the analysis, recommendations and corrective measures should be formulated aimed at updating program content, improving the resource base, and strengthening priority areas, including digitalization, project activities, and inclusive practices. To ensure regular data updates, track changes, and adapt educational programs to new professional and social challenges, monitoring is expected to be cyclical, creating a sustainable basis for continuous improvement in the quality of teacher training.

Summarizing the results obtained in this study, we can formulate a number of recommendations aimed at further improving teacher training programs. These include:

1) strengthening the focus on the development of methodological, digital, and communication competencies, which are equally important for teachers of various profiles and, according to the assessments of students and external stakeholders, are often insufficiently developed;

2) identifying priority factors that influence the formation of teachers' innovative competence and reflecting them in the content of educational programs;

3) adjusting programs to take into account the individual motivation of teachers, as well as digital and inclusive practices;

4) developing targeted programs for professional development and advancement, differentiated by age, experience, and professional profile;

5) evaluating the effectiveness of the educational environment based on indicators of teachers' awareness and involvement in various types of innovative activities;

6) integration of inclusive practices into educational programs with the development of specialized methodological and resource measures;

7) strengthening institutional support for innovative activities by expanding access to professionally relevant resources, grants, and the work of professional communities;

8) developing modular programs that combine digital, research, and inclusive competencies, taking into account the professional experience of teachers;

9) stimulating horizontal professional interaction and cooperation with professional communities;

10) systematically monitoring teachers' levels of awareness and engagement for subsequent adjustment of educational programs.

The proposed recommendations can be considered as a universal basis for the formation of a more sustainable, flexible, and relevant teacher training system and its gradual improvement. Such a system has the potential to adapt to different training profiles and levels of educational organizations, as well as the ability to respond quickly to modern challenges and changes in the educational environment.

A limitation of this study is its predominantly descriptive and correlational nature, which implies the need for further empirical confirmation of the identified relationships and clarification of the causal mechanisms. In addition, the influence of external socio-economic factors was considered only partially and requires further analysis. Overall, the results form the basis for a systematic approach to developing the innovative activity of teachers and may be useful in planning institutional and methodological measures aimed at improving the educational environment and encouraging the sustained participation of teachers in innovative practices.

Conclusion

The study showed that university teachers' innovative activity can be considered an integrated professional characteristic, shaped through the interaction of individual motivation, professional experience, and institutional conditions. It was established that intrinsic professional motivation serves as a key driver of teachers' innovative activity, strengthened by access to resources, participation in professional communities, and leadership support. Differences in the activity profiles of teachers in natural science programs and non-specialized programs indicate the need for a differentiated approach to fostering innovative behavior.

Correlation analysis confirmed stable relationships between teachers' awareness of innovative practices and the degree of their implementation in professional activities. The heterogeneity of incentives, barriers, and forms of engagement, as well as differences in teachers' responsiveness to resource and managerial factors, highlight the importance of a comprehensive approach to evaluating the quality of teacher education. In this regard, a

monitoring algorithm for educational programs is proposed, in which indicators of innovative activity can be used as analytical measures to assess the alignment of program content, organizational mechanisms, and practice-oriented components with professional standards and educational requirements.

Based on the study results, recommendations have been formulated for improving teacher education programs, including the development of key competencies, integration of innovative and inclusive practices, consideration of teachers' motivation and experience, strengthening institutional support, and systematic monitoring of engagement. The implementation of these measures contributes to the formation of a flexible, sustainable, and adaptable teacher education system capable of effectively responding to contemporary challenges and changes in the educational environment.

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Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

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INTELLIGENT EDUCATIONAL TECHNOLOGIES: INDEPENDENT STUDY PRACTICES OF UNIVERSITY STUDENTS

Abstract. The study examines the use of intelligent educational technologies to support independent learning among university students. Attention is paid to what digital tools students use, how actively they use them in the learning process, and how much this contributes to their academic autonomy. The study was conducted among students from various faculties of M. Utemisov West Kazakhstan University. Data collection methods were used to determine students' preferences in using digital educational technologies and their perception of the effectiveness of these tools for independent learning. The results showed that students actively use digital technologies to search for information, complete educational assignments, and communicate with teachers and other students in a group. However, it was found that not all students are aware of the potential of digital educational tools for independent organization of the educational process, and many use them only as required by teachers. The interview results also showed that students increasingly rely on collaborative forms of work with digital technologies, such as online discussions, group projects, and collaborative editing of documents, while individual work with digital resources often remains limited. This highlights the need not only to improve students' digital literacy, but also to develop their skills in independently managing educational activities using digital tools. Thus, the study confirms that in order to improve the effectiveness of students' independent learning, it is necessary not only to expand access to digital resources, but also to develop students' skills in using them consciously and purposefully for educational purposes.

Keywords: independent learning, digital technologies, education, intelligent educational technologies.

Introduction

The modern era is characterized by the rapid development of information and communication technologies, as well as the era of digital transformation. The field of education is also undergoing significant changes, integrating new technologies to enhance the effectiveness of the learning process. The advancement of intelligent educational technologies is playing a crucial role in reshaping students' perspectives on learning and improving teaching methodologies. These technologies provide students with quick access to information, the ability to conduct independent research, explore study materials in greater depth, and personalize their own learning trajectories.

The use of digital technologies in the learning process not only complements traditional methods but also contributes to the emergence of new pedagogical approaches. Today, various online platforms, digital resources, AI-based applications, and other innovative tools are widely utilized to develop students' independent learning skills. However, the effectiveness of these technologies directly depends on how accurately and purposefully students apply them.

Students' engagement in using digital tools directly impacts their level of independence in the learning process. Those with strong self-directed learning skills actively search for information, analyze data, and draw their own conclusions using digital platforms. However, many students primarily use digital technologies only to complete assignments given by

teachers, without fully exploring their potential. This, in turn, may hinder the development of students' academic independence.

Moreover, research shows that students use digital technologies in different ways. While some prioritize independent work, others prefer collaborative activities such as group projects, online discussions, and shared document editing tools. These differences are influenced by students learning styles and their strategies for using digital tools. Therefore, teaching students how to effectively utilize digital technologies and fostering their self-directed learning skills remain key priorities.

This study provides a comprehensive analysis of the use of intelligent educational technologies by students at M. Utemisov West Kazakhstan University. The primary objective of the research is to assess students' engagement with digital tools, examine their impact on learning independence, and propose effective strategies for optimizing the educational process in a digital environment. Additionally, the study explores students' digital literacy, their proficiency in utilizing online learning platforms, and their inclination toward developing personalized learning trajectories.

Exploring this issue contributes to improving the integration of digital technologies into the education system, enhancing students self-learning skills, and increasing their academic performance. Moreover, the effective use of digital tools plays a crucial role in students' future professional careers. Therefore, the efficient implementation of intelligent educational technologies remains one of the key priorities in modern education.

Materials and Research Methods

Self-directed learning is a process in which students take responsibility for planning, monitoring, and evaluating their own learning activities. This process includes goal setting, information searching and analysis, self-regulation, and the development of critical thinking skills. In today's context, self-directed learning has become an essential part of the education system, as it helps students adapt to the rapidly changing demands of the labor market and fosters lifelong learning capabilities.

In traditional teaching models, the teacher plays a central role in the educational process. However, with the digital transformation of education, students need to develop skills for independently acquiring new knowledge, working with information, and critically evaluating it. Self-directed learning requires a high level of motivation, discipline, and time management, which can be challenging without adequate support and resources (Baimenova et al., 2022)..

In this regard, digital educational technologies provide new opportunities for effective self-directed learning. They ensure access to up-to-date information, enable interaction with digital materials, automate the learning process, and offer instant feedback. The integration of digital solutions into education fosters students' independence, increases their engagement, and allows them to learn at their own pace (Mausymbayev, 2022).

Modern digital educational technologies encompass a wide range of tools, including online courses, virtual assistants, educational platforms, intelligent feedback systems, and other AI-based solutions. These technologies not only facilitate access to knowledge but also help structure the learning process, making it more personalized and efficient (Berberyan et al., 2022).

The primary functions of digital educational technologies in self-directed learning are aimed at simplifying the learning process, increasing efficiency, and personalizing education. Let's explore these functions in more detail:

1. Supporting the Learning Process. Digital technologies help students better absorb knowledge by presenting educational materials in various formats. These include video lessons, interactive models, simulations, virtual labs, and audio materials. Such methods are often more accessible and easier to understand compared to traditional text-based learning materials.

Additionally, AI-powered learning systems can provide personalized explanations based on students' proficiency levels, making complex topics more comprehensible.

