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Learning Models Using Digital Technologies in the System of Higher Professional Education

نماذج التعلم باستخدام التقنيات الرقمية في نظام التعليم المهني العالي

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Abstract: The aim of this study was to examine the features of functioning and effectiveness of educational models using digital technologies in the higher professional education systems of the Kyrgyz Republic and China. The Delphi expert evaluation method with the participation of 42 specialists and the method of stratified randomisation in group formation were applied in this work. The testing of the model was carried out from September 2024 to March 2025 in four universities with the participation of 240 students (30 people in the experimental and control groups of each university), studying in the fields of information technology and economics. In the course of the study, five key groups of factors influencing the effectiveness of the implementation of digital educational models were identified: technological, economic, cultural, pedagogical, and institutional. Comparative analysis showed that in the Chinese educational system technological (8.7 points for Internet availability), economic (9.2 points for digitalisation funding), and institutional factors (9.0 points for educational policy) dominated. In the Kyrgyz Republic, cultural factors (8.4 points for traditional values) and technological limitations (5.6 points for Internet availability) prevailed. The results of the testing at Bishkek University showed a 42% increase in students' motivation and a 0.8-point increase in academic performance. At Osh University an increase of 53% in students' digital competences was recorded. At Peking University the implementation of the model reduced the time for mastering material by 21% and increased the proportion of independent assignments by 25%. At Xi'an Jiaotong University a 32% increase in students' professional competence was observed. The practical significance of the study lay in the development of adaptive recommendations for optimising digital educational models, taking into account national and institutional specificities.

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Keywords: Online education, Electronic educational environment, Digital competences, Cultural barriers, Pedagogical innovations.

المستخلص: تهدف هذه الدراسة إلى فحص خصائص عمل وفعالية النماذج التعليمية باستخدام التقنيات الرقمية في أنظمة التعليم المهني العالي في الجمهورية القيرغيزية والصين .تم في هذا العمل تطبيق طريقة تقييم الخبراء بأسلوب دلفي بمشاركة 42 مختصًا، بالإضافة إلى استخدام أسلوب العشوائية الطبقية في تشكيل المجموعات، أُجري اختبار النموذج خلال الفترة من سبتمبر 2024 إلى مارس 2025 في أربع جامعات بمشاركة 240 طالباً (30 طالبًا في المجموعتين التجريبية والضابطة في كل جامعة)، يدرسون في مجالي تكنولوجيا المعلومات والاقتصاد. خلال الدراسة تم تحديد خمس مجموعات رئيسية من العوامل المؤثرة في فعالية تطبيق النماذج التعليمية الرقمية، وهي :العوامل التكنولوجية، والاقتصادية، والثقافية، والتربوية، والمؤسسية. أظهر التحليل المقارن أن العوامل التكنولوجية 8.7 نقطة لتوفر الإنترنت، والاقتصادية 9.2 نقطة لتمويل الرقمنة، والمؤسسية 9.0 نقطة للسياسة التعليمية كانت مهيمنة في النظام التعليمي الصيني .أما في الجمهورية القيرغيزية، فقد برزت العوامل الثقافية 8.4 نقطة للقيم التقليدية والقيود التكنولوجية 5.6 نقطة لتوفر الإنترنت .أظهرت نتائج الاختبار في جامعة بيشكيك زيادة بنسبة42 ٪ في دافعية الطلاب وارتفاعًا بمقدار 0.8 نقطة في الأداء الأكاديمي .وفي جامعة أوش، تم تسجيل زيادة بنسبة53 ٪ في الكفاءات الرقمية لدى الطلاب. أما في جامعة بكين، فقد أدى تطبيق النموذج إلى تقليل الوقت اللازم لإتقان المادة بنسبة21 ٪ وزيادة نسبة المهام المستقلة بنسبة25 ٪ .وفي جامعة شيآن جياوتونغ، لوحظت زيادة بنسبة32 ٪ في الكفاءة المهنية للطلاب .وتكمن الأهمية العملية للدراسة في تطوير توصيات تكيفية لتحسين النماذج التعليمية الرقمية مع مراعاة الخصائص الوطنية والمؤسسية.

الكلمات المفتاحية :التعليم عبر الإنترنت، البيئة التعليمية الإلكترونية، الكفاءات الرقمية، الحواجز الثقافية، الابتكارات التربوية.

1 INTRODUCTION

Digital technologies were rapidly changing all spheres of human activity, including education. In the context of modern realities, higher professional education of specialists required innovative approaches based on the use of digital tools and advanced teaching methods. The study of this issue became especially relevant in countries with different educational systems and paces of digitalisation, such as the Kyrgyz Republic and China, where the transformation of higher professional education was taking place under conditions of globalisation and the development of the information society.

The current state of higher professional education in these countries was characterised by uneven implementation of digital technologies, which created certain challenges for educational systems. In the Kyrgyz Republic there was an active aspiration to integrate digital tools into the educational process with limited resources and insufficiently developed infrastructure. China demonstrated significant success in creating a high-tech educational environment, yet faced problems of standardisation and adaptation of learning models to different regions of the country.

The need to study learning models using digital technologies was due to the growing gap between labour market requirements and the level of training of graduates of higher education institutions. The transformation of professional competences in the digital economy required a revision of traditional approaches to teaching (Bondarenko et al., 2022; Luzan et al., 2024; Symonenko et al., 2019). Modern

technological opportunities created the need to develop effective pedagogical models corresponding to the cognitive characteristics of the new generation of learners.

In the context of the rapid digitalisation of the educational environment, the study of learning models using digital technologies in the system of higher professional education acquired special relevance. Numerous studies in this field formed an extensive field for scientific discourse, covering various aspects of the digital transformation of vocational education.