2. Developing Research Skills. In today's education system, the ability to work with information is essential. Digital technologies enable students to quickly find, process, and analyze relevant data. Online databases, scientific article repositories, search engines, and AI-powered tools facilitate research activities. Additionally, these technologies enhance students' ability to collect, compare, and critically evaluate data. This, in turn, helps develop their research skills and strengthens independent thinking abilities (Cassandra et al., 2025).

3. Providing Feedback. Digital educational technologies allow students to receive real-time feedback through online tests, automated grading systems, and AI-based grammar and style correction tools. These technologies quickly identify mistakes and suggest ways to correct them. Additionally, they help reduce the workload of educators while enabling personalized feedback for each student.

4. Personalizing Learning. Since each student has a unique learning pace, proficiency level, and individual needs, digital technologies enable a more personalized educational experience. Adaptive learning systems tailor educational content based on a student's knowledge level, adjust task complexity, and provide targeted resources. This approach not only enhances comprehension but also boosts motivation and fosters a greater interest in self-directed learning (Bespalov et al., 2025).

Digital educational technologies play a crucial role in organizing an effective self-directed learning process for students. By supporting learning, developing research skills, providing instant feedback, and personalizing education, these technologies make the learning process more modern and accessible. When used correctly, they enable students to deepen their knowledge and enhance their creative thinking abilities.

One of the key elements of digital learning is the ability to adapt educational materials to students' learning preferences. Artificial intelligence facilitates personalized learning paths by adjusting the complexity of assignments and educational resources based on the student's preparedness level (Stosic et al. 2025).

For example, if a student struggles with a particular topic, intelligent tutoring systems can provide additional explanations, suggest interactive exercises, or offer similar problems to reinforce the material (Sidorov, 2022). Virtual assistants, such as chatbots and voice assistants, can explain complex concepts in simple terms and provide visual examples, making the learning process more accessible and easier to understand.

The use of intelligent educational technologies has a significant impact on the learning process. While they enhance learning efficiency, they also introduce certain limitations and challenges. Let's take a closer look at the key advantages and potential drawbacks of these technologies.

Intelligent educational technologies play an increasingly important role in modern learning environments, offering a wide range of benefits for students. One of their key advantages is the facilitation of self-directed learning. These technologies enable students to independently engage with educational content and effectively master learning materials. In particular, personalized learning approaches allow learners to select content based on their individual knowledge level, needs, and pace of study. Artificial intelligence tools further support this process by explaining complex concepts, providing interactive learning formats, and partially automating learning activities. As a result, the educational process becomes more time-efficient, flexible, and engaging.

Another significant advantage is the expansion of access to educational resources. Online platforms, AI-driven learning systems, and digital libraries provide students with the opportunity to access information anytime and from any location. This flexibility is especially

valuable for self-directed learning and lifelong education, enabling students to go beyond the constraints of traditional classroom instruction (Chen et al., 2021).

In addition, intelligent technologies contribute to more effective monitoring and assessment of the learning process. Automated grading systems, adaptive learning platforms, and analytical tools allow for continuous tracking of student progress. These systems help identify individual learning gaps and adjust educational strategies accordingly, thereby improving learning outcomes and supporting continuous academic development.

Despite these advantages, intelligent educational technologies also present several challenges. One of the primary concerns is the potential over-reliance on such tools, which may hinder the development of students' critical thinking skills. When learners excessively depend on AI to complete tasks, their ability to independently analyze information, evaluate alternatives, and make informed decisions may be weakened.

Another important limitation is related to the reliability of AI-generated information. Although such technologies provide rapid access to content, the accuracy and validity of this information are not always guaranteed. Without proper critical evaluation and verification, students may rely on incorrect or misleading data, which can negatively affect the quality of their learning outcomes (Huapaya et al., 2025).

Academic integrity also represents a significant concern. Intelligent technologies may be misused by students not as tools for learning, but as a means of generating ready-made answers, essays, or coursework. Such practices can undermine the educational process, reduce genuine knowledge acquisition, and limit the development of critical and creative thinking skills (Miletic et al., 2025).

Finally, psychological and motivational aspects should be taken into account. Digital learning environments are not equally suitable for all students. Some learners demonstrate a preference for traditional instructional methods, and the use of digital platforms may introduce additional stress or reduce motivation. This, in turn, may negatively affect student engagement and overall learning effectiveness.

Table 1.

Advantages and Disadvantages of Intelligent Educational Technologies

Advantages	Disadvantages
Personalized learning	Reduced direct interaction with teachers
Saves time and resources	Uncertainty about information accuracy
Develops self-learning skills	Issues of plagiarism and academic integrity
Fast feedback	Technical difficulties
Accessibility	Decreased motivation

Intelligent educational technologies play a significant role in enhancing students self-directed learning processes. However, their effectiveness depends on how and for what purpose they are utilized. Therefore, special attention should be given to improving students' digital literacy, developing critical information analysis skills, and maintaining academic integrity. A balanced and thoughtful integration of these technologies can enhance learning quality and contribute to students' intellectual growth.

Research Methodology and Results

In the context of the rapid integration of digital educational technologies and artificial intelligence (AI) tools into higher education, their role in shaping students' self-directed learning has become increasingly significant. Accordingly, the present study aims to examine the extent to which students utilize digital and AI-based tools and to assess their impact on independent learning practices.

The empirical research was conducted among students of M. Utemisov West Kazakhstan University, with a total sample of 120 participants. The study focused on analyzing students' engagement with digital technologies within their individual learning trajectories, as well as evaluating their perceived effectiveness in supporting autonomous learning.

To ensure a comprehensive analysis, a combination of research methods was employed. A survey questionnaire was used to determine the frequency and patterns of students' use of digital and intelligent educational technologies. In addition, qualitative analysis was applied to interpret students' perceptions, attitudes, and experiences related to the use of these tools in self-directed learning. Furthermore, statistical analysis was conducted to process the collected data, identify trends, and validate the obtained results.

The survey was designed to assess the extent to which students utilize intelligent educational technologies including digital platforms, artificial intelligence tools, and online learning environments in their independent learning activities. It also aimed to explore students' perceptions of these technologies, their perceived impact on academic performance, and the challenges encountered during their use.

The objectives of the study included determining the frequency of technology use among students, evaluating its impact on academic performance, identifying challenges associated with the use of intelligent tools, analyzing their influence on independent learning processes, and developing practical recommendations for their effective integration into university education.

The findings indicate that intelligent educational technologies have a substantial impact on students' independent learning practices. Among the respondents, 88.7% reported actively using digital and AI-based tools, which reflects a high level of adaptation to the digital learning environment. The majority of students perceive these technologies as more convenient and efficient compared to traditional instructional approaches. Key factors influencing this preference include ease of access to information, time efficiency, and enhanced clarity in understanding learning materials.

These results demonstrate that digital and intelligent technologies are becoming an integral component of modern educational practices, contributing to the development of students' autonomy, flexibility, and engagement in the learning process.

Survey results revealed that 74.5% of students use online courses for self-directed learning. Platforms such as Coursera, Udemy, and Stepik are widely utilized to acquire additional knowledge and explore topics beyond the university curriculum. The appeal of online courses lies in their interactivity, incorporating video lectures and assignments to make the learning process engaging and accessible. However, some students reported not completing these courses in full. The primary reasons cited include lack of time, the complexity of course materials, and the fact that some courses require payment. Additionally, the predominance of English-language courses poses challenges for certain students.

A total of 67.4% of students reported that artificial intelligence (AI) tools are useful for completing written assignments, processing information, and conducting research. Tools such as ChatGPT, Grammarly, and QuillBot are primarily used for text verification, editing, and content expansion. While these tools contribute to improving students' writing skills, some have encountered difficulties in critically evaluating AI-generated suggestions. Additionally, 35.8% of students expressed concerns about AI posing risks to academic integrity, while 41.3% questioned the reliability of AI-generated information. In some cases, AI tools provided inaccurate or misleading data, highlighting the importance of developing students' ability to work with credible sources.