The study of international experience in digital technologies in vocational education highlights key works. Jiang et al. (2024) conducted a literature review on the use of digital technologies, synthesized research findings, and identified areas for development, while also highlighting gaps in knowledge. Regarding vocational education in China, Hou and Bin Royo (2024) conducted a comparative analysis of online learning, focusing on the digital divide between urban and rural areas. Wu (2024) investigated the impact of multimedia technologies on learning satisfaction but did not cover all aspects of adapting multimedia technologies to various professional fields. Esenalieva et al. (2023) studied teachers' digital literacy but did not account for the specific features of vocational education. The COVID-19 pandemic accelerated digital transformation, as shown in the works of Silvana et al. (2021) and Seyffer et al. (2022) on online learning, and also contributed to the perception of pandemic-related obstacles as opportunities. However, Seyffer's conceptual model did not account for the long-term consequences of emergency digital solutions.

Yanto et al. (2022) developed a problem-oriented method for integrating digital resources into vocational education. However, the utility of this technique is limited to a few educational scenarios. This points to the need for broader research addressing social, economic, and technical variables in the implementation of digital models. Alenezi (2023) proposed a comprehensive approach to digital learning and transformation in higher education, emphasizing systemic changes, while Sailer et al. (2021) highlighted the importance of pedagogical, organizational, and cultural aspects for the successful implementation of digital technologies. Antonetti et al. (2022) investigated the relationship between teachers' digital competence and technology acceptance in vocational education but did not consider regional pedagogical differences.

Despite extensive research, the adaptation and effectiveness of digital learning models in higher professional education, considering regional specificities, remain underexplored. The literature reveals a gap in understanding how sociocultural, economic, and technological factors interact in shaping the success of digital educational ecosystems. Comparative studies on the use of digital technologies in higher professional education across countries with varying technological development levels are limited, hindering the creation of adaptive educational strategies. This study aims to address these gaps by providing a comprehensive analysis of digital learning models in vocational education, factoring in regional, cultural, and economic influences.

The aim of the present study was to identify the features and effectiveness of learning models using digital technologies in the system of higher professional education in the Kyrgyz Republic and China in the context of modern educational requirements and technological opportunities.

In this study, the central concept of a "learning model" is explicitly defined as a systematic pedagogical framework that defines the organisation of the educational process, the selection and sequencing of learning content, the forms of teacher–student interaction, the utilisation of digital tools, and the procedures for assessment and feedback. Within the context of higher professional education, this concept refers not merely to a collection of technologies, but to an integrated system that combines organisational-technological, content-methodological, communicative-interactive, and evaluative-reflexive components, tailored to the institutional, cultural, and infrastructural contexts of the Kyrgyz Republic and China.

In accordance with the stated aim, the following research tasks were defined:

1. To characterise the current conditions and contextual specificities of using digital technologies in the higher professional education systems of the Kyrgyz Republic and China.

2. To identify the factors influencing the effectiveness of the implementation and functioning of digital educational models in the studied countries.

3. To develop and test an experimental learning model using digital technologies for higher professional education of specialists, taking into account the specifics of the educational systems of the Kyrgyz Republic and China.

2 MATERIALS AND METHODS

The effectiveness of digital educational models was assessed through expert evaluation using the Delphi method, involving 42 specialists (21 from the Kyrgyz Republic and 21 from China), including university representatives, ministry employees, and IT specialists. Criteria for expert inclusion included at least five years of experience in digital education, publications or projects on digitalisation, and managerial roles. Experts evaluated 21 factors in 5 categories, such as "availability of high-speed Internet," "state financing of digitalisation," and "adaptation of pedagogical approaches" on a 10-point scale. Two rounds of surveys were conducted to reach consensus, with SPSS 28.0 used to analyze the data, identifying mean values and statistically significant differences between experts from the Kyrgyz Republic and China (t-test for independent samples).

The study's methodology involved developing and testing an experimental learning model using digital technologies. Based on theoretical analysis and expert feedback, a 4-component model was created, including organisational-technological, content-methodological, communicative-interactive, and evaluative-reflexive components. Each component was tailored to the educational systems of the Kyrgyz Republic and China, considering the identified factors influencing effectiveness.

The model was tested from September 2024 to March 2025 at four universities: Bishkek Humanities University (K. Karasaev) and Osh State University in the Kyrgyz Republic, and Peking University and Xi'an Jiaotong University in China. This period included preparatory procedures, entry testing, the instructional intervention, final assessment, and data processing. The selection of these institutions was based on their

representativeness within their respective national educational systems, the availability of necessary infrastructure, and their readiness to implement innovative educational models.

In each university, experimental and control groups of students (30 people in each) were formed, studying in fields related to information technology and economics. The total sample size amounted to 240 people (120 in experimental groups and 120 in control groups). The demographic characteristics of the sample were: at Bishkek Humanities University – 34 women (56.7%) and 26 men (43.3%), average age 20.8±1.4 years; at Osh State University – 32 women (53.3%) and 28 men (46.7%), average age 21.2±1.6 years; at Peking University – 29 women (48.3%) and 31 men (51.7%), average age 20.5±1.2 years; at Xi'an Jiaotong University – 27 women (45%) and 33 men (55%), average age 20.9±1.3 years. The gender distribution in the experimental and control groups was balanced, with a deviation of no more than 5%.

The formation of groups was carried out using the method of stratified randomisation, taking into account the following criteria: year of study (3rd-4th year of the bachelor's programme), average performance score (not less than 3.5 on a 5-point scale), and initial level of digital literacy (determined by the results of preliminary testing). This approach ensured the relative homogeneity of the experimental and control groups and minimised the influence of external variables on the results of the experiment.

The study followed ethical guidelines set by the Helsinki Declaration and CIOMS. Participation was voluntary, with all students signing informed consent. They were informed of their right to withdraw at any time without academic consequences. 8 participants (3.3% of the sample) withdrew for personal reasons, and were replaced by similar students to maintain balance. Entry testing assessed academic performance, digital skills, and professional abilities. A digital competence test, based on DigComp 2.1 (Vuorikari et al., 2022) and UNESCO (2018), evaluated technical skills, critical thinking with digital information, and communication in digital environments. The test was validated with a Cronbach's alpha of 0.84 on a sample of 120 non-participating students, indicating high reliability.

The experimental groups followed a model integrating socio-cultural and competence-oriented approaches with four components: organisational-technological (adapted technical infrastructure for local needs), content-methodological (digital professional competences), communicative-interactive (culturally aware synchronous and asynchronous interaction), and evaluative-reflexive (continuous progress monitoring with digital feedback). The control groups followed traditional instructional methods, which were defined not as a single universal approach but according to the established pedagogical practices of each national context. In the Kyrgyz Republic, where educational practices are strongly influenced by cultural traditionalism and constrained by regional digital limitations, this condition primarily encompassed conventional in-person lecture-seminar instruction. It was characterised by teacher-led explanation of theoretical content, textbook-based assignments, oral questioning, written tasks, and minimal utilisation of digital tools, which were restricted to the basic presentation or dissemination of learning materials. Conversely, in China, reflecting a highly digitised but strictly standardised institutional framework, conventional approaches referred to instructor-led

lectures, standardised practical sessions, syllabus-driven exercises, classroom drills, and summative assessments. Digital interactions in the Chinese control groups were limited to the use of institutional platforms solely for routine administrative tasks or material sharing, without personalised digital feedback, or organised synchronous and asynchronous interactions. Consequently, the control condition upheld the specific traditional pedagogical framework of each nation while ensuring uniformity in core course content, duration, and assessment standards between the experimental and control groups. The instructional experiment itself lasted one semester (15 weeks).

Effectiveness was assessed using both quantitative and qualitative indicators. Academic performance was recorded on a 5-point scale through interim and final assessments. Digital competences were measured by testing, while productivity was assessed by task completion time. Independent work quality was evaluated via project tasks, and professional competences through practice-oriented cases.

Qualitative indicators were studied through questionnaires in Google Forms and focus groups. The students' questionnaire, developed by the author, consisted of 28 questions (18 Likert-scale and 10 open-ended), including questions like "How effective were the interactive elements of the model for your learning?" and "What barriers did you experience when using digital tools?". The teachers' questionnaire, tailored to the teaching specifics and cultural characteristics of the countries, had 32 questions, including "Evaluate the adaptability of the model to your university's cultural context" and "Describe changes in student engagement when applying the model". Pilot testing on 20 participants refined the questions.

A total of 16 focus groups (4 at each university, 60-90 minutes each) supplemented quantitative data with qualitative insights. Thematic content analysis was performed on the discussions. All data were processed anonymously in aggregated form. Additionally, structured observation protocols were used to monitor the learning process, recording student activity, interactions with the teacher, peer interactions, difficulties encountered, and solutions. A total of 60 observations (15 per university) were conducted, with a total duration of 120 hours.

For processing the obtained data, methods of mathematical statistics were applied. The comparison of indicators of experimental and control groups was carried out using Student's t-test for dependent samples (when comparing data before and after the experiment in one group) and independent samples (when comparing experimental and control groups). To identify statistically significant differences between universities and countries, one-way analysis of variance (ANOVA) with subsequent post-hoc analysis (Tukey's test) was applied. Statistical significance of differences was determined at $p<0.05$. To quantitatively assess the effect of the intervention, Cohen's effect size (d) was calculated. Statistical data processing was carried out using the SPSS 28.0 software package.

The validity and reliability of the results were ensured by methodological triangulation (combination of quantitative and qualitative methods), data triangulation (collection of information from different sources), as well as the use of standardised assessment instruments with preliminary verification of the psychometric characteristics.

3 RESULTS AND DISCUSSION

3.1 Factors influencing the effectiveness of the implementation and functioning of digital educational models

The success of digital educational systems in higher professional education in the Kyrgyz Republic and China is influenced by five factors: technological, economic, cultural, pedagogical, and institutional, each requiring a unique approach. The technical infrastructure is crucial for digital education development. High-speed Internet availability is key to the adoption of digital learning technologies. In China, 99.95% of schools had broadband with speeds of at least 100 Mbps by 2021, with 19 provinces reaching full coverage. However, in the Kyrgyz Republic, only 82% of urban families and 77% in rural areas had Internet access, with overall access at 66.4%. Additionally, one fifth of rural children lacked a computer or Internet access, limiting distance learning opportunities (Kadyralieva, 2021).

The speed of data transmission directly impacts the ease of using digital tools, which in turn affects the readiness of teachers and students to adopt new technologies in learning (Almaiah et al., 2022). Educational institutions equipped with modern technology achieve better results in the integration of digital tools among both teachers and students. The level of digital skills among vocational education teachers is crucial for the successful implementation of technology in the learning process (Antonietti et al., 2022). The quality of the technical infrastructure, the development of digital resources, and the availability of specialized programs create favorable conditions for implementing advanced educational approaches and significantly influence their effectiveness.

The financing of the digitalisation of education acts as the most important economic factor (Aizstrauta & Ginters, 2013; Aizstrauts et al., 2013). The cost of access to digital educational resources determines the accessibility of quality education. Thanks to state programmes supporting digital education, it is possible to significantly reduce the cost of using leading educational platforms, which expands opportunities for the implementation of digital educational models.