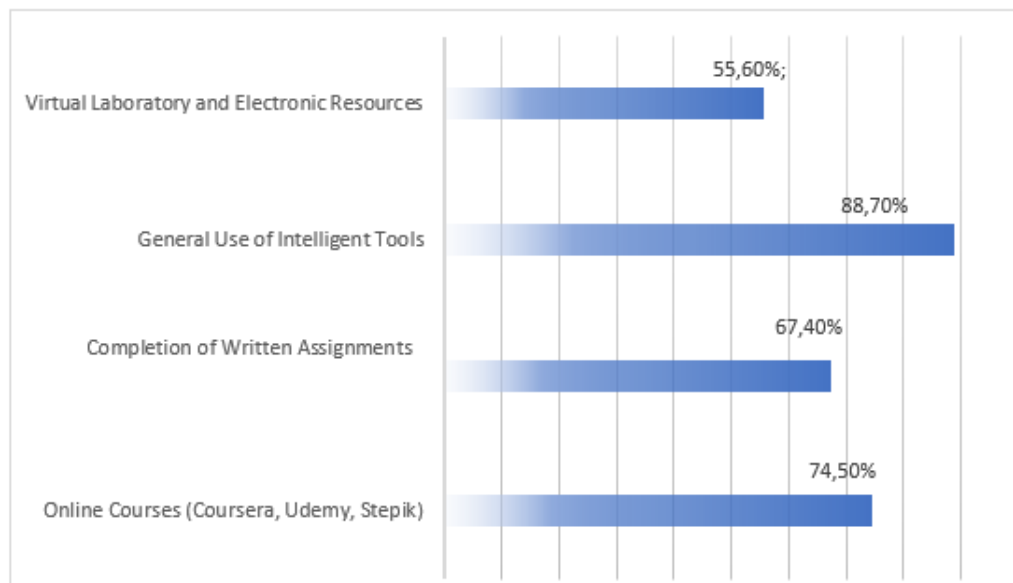
According to the research findings, 55.6% of students highlighted the significant role of virtual laboratories and electronic resources in their research activities. These tools are particularly valuable for students in natural sciences, engineering, and medicine, as they offer

new opportunities for practical learning. Virtual laboratories provide a safe and accessible environment while reducing the need for real-world experiments. However, these tools may not be equally effective for all students, as some laboratory programs have complex interfaces or require a certain level of prior knowledge.

The issue of verifying information accuracy remains highly relevant. According to the survey results, 44% of students reported difficulties in assessing the reliability of information obtained from the internet. This challenge becomes particularly significant when working with large volumes of data. Artificial intelligence tools cannot independently verify the authenticity of the information they provide, while students' ability to distinguish between credible academic sources and unverified information is not always strong. Therefore, universities should organize specialized training sessions on information literacy. Mastering data verification methods, utilizing reliable academic databases, and adhering to principles of academic integrity are crucial factors that will contribute to students' ability to acquire high-quality education in the future.

Picture 1.

Utilization of Intelligent Educational Tools by Students.



Overall, the survey results indicate that intelligent technologies have a positive impact on students' learning processes. However, several measures need to be implemented to maximize their effectiveness. Universities should organize specialized courses to enhance digital literacy and develop methodologies for the proper academic use of AI tools. Additionally, providing students with free or discounted access to online courses is crucial. By implementing these measures, intelligent educational technologies can significantly contribute to the development of students' creative thinking skills and improve their academic performance.

Discussion

Analyzing the research findings allows us to draw several key conclusions regarding students' experiences with and the effectiveness of intelligent educational technologies. First, the majority of students actively use digital resources for independent learning. This trend highlights a shift away from traditional teaching methods toward a more flexible and self-directed learning model. Digital education platforms and AI-powered tools enable students to go beyond textbooks, engage with supplementary materials, conduct independent research, and enhance their creative thinking skills.

However, it cannot be said that the widespread use of technology has only positive effects on students. The research revealed that some students face difficulties in mastering new digital tools. This issue is particularly relevant for those with limited technical knowledge or those who require additional time to adapt to new programs. Additionally, maintaining motivation in a digital learning environment remains a crucial factor. For students with lower levels of self-discipline, the flexible learning format can sometimes lead to decreased productivity.

Although AI tools offer students numerous opportunities, they also pose the risk of reducing personal responsibility. Some students may become overly reliant on AI assistance, neglecting the development of independent thinking skills. This can raise concerns about academic integrity and negatively impact the quality of the learning process. Therefore, it is essential to cultivate a responsible approach to working with AI, encouraging students to verify information accuracy, enhance their analytical thinking skills, and make independent decisions.

Moreover, the use of intelligent technologies by students is significantly influenced by their field of study. For instance, students in technical and natural sciences frequently utilize virtual laboratories and programming tools, whereas those in humanities tend to rely more on text-processing software and online courses. This highlights the need to adapt educational content to the specific requirements of different disciplines.

In conclusion, intelligent educational technologies significantly expand students' opportunities for independent learning. However, to enhance their effectiveness, universities should introduce specialized courses and methodologies aimed at developing digital literacy. Additionally, it is crucial to educate students on the responsible use of new technologies, foster their ability to critically evaluate information, and uphold academic integrity principles. When these aspects are taken into account, intelligent technologies can improve the quality of education and contribute to the professional competency of future specialists.

The conducted research results have demonstrated that intelligent educational technologies significantly influence students' independent learning processes. Today, digital technologies and artificial intelligence tools are increasingly integrated into the education system, complementing traditional teaching methods. This shift has introduced substantial changes in students' learning skills, information processing approaches, and self-directed learning strategies.

The research revealed significant differences in the level and purpose of intelligent technology usage among students from various faculties. Humanities students primarily enhance their knowledge through online courses, e-books, and academic articles, while technical students frequently utilize artificial intelligence tools and digital laboratories for programming, modeling, and analysis. These variations reflect the specific needs associated with their respective fields of study.

The research findings indicate that students have a high level of trust in intelligent technologies. Many students noted that artificial intelligence helps them grasp complex topics more quickly and encourages independent research. Additionally, intelligent technologies facilitate effective time management, streamline the learning process, and enable the creation of personalized learning trajectories. This is particularly crucial for students engaged in distance learning and academic mobility programs.

However, the study also identified several challenges. Not all students can effectively utilize intelligent tools, and some participants reported facing technical difficulties while using them. Additionally, excessive reliance on artificial intelligence may reduce creativity and independent inquiry among certain students. The need to assess the reliability of information also emerged as a significant issue, as AI-generated data is not always accurate or trustworthy.

Moreover, some students expressed concerns about the impact of intelligent technologies on academic integrity. The ability to obtain ready-made answers through artificial intelligence or complete assignments using automated tools may negatively affect the quality of education.

Therefore, there is a growing need to enhance students' digital literacy, foster a responsible approach to AI tools, and uphold academic ethics.

Overall, it has been established that intelligent educational technologies enhance students' learning efficiency and improve their independent learning skills. To effectively integrate these technologies into the educational process, universities should strengthen methodological support and develop specialized training programs. Additionally, fostering dialogue between educators and students regarding the proper use of digital technologies is essential. The effective utilization of intelligent technologies contributes to the development of students' professional competencies and enhances their competitiveness in the job market.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

A. Kushekkaliyev: Conceptualization, Writing Original Draft Preparation.
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THE SYSTEM OF INTERCULTURAL INTERACTION IN HIGHER PEDAGOGICAL EDUCATION

Abstract. This research determines to illuminate the crucial role of teacher-student engagement in cultivating foreign learners' preparedness for intercultural collaboration. This preparedness is particularly vital within a university's diverse academic setting. Furthermore, engaging in cross-cultural dialogue is essential for aspiring professionals to unlock their career capabilities. Consequently, the study's objective is to provide both theoretical grounding and practical evidence for the necessity of pedagogical guidance in fostering foreign students' readiness for intercultural cooperation during foreign language instruction. The research employed theoretical approaches, encompassing a thorough examination of pedagogical and methodological literature, alongside relevant materials and publications from educational and scientific sources pertinent to the inquiry. This involved processes of concretization, analogical reasoning, and an analysis of pedagogical practices observed in various universities. The study's outcomes illuminate the foundational principles for structuring pedagogical support aimed at cultivating foreign students' preparedness for intercultural collaboration. Furthermore, they deepen our comprehension of the specialized educational content for these students. A key finding underscores the critical importance of conveying the inherent value of intercultural education for the holistic development of a foreign student's personality and their professional formation. These resources are shaped by the author's unique understanding of the research concept and a flexible array of pedagogical methods.

Keywords: organizational and pedagogical conditions, intercultural communication, resources, approach, foreign language, social and cultural activity, intercultural interaction, pedagogical support.

Introduction

In the context of globalization and increased academic mobility, intercultural communication has become a fundamental component of higher education. Students, as a socially active group, are particularly sensitive to global transformations, including migration processes, digitalization, and cultural hybridization.

Modern higher education institutions are expected not only to provide professional knowledge but also to develop students' intercultural competence, which includes the ability to interact effectively with representatives of different cultures.