The successful implementation of digital models in education is directly linked to a region's economic development (Smolinska et al., 2024). The digitization of vocational education is more widespread in economically prosperous regions than in less developed ones. Students' financial ability to purchase the necessary technological tools also significantly influences the effectiveness of these approaches. Economic issues are key to ensuring the sustainable development of digital education following the COVID-19 pandemic. Investment in digital technologies typically declines during periods of economic crisis and budget cuts (Ginters & Revathy, 2021; Loucif et al., 2019). Seyffer et al. (2022) argue that the challenges of the pandemic should be viewed as an opportunity to create sustainable digital solutions that will ensure the long-term sustainability of digital learning in vocational education. Global economic changes also influence the development of digital educational models. Educational institutions are adopting digital technologies to ensure their graduates' competitiveness in the international labor market.

Traditional educational ideals are an obstacle to the transition to digital teaching methods. Many teachers and students value a personalized approach to learning. Younger teachers have a more positive attitude toward digitalization than older ones, so it is important to consider age in teacher training programs (Oleksandrivna et al., 2023). Cultural attitudes toward school education also play a role in the success of digital models. In societies where structure and discipline are paramount, organized and controlled models are most effective. Blended models that integrate traditional and modern methods are more effective in systems with diverse educational traditions (Nurzhanova et al., 2020).

The impact of national communication characteristics on the effectiveness of digital interaction in education. Digital models that limit nonverbal communication are considered less effective in high-context cultures. In societies with high teacher authority, some people resist student-centered digital models, as many believe that technology cannot replace the teacher's active role (Kryshtanovych et al., 2021). Cultural readiness for change is also crucial. Regions with a strong culture of innovation are more successful in integrating digital education than more conservative regions.

Traditional pedagogy based on knowledge transfer is less effective in digital contexts than interactive, problem-solving-oriented forms of education. These approaches enhance the effectiveness of digital models, develop professional competencies and critical thinking, leading to increased student satisfaction (Battaglia et al., 2024; Yanto et al., 2022). The quality of digital content and pedagogical practices depends largely on teachers' digital competence, making the development of teachers' digital literacy a crucial aspect of successful technology integration (Esenalieva et al., 2023).

Adapting pedagogical methods to the digital world requires a reevaluation of existing teaching methodologies. Digital models are most effective when approaches are aligned with aspects of digital communication and the cognitive properties of digital content. Multimedia technologies have a significant impact on learning satisfaction in vocational education (Shweikeh et al., 2021; Wu, 2024), and their effectiveness depends on the pedagogical implementation of these technologies. Student satisfaction increases when specialized multimedia methods are used. The individualization of education through digital technologies requires further transformation of teachers' pedagogical skills and enhances the effectiveness of digital models and student satisfaction.

Institutional support for the digitalisation of education at the state level is crucial for ensuring systemic and sustainable transformation. State programmes with allocated budgets and a strong regulatory framework promote the development of digital educational models. Legislation covering data protection, content standards, and digital infrastructure supports the implementation of these models. Institutional mechanisms for assessing digital education quality allow for objective evaluation and strategy adjustment. Grant programmes stimulate innovation, encouraging the development of new models.

The organisational structure and institutional flexibility of educational institutions also impact the success of digital transformation. Institutions with flexible structures and high autonomy are more effective in implementing digital models than those with rigid hierarchies. Successful digital transformation requires not only technological innovations but also institutional changes in structure and management (Aizstrauta et al., 2013; Alenezi, 2023).

A comprehensive analysis of five groups of factors affecting the effectiveness of digital educational models allows for both qualitative assessment and quantitative measurement of their influence in the educational systems of the Kyrgyz Republic and China. The intensity of each factor's impact is shaped by the specifics of national education systems, socio-economic conditions, and cultural-historical contexts. The detailed results of the comparative analysis are shown in Table 1, where the factors are ranked by their level of influence based on the expert evaluation scale.

Table (1). Comparative matrix of the influence of factors on the effectiveness of digital educational models in the higher professional education systems of China and the Kyrgyz Republic

Group of factors	Key components	Degree of influence in China*	Degree of influence in the Kyrgyz Republic*	Characteristics of differences
Technological	Availability of high-speed internet	8.7	5.6	National infrastructure development programmes (China) vs. local solutions (Kyrgyzstan)
	Technical equipment of educational institutions	8.3	4.8	Systemic approach to equipment (China) vs. fragmented provision (Kyrgyzstan)
	Availability of specialised software	7.9	4.2	National educational platforms (China) vs. imported solutions (Kyrgyzstan)
	Digital competencies of teachers	7.8	5.1	Significant gap between required and actual competencies in both countries
Economic	State funding for digitalisation	9.2	5.3	Strategic investments (China) vs. limited financing (Kyrgyzstan)
	Cost of access to digital resources	7.6	4.7	Subsidised access (China) vs. high relative cost (Kyrgyzstan)
	Regional economic inequality	6.8	7.9	More pronounced negative impact in Kyrgyzstan on uniformity of implementation
	Economic opportunities for students	8.2	5.6	Systemic support programmes (China) vs. limited initiatives (Kyrgyzstan)
Cultural	Traditional educational values	7.3	8.4	More significant influence of traditionalism in the Kyrgyz Republic
	Age-related features of perception of digitalisation	6.9	7.8	More pronounced age barriers in the Kyrgyz Republic

	National Peculiarities of Communication	7.4	8.2	High-context communication as a barrier in both countries
	Innovative culture	8.1	6.3	Greater readiness for innovation in China's education
Pedagogical	Adaptation of pedagogical approaches	7.9	5.4	Systemic development of digital pedagogy (China) vs. isolated initiatives (Kyrgyzstan)
	Teacher training system	8.3	4.9	Large-scale programmes (China) vs. local initiatives (Kyrgyzstan)
	Integration of traditional and innovative methods	7.7	6.8	Integration trend with different intensity in both countries
	Personalisation of the educational process	7.5	4.6	Systemic approach to individualised learning in China
Institutional	State educational policy	9.0	5.7	Comprehensive programmes (China) vs. emerging policy (Kyrgyzstan)
	Regulatory framework	8.5	5.2	Developed legislative system (China) vs. emerging framework (Kyrgyzstan)
	Mechanisms for assessing the quality of digital education	8.2	4.8	National quality assessment system (China) vs. conceptual development (Kyrgyzstan)
	Stimulating innovation	8.7	5.5	Grant support system (China) vs. limited mechanisms (Kyrgyzstan)
	Organisational flexibility of institutions	7.5	6.1	Specialised structures for digital transformation in China

Note: China — People's Republic of China, Kyrgyzstan — the Kyrgyz Republic. The degree of influence was assessed by experts on a scale from 1 to 10, where 1 is minimal influence and 10 is the maximum influence of the factor on the effectiveness of the implementation and functioning of digital educational models.

Source: compiled by the authors based on Almaiah et al. (2022), Antonietti et al. (2022), Timotheou et al. (2023), Alenezi (2023), Elumalai et al. (2021), Wu (2024), Esenalieva et al. (2023).

The results in Table 1 show significant differences in the influence of factors between the Kyrgyz Republic and China. Technological, economic, and institutional factors are more dominant in China, while cultural factors play a stronger role in the Kyrgyz Republic. The gap in technological and institutional factors reflects differences in state priorities and technological development. These findings highlight the need

for a differentiated approach to digital transformation in vocational education, considering regional contexts and priority factors.

The analysis reveals a complex system of interrelated factors determining the effectiveness of digital educational models. Effective strategies must account for technological, economic, cultural, pedagogical, and institutional factors, using an integrated approach tailored to national, provincial, and local conditions.

3.2 Development and testing of an experimental learning model using digital technologies

An experimental learning model for the Kyrgyz Republic and China's higher professional education systems was developed, integrating traditional pedagogy with digital solutions adapted to each country's cultural and institutional context. The model focuses on personalised learning, a problem-oriented approach, and digital competences essential for the digital economy (Alenezi, 2023).

It includes organisational and technological infrastructure, tailored to each country's needs, content and methodological approaches aligned with local labour markets, and communication tools adapted to cultural norms. The model also incorporates systems for assessing effectiveness and providing feedback, reflecting the unique institutional characteristics of both educational systems.

The model was tested from September 2024 to March 2025 at universities in the Kyrgyz Republic and China, using a comparative analysis of traditional and experimental educational programs in control and experimental groups. Both academic performance and subjective assessments were considered. Each institution formed experimental and control groups of 30 participants to ensure representative samples and reliable results. In the Kyrgyz Republic, the study involved Bishkek Humanities University and Osh State University, with students from information technology and economics faculties. In China, Peking University and Xi'an Jiaotong University participated, with students from computer science and business administration faculties.

The testing results were analyzed to compare the effectiveness of the model in different national and institutional contexts, focusing on educational achievements, professional competences, and the quality of the educational process. The data, shown in Table 2, highlight significant variability in the model's impact across different cultural and technological environments.

Table (2). Comparative analysis of the results of testing the experimental learning model using digital technologies in the educational systems of the Kyrgyz Republic and China

Comparison parameter	Bishkek Humanities University (the Kyrgyz Republic)	Osh State University (the Kyrgyz Republic)	Peking University (China)	Xi'an Jiaotong University (China)
Improvement in academic performance (difference in average grades between EG and CG)	0.8 points	0.7 points	0.6 points	0.7 points
Increased motivation for learning (compared to CG)	42%	38%	28%	30%

Improving the level of digital competencies (based on the results of final testing)	48%	53%	27%	31%
Development of independent work skills (increase in the share of independently completed assignments)	31%	28%	25%	24%
Improvement in the productivity of the educational process (reduction in time to master material while maintaining quality)	22%	19%	21%	20%
Growth of professional competence indicators	34%	32%	30%	32%
Subjective assessment by students (average score on a 5-point scale)	4.3	4.1	4.2	4.1
Subjective assessment by teachers (average score on a 5-point scale)	4.2	4.0	4.3	4.2
Key barriers to implementation of the model	Technological limitations, insufficient level of digital competencies of teachers	Cultural barriers, technological limitations	Institutional barriers, the need to comply with national standards	Institutional barriers, cultural characteristics
The most effective components of the model	Communicative-interactive	Content-methodological	Organisational-technological	Evaluative-reflexive
Recommendations for model adaptation	Development of technological infrastructure, improvement of teachers' digital competences	Adaptation to cultural context, development of technological infrastructure	Integration with national educational platforms	Adaptation to traditional pedagogical approaches

Note: EG — experimental group, CG — control group. The improvement in the level of digital competences was assessed according to a specially developed testing methodology, including the assessment of technical skills in working with digital tools, critical thinking in working with digital information, and communication skills in the digital environment. The lower relative dynamics of indicators in Chinese universities is explained by the higher initial level of students' digital literacy and the technological equipment of the educational process.

Source: compiled by the authors based on Almaiah et al. (2022), Antonietti et al. (2022), Timotheou et al. (2023), Alenezi (2023), Elumalai et al. (2021), Ma (2025), Wu (2024), Yanto et al. (2022).

The testing of the experimental model in the Kyrgyz Republic and China showed varying effectiveness based on national context and technological conditions. At Bishkek Humanities University, the model increased student motivation by 42% and improved academic performance by 0.8 points. However, technical limitations like unstable Internet and limited access to devices hindered interactive online classes and group projects. At Osh State University, cultural factors, such as hierarchical teacher-student

relationships, created barriers to student-centred approaches, though digital competences improved by 53%.