The development of a student's character is a pedagogical journey driven by the interplay of their inner world and external circumstances. The educator, acting as a conductor of these external forces, bears the primary responsibility for guiding the foreign student's growth. Their aim is to cultivate a self-assured individual, capable of critically assessing and managing external pressures, and ultimately making sound choices. Socio-economic transformations have had a certain impact on the renewal of the structure, content, and dissemination of best practices in educational activities at higher education institutions.

As the most educated and socially active macro-group of young people, students are particularly sensitive to the changes taking place in society. Due to the destructive trends in social development, sociologists have observed an increase in pragmatism among young people and an increased susceptibility to the influence of low-quality mass culture. In these contradictory conditions, intercultural education becomes relevant at all levels of public life and can have an effective impact on the formation of spiritual and moral values, aesthetic culture, worldview, and behavioral patterns among the younger generation (Agasieva, 2015). This is because the pedagogical process itself is where individuals cultivate their preparedness for engaging in intercultural exchanges. The significance of this subject is beyond dispute, given that the topic of intercultural interaction is intrinsically linked to cultivating tolerance and esteem for diverse religions, cultures, and languages. Furthermore, its urgency is particularly pronounced today, owing to escalating global migration and the consequent blending of populations.

The systematic investigation of educational phenomena inherently necessitates the development of a model representing the phenomenon under scrutiny. Within contemporary scientific logic and methodology, a model is conceptualized as a representation and it can be a schema, structure, or symbolic system of a particular segment of natural or social reality. It can also be understood as a construct of human culture, or a conceptual/theoretical construct.

From an epistemological standpoint, a model functions as a surrogate for the original object in both cognitive processes and practical applications. In this capacity, it fulfills both an explanatory and a discovery-oriented function.

Recent international research demonstrates a shift from traditional descriptive approaches to competence-based and integrative models of intercultural learning. For example, Deardorff (2020) emphasizes that intercultural competence should be understood as a process-oriented construct, including attitudes, knowledge, skills, and internal outcomes. Similarly, Byram (2021) highlights the importance of critical cultural awareness as a key component of intercultural education.

In recent years, scholars have increasingly focused on digital intercultural learning environments. According to Helm and Guth (2022), online collaboration platforms significantly enhance intercultural dialogue by enabling authentic communication across borders. Another important trend is the concept of global competence in higher education (OECD, 2021), which integrates intercultural communication, critical thinking, and social responsibility.

However, despite the growing number of studies, several gaps remain:

- insufficient integration of pedagogical modeling and intercultural competence;
- lack of structured models for non-linguistic universities;
- limited focus on teacher mediation in multicultural classrooms.

Thus, this study aims to address these gaps by proposing a conceptual model of intercultural interaction.

As global interactions intensify across all facets of life, contemporary societal progress necessitates professionals adept at navigating cross-cultural exchanges. To effectively conduct business and professional interactions with international counterparts, intercultural proficiency is paramount. However, cultivating this competence in students pursuing non-language degrees presents a challenge, largely due to the specialized nature of their field-specific communication. This paper examines the aims of foreign language instruction through the lens of communicative and intercultural methodologies within language education. It distinguishes between the competencies required for general intercultural communication and those specific to foreign language interaction. The importance of emphasizing profession-specific elements within the framework of knowledge, skills, and abilities has been demonstrated, stemming from an analysis of the unique characteristics of professional intercultural communication for

aspiring specialists. Furthermore, the article discusses criteria for evaluating the degree to which intercultural communicative competence has been developed (Byram, 2021).

Research methods and organization

The construction of a pedagogical system model begins with conceptualizing an idea, followed by the elaboration of a preliminary design. This is complemented by an analysis of comparable prior efforts and culminates in a scientific description of the emergent system. Modeling finds its utility in two distinct situations: firstly, for examining the operational mechanisms and developmental trajectories of subjects that defy direct perception or interaction (where the model itself is subsequently analyzed); and secondly, for the creation or real-world construction of novel entities. The latter application is notably frequent in pedagogical practice.

This study is conceptual and theoretical in nature and is based on a combination of qualitative research methods. First, a systematic literature analysis was conducted using sources indexed in Scopus and Web of Science, covering publications from 2020 to 2025. This allowed for the identification of key trends, approaches, and gaps in the study of intercultural competence and its development in higher education.

Second, a comparative analysis of existing models of intercultural competence was carried out to evaluate their structural components, underlying principles, and applicability in contemporary educational contexts. This analysis provided a foundation for identifying common patterns and limitations across different theoretical frameworks.

Third, pedagogical modeling was employed to construct a conceptual framework aimed at fostering students' preparedness for intercultural communication. This approach enabled the integration of various theoretical perspectives into a coherent model.

Finally, the synthesis method was applied to combine psychological, cultural, and activity-based approaches, ensuring a comprehensive and interdisciplinary foundation for the proposed model.

The development of the model was guided by several key criteria, including internal consistency and integrity, applicability within higher education settings, and adaptability to multicultural learning environments. Given the present circumstances, our chosen approach to constructing pedagogical systems within this research involves a progression from foundational theoretical concepts (or a collection of pedagogical notions that underpin the system's model) to the actual creation of that model. We define a model here as any conceptual or symbolic representation of the pedagogical system under development. Within educational system theory, a model can represent either an existing system (a model of the present) or a system that is yet to be realized (a model of the future) (Karaulov, 2012).

At present, investigations into pedagogical modeling reveal the establishment of a scientific framework for this concept. The methodological underpinnings of this modeling approach are rooted in principles of holism, coherence, comprehensiveness, and the faithful representation of established pedagogical phenomena, even amidst conditions of uncertainty. Here, uncertainty is understood as an inherent characteristic of humanitarian systems, including the pedagogical, stemming from the presence of subjects as crucial components. These subjects exhibit variability, emotional responses, and the capacity for qualitative transformation (development) in their awareness and actions.

A core attribute of any pedagogical framework is its adaptability, a concept explored in academic discourse through two primary lenses: intrinsic and extrinsic. Intrinsic adaptability refers to the dynamic and effective integration of diverse pedagogical systems, methodologies, and paradigms within the educational and developmental process, acknowledging that no single approach is entirely self-sufficient. A prerequisite for this internal flexibility is the harmonious coexistence of varied educational philosophies within the learning environment. Extrinsic adaptability, conversely, is demonstrated by the educational system's prompt

responsiveness to evolving socioeconomic and sociocultural landscapes, alongside its timely capacity to address societal demands and individual requirements. The development of the theoretical framework for the proposed pedagogical model aimed at fostering students' readiness for intercultural communication is grounded in key psychological and pedagogical approaches to education.

First, the anthropological approach conceptualizes the student as both an active subject and a product of culture. Within this perspective, the learner is not only a recipient of knowledge but also an agent who interprets, reproduces, and transforms cultural meanings through educational interaction.

Second, the cultural approach emphasizes that, in the context of contemporary global competition, individual success is determined not solely by specialized knowledge or technical competencies, but by a holistic integration of general and professional culture. Such a cultural foundation promotes personal development, enables individuals to transcend conventional boundaries, and fosters the capacity to create, interpret, and transmit values within diverse sociocultural contexts.

Together, these approaches provide a conceptual basis for understanding intercultural communication as a multidimensional process that requires not only cognitive competencies but also cultural awareness, reflexivity, and value-oriented thinking. The activity-based approach stands as the paramount determinant in shaping a model for cultivating this preparedness. It dictates the foundational design strategy of the model, fostering highly adaptable, invariant pathways for the future individual's growth and self-actualization across all forms of engagement, including educational pursuits. To effectively implement this approach, it is crucial to not only structure fruitful educational (or other) activities but also to imbue them with a communicative focus, embedding them within a broader cultural communicative framework, while considering their unique characteristics, methods, and operational contexts (Gasanov, 2010).

A methodical examination of educational events facilitates a comprehensive view of how pedagogical systems integrate. It is this wholeness and systematic organization that unlock our understanding of general and communicative culture's many sides, including its moral, teaching, aesthetic, innovative, and other dimensions. In contrast, a student-centered approach concentrates on developing socially relevant personality characteristics, catering to individual student interests, and acknowledging the intricate and dynamic nature of cultural development.

Our theoretical investigation during this research indicated that readiness can be understood in two ways: as a transient condition and as an inherent personality trait. Psychology recognizes a notion of "situational readiness," which defines readiness as a temporary state of an individual. This state dictates how effectively an activity can be performed at a particular juncture and within defined circumstances. Beyond this fleeting mental state, readiness also exists as a more enduring personal attribute. Given that our current work is dedicated to cultivating intercultural communication proficiencies, we deem it essential to explore the concept of "culture" as a foundational element for constructing a pedagogical framework aimed at nurturing these skills within the university's academic environment.