In China, the model showed positive results, though the growth in indicators was lower than expected due to students' higher initial technological literacy. At Peking University, the model improved educational quality, reducing material mastery time by 21%, and developed independent working skills, with a 25% increase in tasks completed independently. At Xi'an Jiaotong University, the use of AI for personalized learning showed the most significant impact, with a 32% increase in students' professional competences compared to the control group.

The digital transformation of higher professional education is a complex, ongoing process requiring a systematic approach. Success depends not only on technological infrastructure but also on shifting the educational paradigm, teacher training, and creating inclusive ecosystems that meet the needs of all participants and align with the digital economy's demands.

3.3 Recommendations for optimising learning models using digital technologies

The study's results led to recommendations for optimizing digital learning models, considering the unique features of the educational systems in the Kyrgyz Republic and China, as well as universal principles of digital transformation. These recommendations aim to address barriers and enhance the positive impact of digital education in both countries.

In the Kyrgyz Republic, the analysis of higher professional education in the context of digital transformation highlighted key issues, particularly digital inequality between regions. While 82% of urban families had Internet access, only 77% of rural families did, and one fifth of rural children lacked a computer or device (Kadyralieva, 2021). To address this, it is essential to invest in digital infrastructure, especially in rural areas, by improving broadband Internet access, providing modern equipment, and ensuring universal access to digital resources for all students (Puerto & Gutiérrez-Esteban, 2022).

A key area for improving digital competences in the Kyrgyz Republic's higher professional education system is teacher training. Despite increased awareness, many teachers lack the skills to effectively use digital technologies. The experimental model testing revealed that insufficient digital literacy was a major barrier. To address this, programs should be developed to enhance teachers' digital competence, focusing on both theoretical and practical aspects of digital pedagogy. Establishing a professional community for sharing best practices is also crucial. Another issue is that curricula and teaching methods often do not meet the digital economy's requirements. To address this, educational programs should be updated to include problem-based and project-based learning methods, promoting critical thinking, independent work, and digital communication skills.

Developing a national programme for digital educational infrastructure in the Kyrgyz Republic requires considering regional characteristics and specific institutional needs. A unified national platform should be created, adapted to the Kyrgyz Republic's educational system and regional technological limitations, providing access to quality resources, interaction tools, and assessment capabilities. Teachers' digital competences should be developed through a multi-level system (basic, intermediate, advanced) with

various formats, focusing on practical aspects of integrating digital technologies with traditional education.

Higher professional education curricula should be updated to meet the digital economy's demands, balancing universal professional competences with industry-specific digital skills. A public-private partnership for the digitalisation of higher professional education is essential for creating and updating infrastructure, developing programmes, and organizing practice-oriented training, ensuring alignment with labour market needs. A national system for assessing the quality of digital education should be established to objectively evaluate the effectiveness of digital models and guide improvements.

To boost innovation in education and spread best practices in digital technologies, it's crucial to support digital education innovations, create tech incubators, and run competitions and grants for teachers and institutions (Al-Rajab et al., 2023). Special focus should be placed on developing personalised learning systems using digital tools, considering students' individual needs and learning paces. Artificial intelligence technologies, enabling adaptive learning paths and personalized support, are particularly valuable (Kaswan et al., 2024). In China, despite high technological development in digital education, challenges remain. The first issue is the uneven development across regions, with disparities between the developed east and less developed west. To address this, digital infrastructure must be expanded in remote areas for equal access to quality resources. The second problem is institutional barriers, where rigid adherence to unified standards hinders innovation. Solutions include improving the regulatory framework to allow more flexibility in updating educational standards and programs.

The third issue is the need for better integration of digital education models with the traditional Chinese educational system. This requires developing hybrid learning models that combine digital technology with the values and methods of Chinese education, adapting platforms to cultural and educational traditions.

Recommendations include prioritizing the development of the "Smart Education of China" platform, expanding its functionality and tailoring it to students' needs. It's crucial to enhance the platform's personalisation features and improve integration with local higher professional education systems, ensuring technical compatibility and unified data exchange standards. Developing hybrid learning models that blend digital technology with traditional methods will help maintain a balance between innovation and cultural traditions in education.

Teacher training programs in digital pedagogy should focus not only on technical skills but also on the psychological and pedagogical aspects of digital education. Central to these programs should be integrating digital technologies with traditional education methods, tailored to Chinese cultural features. To support effective digital education, it's important to create experimental platforms for testing new models, disseminate best practices through teaching communities, and improve the quality assessment system for digital education. Criteria should account for both technological and pedagogical effectiveness.

Expanding international cooperation in digital education will bring global best practices to China's higher professional education system. The use of artificial intelligence for personalized learning is crucial,

enabling individualized learning paths, adapting content to students' needs, and providing tailored feedback. Alongside specific recommendations for the Kyrgyz Republic and China, universal recommendations for adapting digital educational models to various national and institutional contexts should be developed, based on global trends in educational technology.

An integrated approach to implementing digital educational models is essential, considering the interconnection of various factors. Technological solutions should align with changes in pedagogy, educational content, and the organizational structure of institutions (Gabriel et al., 2022). National strategies for digital transformation, tailored to specific country contexts, are crucial for successful implementation. These strategies should address infrastructure, content, staff training, and regulation, with continuous monitoring and evaluation mechanisms for timely adjustments.

Adapting digital models to national educational traditions and sociocultural contexts is vital. Models from other countries, without considering local specifics, often fail. Digital solutions must be carefully aligned with national systems, pedagogical traditions, and cultural values. International cooperation can help adapt global best practices, through joint projects, educational programs, and exchanges. Flexible management models with decentralization, autonomy, and rapid decision-making processes will foster effective digital innovation in education.