The engagement between educators and international learners seeks to establish a comprehensive pedagogical framework within the realm of cross-cultural collaboration between national and international academic institutions. This involves replicating successful socio-cultural practices within the global educational arena. Foreign students' learning is facilitated by showcasing various facets and paradigms of socio-cultural engagement in both intercultural education and practical socio-cultural endeavors. Consequently, the international student's identity evolves, gaining diverse competencies through participation in intercultural activities. Key phases of this process incorporate elements of both specialization and unification within the overarching pedagogical approach.

Results and their discussion

In constructing a model for fostering students' preparedness for intercultural exchange, a fundamental principle we adhere to is that the model must accurately reflect the reality it represents. The subjects of our modeling are intricate social and educational dynamics, inherently shaped by human involvement. This encompasses both the journey of cultivating students' intercultural communication skills and the pedagogical interventions designed to guide this development.

The model demonstrates that intercultural interaction is not a spontaneous process but a structured pedagogical system.

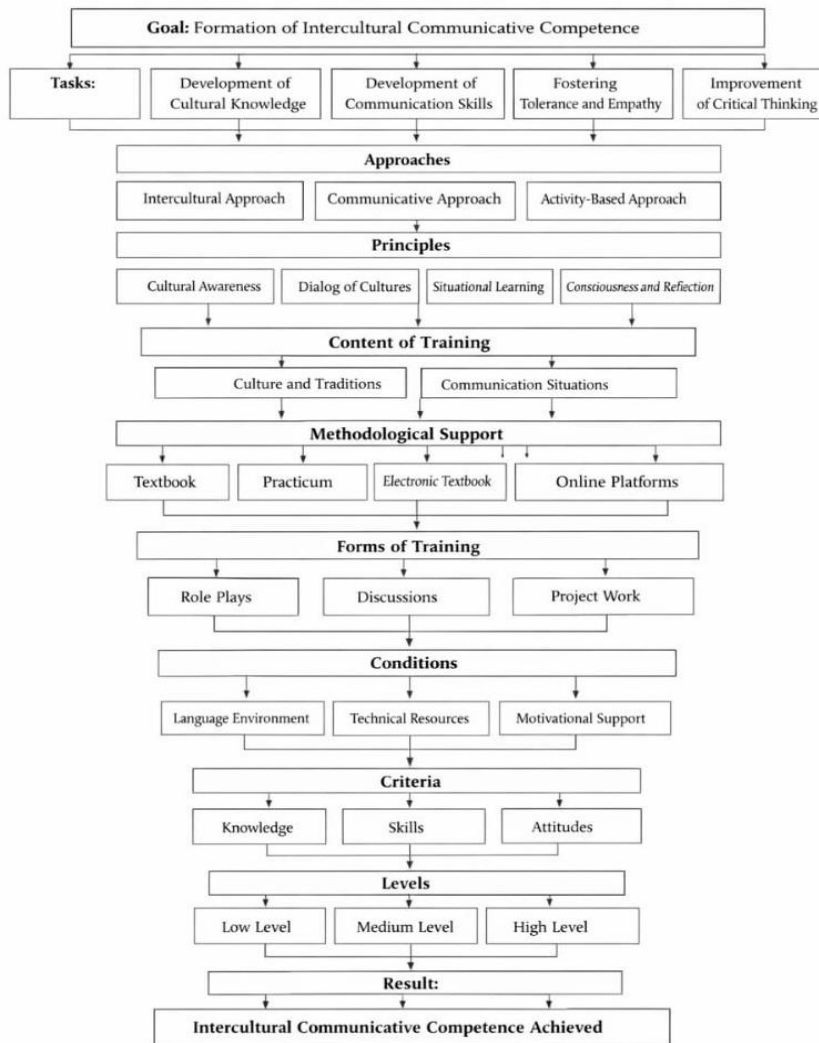
Teacher mediation plays a pivotal role in facilitating students' engagement with intercultural experiences by providing guidance, scaffolding, and reflective support throughout the learning process. In parallel, the integration of digital technologies significantly expands opportunities for authentic intercultural interaction, enabling learners to access diverse cultural contexts and communication environments.

In contrast to traditional pedagogical approaches, the proposed model is characterized by a stronger emphasis on systemic integration, ensuring the coherent alignment of objectives, content, and instructional methods. It also demonstrates a high degree of adaptability, allowing for flexible implementation across different educational contexts and learner needs. Furthermore, the model prioritizes practical application, focusing on the development of transferable intercultural competencies through real-world tasks and interactive learning activities. This comprehensive model represents a holistic system for forming intercultural communication competence in higher education. It integrates theoretical and practical components, ensuring the development of knowledge, skills, and attitudes necessary for effective intercultural interaction.

The proposed model places particular emphasis on comprehensive methodological support, which is implemented through a combination of traditional and digital learning resources. These include textbooks that provide the theoretical foundations of intercultural communication, as well as practicum materials consisting of exercises, tasks, and case studies aimed at developing students' applied skills. In addition, electronic textbooks are incorporated to offer interactive modules, multimedia content, and digital exercises that enhance student engagement. Online platforms also play a crucial role by enabling virtual simulations, discussions, and collaborative project work, thereby extending learning beyond the classroom environment (see Table 1).

The implementation of this model contributes to the creation of an interactive and multicultural learning environment that promotes tolerance, dialogue, and intercultural awareness. As a result, students are better prepared to achieve a high level of intercultural competence and effectively participate in global communication contexts.

Table 1
The model of formation of Intercultural Communication



Understanding a new culture involves several key elements. The first is factual knowledge, encompassing language proficiency, historical context, cultural values and characteristics, and social norms. The second is the development of skills. This includes the ability to learn and integrate new cultural information, to apply that information practically, to compare and contrast the new culture with one's own, to interpret cultural nuances, and to objectively evaluate both cultures. Effective intercultural communication relies on the proper application and integration of both knowledge and skills.

To build strong relationships across cultures, mastering the skills mentioned is crucial. This allows individuals to effectively adapt their communication style and choose the best approach for each intercultural interaction, leading to more successful and positive outcomes.

Building successful relationships across cultures requires cultivating the skills mentioned previously. This allows individuals to adapt their communication style and choose the most effective approaches for each intercultural encounter. Ultimately, this leads to productive and positive interactions.

However, despite the significant scientific interest in this issue, the aspect of organizational and pedagogical conditions for the formation of intercultural communication among university students has not been sufficiently addressed in scientific research. A theoretical analysis of the literature on this issue, as well as a study of the experience of forming

intercultural communication among university students, revealed the following contradictions: - the need to address the current challenges in the formation of intercultural communication and the lack of new approaches to solving this problem; - the potential for the formation of intercultural communication among university students. - the presence of separate empirical experience in the formation of intercultural communication and the insufficient development of organizational and pedagogical conditions for their implementation (Knyazeva, 2018).

Conclusion

Intercultural communication is a key priority in modern higher education. The proposed model provides a structured framework for developing intercultural competence and can be used in curriculum design and pedagogical practice. Future research should focus on empirical validation of the model.

Consequently, educators must ensure that foreign students grasp the intercultural dimension of their learning by identifying intercultural contexts within their professional studies and engaging in reflection on socio-cultural activity concepts, understanding the substance of intercultural education, and utilizing methods to enhance socio-cultural engagement. Intercultural communication is crucial in education because it fosters mutual understanding among students and broadens their perspectives on the world. This, in turn, cultivates tolerance and teamwork abilities. Educators are key to this process, and thus, they must continuously update their expertise in intercultural communication.

Ultimately, building strong intercultural communication skills is an ongoing endeavor. While it demands dedication, it's a vital component in building a society that values harmony and acceptance.

Intercultural communication is a key aspect of modern pedagogy in a globalized and multicultural society. In today's interconnected world, fostering intercultural communication is a crucial priority. This skill is essential for individuals to thrive in a globalized environment. Governments also recognize the importance of this. To succeed, people must acquire specific competencies. Education plays a vital role in cultivating these skills by establishing environments and providing resources that promote intercultural understanding.

Also an intercultural communication is crucial in education. It fosters student understanding of diverse perspectives and global issues. This, in turn, promotes empathy and collaborative skills. Educators are key to cultivating this ability, and therefore, must continuously enhance their expertise in intercultural communication. In today's interconnected world, teaching and learning effectively involves understanding how people from diverse backgrounds interact. Successful communication across cultures is essential. This means being able to appreciate and value different perspectives, and being open to having meaningful conversations.