The principle of inclusiveness is one of the key ones in the adaptation of digital educational models and implies ensuring the accessibility of digital education for all categories of students, including people with special educational needs. Digital technologies should not exacerbate existing inequalities, but rather help to overcome these inequalities, providing equal educational opportunities for all students, regardless of the location, socio-economic status, physical or cognitive characteristics. In this context, the development of inclusive digital educational models, taking into account the needs of students with special educational needs, acquires particular importance (Kocdar & Bozkurt, 2023). The development of adaptive educational programmes that take into account the individual needs and characteristics of students should become a priority for the development of digital education. Digital technologies provide unique opportunities for the personalisation of learning, which should be maximally used to increase its effectiveness. An equally important aspect is the formation, within the framework of digital education, of the idea of lifelong learning as an ecosystem of opportunities for continuous learning. This presupposes the recognition of the results of non-formal and informal education, the creation of mechanisms for the integration into formal educational programmes.

In the context of the active implementation of artificial intelligence and big data technologies in education, issues of ethics and security acquire special relevance. The development of ethical standards and principles for the use of digital technologies in education, the protection of personal data, information security, and the prevention of negative consequences of digitalisation become mandatory conditions for the sustainable development of digital education. Special attention should be paid to the creation of inclusive digital educational models accessible to all categories of students, including those with special educational needs. This presupposes the development of technological solutions adapted to various types of limitations, as well as the training of teachers to work with a diverse student body in a digital environment. Universal design in digital education becomes a key factor in ensuring equal

opportunities for all categories of learners, allowing the overcoming of existing barriers and making digital educational resources accessible to the widest possible audience (Puerto & Gutiérrez-Esteban, 2022).

The generalised results of the study are presented in a comparative analysis of the key characteristics of the optimisation of learning models using digital technologies in the educational systems of the Kyrgyz Republic and China (Table 3).

Table (3). Comparative analysis of the key aspects of optimising learning models using digital technologies in the educational systems of the Kyrgyz Republic **and China**

Aspect of optimisation	**Higher professional education system of the Kyrgyz Republic**	**Higher professional education system of China**	**General recommendations**
Priority areas for the development of digital infrastructure	Providing educational institutions with high-speed Internet, especially in rural and remote areas	Increasing the uniformity of digital infrastructure development between the eastern and western regions of the country	Development of national strategies for the development of educational digital infrastructure, taking into account regional specificities
Development of digital educational platforms	Creation of a national digital educational platform adapted to the technological limitations of different regions	Further development of the "Smart Education of China" platform with an emphasis on higher professional education	Ensuring interoperability of national and local educational platforms, compliance with international standards
Enhancement of teachers' digital competences	Creation of a multi-level system for developing digital competencies of teachers, accessible to teachers from all regions	Expansion of training programmes in the field of digital pedagogy, integration with traditional pedagogical approaches	Development of international cooperation and exchange of experience, creation of professional communities
Updating of educational content	Inclusion of components aimed at developing digital competencies, taking into account the requirements of the labour market	Adapting educational programs to the requirements of the digital economy while maintaining traditional values	Integration of formal and informal education, creation of flexible adaptive programs
Development of pedagogical approaches	Implementation of problem-based and project-based teaching methods using digital technologies	Development of hybrid models that combine innovative approaches with traditional pedagogical principles	Personalisation of learning, adaptation to individual needs and characteristics of students
Institutional mechanisms	Development of public-private partnerships, involvement of business in digitalisation of education	Improving the regulatory framework, creating more flexible mechanisms for updating standards	Formation of flexible management models, decentralisation, expansion of autonomy of institutions

Quality assessment system	Formation of a national system for assessing the quality of digital education, adapted to the specifics of the country	Improving the existing system, taking into account the pedagogical effectiveness of digital models	Developing internationally comparable indicators of quality of digital education
Support for innovation	Creation of educational technology incubators, competitions, and grant programs	Development of experimental platforms, dissemination of best practices through professional communities	Creation of an ecosystem of educational innovations, integration with scientific research
Ensuring inclusiveness	Development of special programs for students from low-income families and remote regions	Adapting digital educational resources for students with different educational needs	Development of ethical standards and principles of inclusive digital education

Note: the table reflects the key aspects of optimising learning models using digital technologies in the educational systems of the Kyrgyz Republic and China, as well as universal recommendations applicable in various national contexts. The recommendations are based on the results of the conducted study and take into account the specifics of the educational systems of the countries under investigation.

Source: compiled by the authors based on Gabriel et al. (2022), Kocdar and Bozkurt (2023), Puerto and Gutiérrez-Esteban (2022), Kaswan et al. (2024).

The presented recommendations for optimising learning models using digital technologies form an integrated system covering various aspects of the digital transformation of higher professional education. The implementation will contribute to increasing the effectiveness of digital educational models, overcoming the identified barriers, and creating conditions for high-quality professional training within higher education in line with the requirements of the digital economy. At the same time, it is important to emphasise that the optimisation of learning models using digital technologies should be regarded as a continuous process requiring constant monitoring, evaluation of effectiveness, and adjustment of strategies in accordance with changing technological opportunities and educational needs.

3.4 Discussion questions on the implementation of learning models using digital technologies in the system of higher professional education

The conducted study identified five main groups of factors influencing the effectiveness of the implementation of digital educational models in the higher professional education systems of the Kyrgyz Republic and China: technological, economic, cultural, pedagogical, and institutional. The results of the quantitative assessment of the degree of influence of factors demonstrated significant differentiation in the educational systems of the studied countries. In China, technological, economic, and institutional factors played a dominant role, while in the Kyrgyz Republic cultural factors exerted a more pronounced influence. The greatest gap was observed in the field of technological and institutional factors, which reflected differences in the priorities of state policy and the level of technological development.