The modern landscape of business and science frequently requires individuals proficient in foreign languages to engage with international counterparts. Therefore, a key aim of foreign language programs is to equip students with intercultural competence. This entails developing strong linguistic skills, including vocabulary and grammar, and fostering the ability to participate in cultural exchanges characterized by mutual respect, acceptance of differences, and the overcoming of barriers. Acquiring intercultural competence means learning about the target culture through its language and adopting the communication styles of its speakers.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

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Saya Ayazbayeva: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft, Visualization. Maral Yessekeshova: Supervision, Conceptualization, Validation, Writing – review & editing. Viktor Tarantsei: Methodology, Theoretical framework development, Validation, Writing – review. Nursaule Tastanbekova: Data curation, Resources, Writing – review & editing, Project administration.

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THE EVOLUTION OF STUDENT FEEDBACK LITERACY IN HIGHER EDUCATION: A SCOPING REVIEW (2005 - 2025)

Abstract. Feedback literacy is becoming acknowledged as a "foundational capability" students need to self-regulate learning and improve performance at university. This scoping review charts developments in feedback literacy between 2005 and 2025 in terms of conceptualisation, pedagogical interventions, measurement and student-related factors, as well as mediators of feedback literacy related to digital technology use in English as a Foreign Language (EFL) learning contexts. We followed PRISMA-ScR guidelines for scoping reviews to search for, select, and screen peer-reviewed empirical studies and conceptual articles published in Scopus, Web of Science, and ERIC databases. Thematic analysis was used to synthesise evidence from 43 studies resulting from this search process. The feedback literature is undergoing an ontological paradigm shift, from transmission- to connection-based views of feedback processes. Pedagogical interventions to support students' development of feedback literacy are focused on evaluative judgement through peer- and self-assessment practices and feedforward through curriculum-long approaches to feedback. As learning analytics and Generative AI gain momentum in education, students need critical «AI feedback literacy» to assess machine-generated messages. Students' development of feedback literacy is also contingent on teacher feedback literacy and relational trust. Recommendations for future research include measuring feedback literacy behaviorally and using research designs that triangulate self-report with digital log files when testing students' uptake of feedback.

Keywords: feedback literacy, scoping review, higher education, formative assessment, feedback interventions.

Introduction

In recent years, higher education systems worldwide have increasingly emphasized the role of feedback in enhancing student learning, self-regulation, and academic performance. Feedback in higher education relies on the formative assessment principles and actions that students take after receiving comments. Feedback was conceptualized by Hattie and Timperley (2007) and Boud and Molloy (2013) as part of a learning cycle wherein the instructor provides information about how good the work is, and learners interpret that information into what they will do next to improve. Carless and Boud (2018) later coined the term student feedback literacy, which they described as students' ability to value feedback, make judgements about quality, manage affect, and act on feedback to enhance future work.

Scholars connect feedback literacy with a learner's evaluative judgement or ability to make an informed judgement about the quality of work using criteria, exemplars, and the standards they should meet. Sutton (2012) provided one of the first perspectives on feedback literacy through the lens of reading and acting on comments. Nieminen and Carless (2023) provided a more nuanced discussion on how context and learning relationships impact learners' interpretation of feedback. Current publications are building on pedagogical interventions to promote feedback literacy, including training students in peer review, engaging in self-assessment and reflection activities, dialoguing criteria, and creating online feedback spaces.

Another body of work is focused on creating measurement tools and identifying behaviors associated with feedback literacy. These instruments allow researchers and instructors to measure whether interventions can affect change.

This scoping review synthesizes peer-reviewed journal articles published between 2005-2025 on feedback literacy in higher education. This review includes journal articles specific to EFL programs, as well as scholarship in the broader university context that can be applied to EFL by studying writing assignments and engaging with content area texts. This review illustrates how these works have mapped out conceptual understanding, intervention techniques, measurement tool creation, and methodological approaches.

In more detail, this literature review will be exploring three research questions:

RQ1: How has student feedback literacy been conceptualized, supported through pedagogical interventions, and measured in the current research?

RQ2: What role do the affordances of emerging digital ecologies, learning analytics, and generative AI play in mediating feedback literacy formation and practices?

RQ3: In what ways have feedback literacy practices been enacted in EFL contexts?

Methodology

This study was based on a scoping review design. This design is appropriate for mapping concepts, research approaches, and intervention types concerning feedback literacy at universities as well as for identifying research gaps. The study was conducted in accordance with the reporting standard Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR), and its design integrated and adjusted the search, selection, and synthesis steps to reflect the reporting elements of this standard.

The authors set up an a priori protocol before the selection began. It outlines the purpose, research questions, selection criteria, sources of data, search strings, screening, data extraction tools, and analysis plans.

Sources of Data and Search Strategy Data

The authors searched for tools, including Scopus, Web of Science, and ERIC. The range is restricted to the years 2005-2025. The authors defined a primary search string to include Scopus, Web of Science, and ERIC and adjusted its own syntax to suit each of the database's requirements. We searched from 1-30 December 2025, with each search replicated by two authors to capture all relevant articles and avoid selection bias. Table 1 lists the finalized database-specific Boolean search strings.

Table 1.
Boolean Search Strings

Database	Search Query String
Scopus	TITLE-ABS-KEY("feedback literacy" OR "student feedback literacy" OR "learner feedback literacy" OR "academic feedback literacy" OR "feedback engagement" OR "feedback uptake") AND TITLE-ABS-KEY("higher education" OR university OR "tertiary education") AND TITLE-ABS-KEY(EFL OR "English as a foreign language" OR "second language writing" OR "academic writing") AND PUBYEAR > 2004 AND PUBYEAR < 2026
Web of Science	TS=("feedback literacy" OR "student feedback literacy" OR "learner feedback literacy" OR "academic feedback literacy" OR "feedback engagement" OR "feedback uptake") AND TS=("higher education" OR university OR "tertiary education") AND TS=(EFL OR "English as a foreign language" OR "second language writing" OR "academic writing") Timespan: 2005 to 2025 Indexes: SCI-EXPANDED, SSCI, A&HCI, ESCI
ERIC	AB("feedback literacy" OR "student feedback literacy" OR "learner feedback literacy" OR "academic feedback literacy" OR "feedback engagement" OR

"feedback uptake") OR TI("feedback literacy" OR "student feedback literacy" OR "learner feedback literacy" OR "academic feedback literacy" OR "feedback engagement" OR "feedback uptake") AND AB("higher education" OR university OR "tertiary education") OR TI("higher education" OR university OR "tertiary education") AND AB(EFL OR "English as a foreign language" OR "second language writing" OR "academic writing") OR TI(EFL OR "English as a foreign language" OR "second language writing" OR "academic writing")
Publication Date: January 2005 to December 2025

Inclusion and exclusion criteria

The authors included peer-reviewed journal articles published in English or Russian that focused on feedback literacy in higher education. The inclusion criteria were as follows: empirical studies on interventions, works on the development and validation of measurement instruments themselves, and conceptual papers of literature focused on describing the conceptual model, providing an operational definition of feedback literacy, or describing feedback literacy as a construct. The review comprised general university-level studies, as well as EFL-based studies in the context of general university education and studies involving EFL, where the assignments included academic writing, disciplinary genres, or tasks involving detailed feedback to students. The authors excluded publications on school education, conference proceedings, dissertations, books, book chapters, and reports. Studies without access to the full text were excluded. We excluded articles in which the term “feedback literacy” was missing and those in which the authors did not connect results to feedback literacy through a definition, model, or measurement tool.

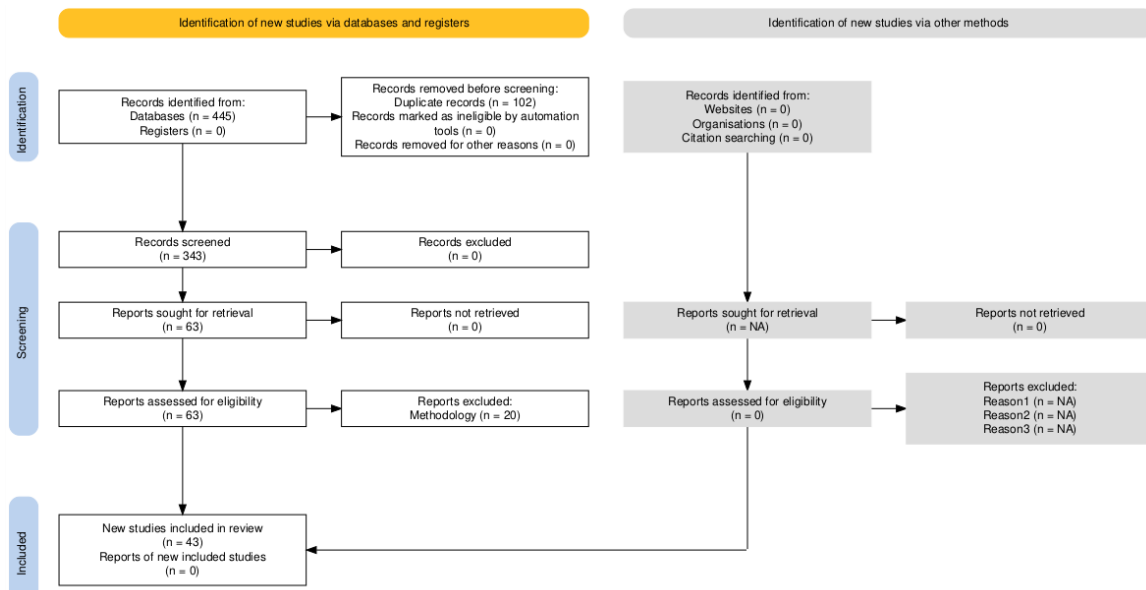
Selection of Studies

PRISMA guidelines were applied to the study selection process for transparency and replicability purposes. Searching databases (Scopus, Web of Science, and ERIC) generated 445 records, of which 102 duplicates were removed using automated and manual duplication checks. The remaining 343 records were imported into Covidence™, where title and abstract screening were conducted independently. At this stage, 280 publications were excluded because they did not meet the inclusion criteria. After removing duplicates, 63 publications were subjected to full-text assessment. Of these, 20 did not meet the requirements specific to the review regarding methodology or thematic focus and were excluded. In total, 43 studies met all the requirements for inclusion and were used in the final qualitative synthesis of this scoping review. Figure 1 presents the PRISMA flow diagram for the search and selection processes of this study (Haddaway et al., 2022).

Data extraction and analysis

A data extraction form and codebook were developed by the authors. A subset of articles was used to pilot the form and identify categories to strengthen definitions. Descriptive and thematic analyses were conducted. Thematic analysis divided interventions into four categories and defined the differences between the EFL sub-corpus and the overall higher education corpus.

Figure 1.
PRISMA flow diagram.



Results

A total of 43 studies were included in the final analysis. Publications span the period from 2005 to 2025, reflecting the gradual evolution of feedback literacy from early conceptual foundations to recent empirical and technology-enhanced applications. The majority of studies were published after 2018, indicating growing scholarly attention to feedback literacy in higher education. Most articles appeared in high-impact journals, such as *assessment and evaluation in higher education*, *higher education*, *teaching in higher education*, and *innovations in education and teaching internationally*, highlighting the academic significance of the field.

Models and Levels of Analysis Underpinning Feedback Literacy Constructs

Within the corpus, early works describe a paradigmatic shift from thinking about feedback as a message provided by the teacher to reconceptualizing feedback as an activity of learning in which students interpret criteria, judge quality, and make plans to act on feedback. Hattie and Timperley (2007) associated the impact of feedback with the goals and level of instructional regulation embedded within assignments. Sutton (2012) posits feedback literacy as the ability to make sense of comments and act upon their meanings. Building on theoretical conceptions of feedback literacy, Boud and Molloy (2013) reframe feedback models to associate feedback utility with assessment design and the locus of responsibility. Carless and Boud (2018) developed a model of student feedback literacy and defined its components, including valuing feedback, making evaluative judgements, managing affect, and taking action. By advancing a learning-centered conception of feedback literacy, Molloy et al. (2020) connects feedback to instructional designs that promote deliberate practice.

Contributions within the corpus have extended these models and advanced new perspectives. Chong (2021) presents an ecological perspective of feedback literacy, delineating how environmental resources contribute to its development. Gravett (2022) articulates a sociomaterial perspective by associating feedback practices with artifacts, interfaces, and spaces. Nieminen and Carless (2023) critically reviewed feedback literacy and cautioned against simplifying the construct to an individual capability without considering context and connection. Gravett and Carless (2024) delineated feedback literacy-as-event to associate specific instances of feedback with tasks, relationships, and other course conditions. Building on the idea of situatedness, Carless (2025) offers the concept of academic feedback literacy to

bridge the gap between how students engage with feedback and academic genres and expectations.

Studies in this area increasingly shift their unit of analysis to the educator and the co-design of feedback. Deneen and Hoo (2023) connect teacher and student assessment literacies and illustrate how the coordination of criteria and teacher expectations lays the groundwork for productive interactions. Chan and Luo (2022) described how teachers' personal conceptions of "giving" feedback align with specific assessment formats. Drawing forward the idea of teacher feedback literacy, Boud and Dawson (2023) propose a theoretical framework for "feedback literate teachers" that connects teachers' professional capabilities to students' capacity to develop feedback literacy. Heron et al. (2023) connects teacher feedback literacy to "relationality," associating effective feedback with trusting relationships. Continuing this line of research, Heron et al. (2024) employed an observational lens and studied feedback via an analysis of live classroom interactions. Matthews et al. (2024) describes learning partnerships between teachers and students and connects feedback literacy to the co-development of "ground rules" for feedback. Nicola-Richmond et al. (2023) delineate feedback literacy in the workplace and examine how learners experience feedback in ways that matter to identity and professional learning.

Feedback-related interventions and instructional designs aimed at actions after feedback

Peer feedback and peer assessment interventions comprise the largest group of interventions through which evaluative judgement is developed. Winstone et al. (2019) reported how feedback literacy is scaffolded by particular pedagogical conditions, such as requirements to respond to others' comments and expectations to apply feedback to new work. Fernández-Toro and Duensing (2021) demonstrated that reciprocal assessment fosters criterion mastery and reasoned evaluative judgement. Hoo et al. (2022) link self- and peer-assessment activities to increase student ownership of work quality and subsequent revisions. Hoo, Deneen, and Boud (2022) reviewed this body of intervention with a particular focus on criteria, exemplars, and reflection. Man et al. (2024) revealed that targeted peer-review training directly improves comment quality and text revisions. Ultimately, Zhu and Evans (2024) clarified the mechanism behind these successes, illustrating that active engagement with criteria is a fundamental prerequisite for developing robust evaluative judgement.

Interventions related to self-assessment, reflection, and feedback-seeking behaviors are also prominent in the corpus. Ducasse and Hill (2019) described how feedback comments in university writing tasks are complemented by educational technology and reflection activities. Malecka et al. (2022) traced the behavioral trajectory of students and analyzed the progression from initially requesting feedback to implementing final text revisions. Viewing this phenomenon through the lens of reflective literacy, Carless and Young (2023) argue that strategic feedback-seeking indicates the adoption of a highly proactive learner stance. This active engagement yields measurable benefits. Hey-Cunningham et al. (2021) established a strong correlation between students' deep interactions with comments and the improved quality of subsequent drafts. To expand this scope beyond the university, Nicola-Richmond et al. (2023) projected these skills into the professional sphere, asserting that modern workplace expectations demand a high level of feedback literacy from graduates.

Feedforward interventions and instructional designs embedded in programs link learning from feedback to future assignments and long-term learning. Noon and Eyre (2020) illustrated how analyzing common feedback behaviors can generate actionable recommendations for upcoming tasks. This process is deeply interpersonal. Hill et al. (2021) conceptualize "relational feedforward," noting that its effectiveness relies heavily on aligned teacher-learner expectations and a mutual understanding of future steps. At the structural level, de Kleijn (2023) advocates integrating feedback literacy directly into instructional design by proposing a longitudinal learning sequence that spans an entire course. To explore the empirical impact

of such approaches, Little et al. (2024) evaluated the teachability of these skills by examining how pedagogical interventions inform broader program-design decisions and metric selection. To track this developmental progress over time, Carless and Young (2023) introduced an analytical model that followed a student's feedback uptake across multiple draft versions and assignments. Complementing this structural research, Matthews et al. (2024) demonstrated that a partnership approach to co-designing feedback activities significantly enhanced student agency.

Digital and data-driven feedback formats

Articles on this theme describe the emergence of digital formats that change the temporality, modality, and visibility of student review practices. Ma et al. (2021) discussed feedback in online assessment, connecting digital assessment practices to feedback literacy enactment through actions such as reviewing criteria, responding to comments, and implementing feedback into revisions. Wood (2021) characterizes dialogic feedback that is mediated by technology, interpreting the student–teacher conversation that occurs within a digital space in which student responses make the criteria meaningful and negotiate the next steps. Jin et al. (2024) provides an account of a scaffolding feedback literacy tool implemented within learning analytics research, tying digital support to improve student feedback enactment. Gravett (2022) and Gravett and Carless (2024) linked digital feedback formats to sociomaterial and consequential views of feedback literacy, where interfaces and digital artifacts inform students' decision-making about revisions.

The articles within this digital strand also connect feedback literacy to data-reading practices and automatically generate feedback. Weidlich et al. (2025) report on learning analytics feedback by describing how analytics reports influence approaches to feedback practice within higher education. Tepgec et al. (2025) proposed learning analytics-informed feedback literacy by connecting feedback literacy development to the ability to read data on learning activities. Liu and Deris (2025) proposed the concept of AI feedback literacy by specifying the abilities necessary to critically read automated comments and determine the limits of artificial intelligence feedback. Nieminen (2023) and Carless (2025) situated reading digital outputs within context, relationships, and disciplinary conventions, highlighting how automated feedback is contingent on students' understanding of genre expectations.

Feedback Literacy Measurement Studies and Solutions

Measurement papers have established methods for quantifying feedback literacy relations. Zhan (2022) reported on the validation of a feedback literacy scale, advanced the measurement instrument, and tested its psychometric qualities. Song (2022) introduced a model for feedback literacy measurement and investigated the structure of the construct at the factor level. The results support the comparability of self-report indicators across studies. Dawson et al. (2024) present the feedback literacy behavior scale, which anchors measurement in student behaviors enacted after receiving comments.

Feedback literacy measurement practices connect feedback literacy to related assessment constructs and feedback transfer models. Zhu and Evans (2024) associated assessment literacy development with activity structures that support engagement with criteria and evaluative judgement, providing a framework for understanding the outcomes of peer- and self-assessment learning activities. Carless and Young (2025) offer a model of feedback uptake that develops an analytic framework fit for triangulating questionnaire data with observations of behaviors enacted in comments and drafts of student texts. Little et al. (2024) relate the measurement of feedback literacy gains to indicator selection and the duration of pedagogical intervention.

The methodological profiles of papers in this corpus draw upon conceptual papers, qualitative studies, mixed-methods research, quasi-experimental learning activity designs, and the psychometric validation of quantitative measures. Arksey and O'Malley (2005) offer a

scoping review method through which this study was mapped. Qualitative and observational studies by Heron et al. (2023) and Heron et al. (2024) connects feedback literacy measurements to classroom interactions. Finally, the conceptual contributions from Chong (2021), Gravett (2022), Nieminen and Carless (2023), and Gravett and Carless (2024) increase the sophistication with which context is treated in the analysis of the results. The instructional models designed by de Kleijn (2023) Carless and Young (2023) provide a means of considering feedback transfer longitudinally.

Discussion

Themes provide an account of how feedback literacy has been formed into a research program over time. Conceptually, publications have supplied language to discuss student agency (Boud & Molloy, 2013; Hattie & Timperley, 2007) and framed contexts (Carless & Boud, 2018; Molloy et al., 2020; Sutton, 2012). Contributions have described feedback literacy as when students decode criteria (assign meanings to comments) and act accordingly. This work was extended by Chong (2021), Gravett (2022), Nieminen and Carless (2022), Gravett and Carless (2024), and Carless (2025), who applied an ecological, sociomaterial, event-based, and academic lens to feedback literacy research and demonstrated how feedback literacy is mediated by relationships with teachers, peers, and disciplinary genres when students make decisions about revisions.

Intervention work has made visible how feedback literacy develops only when whole courses are programmed with learning activities designed to promote student feedback. Peer- and self-assessment interventions guide students to develop evaluative judgement by providing opportunities to engage with criteria and examples over time; Winstone et al. (2019), Fernández-Toro and Duensing (2021), Hoo et al.(2022), and Zhu and Evans (2024) each unpack this logic. Training students to peer review their EFL writing (Man et al., 2024) and provide feedback for others' academic writing (Hey-Cunningham et al., 2021) explicates the connection between feedback literacy and disciplinary writing expertise. Studies eliciting and enacting feedback (Malecka et al., 2022) and feedback-seeking behaviors (Carless & Young, 2025) show a connection between student agency and translating comments into revisions. Finally, the feedforward design (Noon & Eyre, 2020), relational feedforward (Hill et al., 2021), and longitudinal curriculum models (de Kleijn, 2023) provide examples of how course programming enables students to learn how to take feedback into the next assignment.

Regarding RQ3, feedback literacy practices in EFL contexts and writing courses seem to be enacted mostly through cycles of drafting and peer review activities. Students learning English as a foreign language face the dual task of attending to surface-level language issues and grappling with complicated academic genres that might be new to them(Carless, 2025). Against this backdrop, teacher intervention plays an important role. Teaching students how to peer-review their peers' writing in language classrooms can help learners do more than correct surface errors, as well as prepare students to interpret language requirements with intention, which has been shown to have a direct impact on students' own review comments as well as revised drafts (Man et al., 2024). Pairing writing activities with digital tools and reflection activities can also allow English learners to move beyond seeing teacher feedback on grammar as one-way street (Ducasse & Hill, 2019). In other words, when students engage in dialogue with teachers and peers about their writing over time, there is evidence of development through drafts (Hey-Cunningham et al., 2021). Therefore, feedback literacy skills may serve to connect students to the language learning context, as well as to the broader academic community.

Feedback literacy in digital publications operationalizes the necessary conditions during the shift to online assessment and learning analytics platforms. Ma et al. (2021) Wood (2021) connects digital formats to conversations and the spirit of revising. Jin et al. (2024) pair analytics with scaffolding to describe processes that digitally enable students to enact feedback. Weidlich et al. (2025) and Tepgec et al. (2025) Connect learning analytics to interpreting data

and student feedback practices. Liu and Deris (2025) coins AI feedback literacy and attends to why students need to critically read automated prompts. Nieminen, Carless, (2023) and Carless (2025) both conceptually argue that interpreting data and analytics requires attention to context, relationality, and academic genres, because machine-based feedback can only produce recommendations based on written assumptions of text quality and encoded criteria.

Feedback literacy is measurable when reading these articles. The measures produced by Zhan (2022) and Song (2022) enable self-report assessment of different facets of feedback literacy. In contrast, the behavioral scale proposed by Dawson et al. (2024) and Carless and Young's (2025) model of feedback takes anchor measurement in students' actions after receiving comments and taking feedback forward to new drafts. Little et al. (2024) connected evidence of feedback literacy's plasticity to the length of interventions and choice of measured indicators; this conclusion should motivate more robust applications in the next wave of scholarship.

This collection of articles delineates the areas of inquiry that can be tested with EFL learners in higher education. Collecting versions of student writing and log files from digital platforms would make it possible to triangulate self-reported data with revision behaviors, as suggested by Jin et al. (2024). However, any initiative should also measure faculty engagement with feedback literacy activities based on Deneen and Hoo (2023), Chan and Luo (2022), Boud and Dawson (2023), Heron et al. (2023, 2024), and Matthews et al.'s (2024) partnership measurements. This recommendation stems from the recognition that students cannot develop feedback literacy if the criteria are not aligned, trust is lacking, and classroom dialogue is unproductive. Finally, Nicola-Richmond et al.'s (2023) workplace lens offers criteria to articulate transfer measures when graduates enter the workforce.

Conclusion

The conceptualization and operationalization of student feedback literacy has undergone marked changes in the last two decades, from a personal cognitive construct to deeply relational, sociomaterial and ecologically oriented practice. This scoping review emphasizes that building robust feedback literacy in higher education, and in the EFL context, will not be just achieved through isolated interventions. It requires longitudinal, curriculum-embedded designs with students serving as evaluative mediators and engaging in structured peer conversations. Given the increasing integration of digital ecologies, learning analytics, and Generative AI in higher education, the construct of feedback literacy needs to be widened. Students are now required to critically interpret and negotiate machine-generated data, which requires new forms of "AI feedback literacy."

Finally, student feedback literacy is directly associated with teacher feedback literacy and the co-design of assessment contexts. For EFL learners who negotiate linguistic barriers in combination with complex academic genres, relational trust and explicitly modeled feedforward mechanisms are critical. This field will have to go beyond self-reported metrics as future work.

Future research should measure behavior to see how real uptake of feedback looks across various drafts and use digital log files. In the end, producing feedback-literate graduates is not just an academic undertaking, but a vital piece of institutional mandate for learners to meet the ongoing evaluative requirements of a contemporary professional workforce.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

A. Igembekova: Conceptualization; Data Curation; Writing – Original Draft Preparation.
A. Almatova: Conceptualization; Methodology; Writing – Review & Editing; Supervision;
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