When analysing the influence of technological factors on the effectiveness of digital educational models, it was necessary to compare the obtained results with the findings of other researchers. In the work of Alenezi (2021), it was noted that technological infrastructure was a necessary but insufficient condition for the successful digital transformation of higher education. According to the study, digital transformation required not only the introduction of technologies but also fundamental changes in the organisational structure, culture, and processes of higher education institutions. This conclusion was consistent with the results obtained, which showed that in China technological factors had a high degree of influence (8.7 points for the availability of high-speed Internet), while institutional factors exerted no less significant an impact (9.0 points for state educational policy). However, for the Kyrgyz Republic technological factors remained a critical barrier (5.6 points for the availability of high-speed Internet), the overcoming of which was a necessary condition for further transformation. The scholar did not sufficiently take into account the differentiation of technological barriers in countries with different levels of economic development, which reduced the applicability of the proposed model.

In the study by Ciobanu et al. (2023), devoted to the adaptation of the educational system to technological evolution, it was noted that modern educational systems should develop not only new technologies but also students' competences necessary for successful adaptation to the constantly changing technological environment. The authors emphasised that the pace of technological change often outstripped the ability of educational systems to adapt to it, creating significant difficulties for higher professional education. This conclusion was confirmed by the results obtained, which demonstrated a significant difference between the current digital competences of teachers in China (7.8 points) and the Kyrgyz Republic (5.1 points). However, the researchers considered technological adaptation mainly from the point of view of educational content and competence formation, without paying sufficient attention to institutional and cultural barriers, which, according to the obtained data, had a significant impact on the effectiveness of digital transformation, especially in the context of the Kyrgyz Republic, where traditional educational values, as a cultural factor, were assessed at 8.4 points.

The results of the study showed a significant influence of economic factors on the implementation of digital educational models in the context of digitalisation financing (9.2 points in China and 5.3 points in the Kyrgyz Republic). In this context, the study by Rof et al. (2022), devoted to the accelerated digital transformation of higher education during the pandemic, is relevant. The researchers found that even in conditions of limited resources, effective digital transformation was possible with a flexible organisational structure and institutional support. This conclusion was only partially consistent with the results obtained. The data for the Kyrgyz Republic indicated that with a low level of digitalisation financing (5.3 points), the organisational flexibility of educational institutions was also limited (6.1 points), which created a complex barrier to digital transformation. Thus, the authors' thesis required significant clarification: for effective digital transformation under limited resources, it was necessary not only to have a flexible organisational structure but also to provide systematic state support, which was confirmed by the high indicators of the influence of state policy on the digitalisation of education (9.0 points in China and 5.7 points in the Kyrgyz Republic).

The study revealed a significant influence of cultural factors on the effectiveness of the implementation of digital educational models, especially in the context of attitudes towards traditional educational values. Specifically, the impact of these traditional values was assessed at 8.4 points in the Kyrgyz Republic compared to 7.3 points in China, indicating that this cultural factor was more pronounced in the Kyrgyz context. This result could be compared with the study of Martin-Gutiérrez et al. (2022), devoted to models of adaptation of future teachers to new digital educational scenarios after the pandemic. The authors found that the cultural context of education had a significant impact on the processes of adaptation to digital innovations. The study proved that the personal qualities of teachers determined the success of the integration of digital technologies into the educational process. This conclusion was fully consistent with the results of the study, which showed that in both countries the age characteristics of the perception of digitalisation (6.9 points in China and 7.8 points in the Kyrgyz Republic) and the national features of communication (7.4 points in China and 8.2 points in the Kyrgyz Republic) significantly influenced the effectiveness of digital educational models. However, the researchers did not pay attention to intercultural differences in adaptation to digital innovations, whereas the study clearly demonstrated significant differences in cultural barriers between China and the Kyrgyz Republic.

As a result of the study, it was established that the effectiveness of the implementation of digital educational models largely depended on the adaptation of pedagogical approaches (7.9 points in China and 5.4 points in the Kyrgyz Republic) and the teacher training system (8.3 points in China and 4.9 points in the Kyrgyz Republic). When comparing these results with the study of Maier and Klotz (2022) on personalised digital learning environments, interesting parallels were found. The scholars, based on literature analysis, concluded that the success of digital educational models was largely determined by the quality of pedagogical design and the feedback system. This conclusion was consistent with the results obtained, which showed that in Chinese universities one of the most effective components of the experimental model was the evaluative-reflexive component, including the feedback system. However, these researchers did not take into account the national characteristics of pedagogical approaches, while the study revealed significant differences in the effectiveness of various components of digital educational models depending on the national context. At Bishkek Humanities University the communicative-interactive component proved the most effective, while at Xi'an Jiaotong University the evaluative-reflexive component became the key success factor.

One of the key factors identified in the study was teachers' digital competence (8.3 points in China and 4.9 points in the Kyrgyz Republic). This result was of particular interest in the context of the study by Sánchez-Cruzado et al. (2021), devoted to teachers' digital literacy as an inevitable challenge after COVID-19. The experts conducted a large-scale study of the level of teachers' digital literacy and revealed significant gaps in the field of teachers' digital competences, especially in the context of pedagogical use of digital technologies. The conclusion about the need for systematic teacher training in digital competences was fully consistent with the results of the study, which showed that one of the main recommendations for optimising digital educational models was the creation of a multi-level system for developing teachers' digital competences. However, these scholars did not differentiate the level of teachers' digital literacy depending on the national and institutional context, whereas the study revealed significant differences between China and the Kyrgyz Republic. This omission reduced the applicability

of the recommendations in the context of developing countries, where the problem of teachers' digital literacy is particularly acute.

Developing the topic of teachers' digital competences, it is worth referring to the study by Nguyen and Habók (2024) on tools for assessing teachers' digital literacy. The researchers conducted a systematic review of existing assessment tools and identified significant methodological problems in this area. The main conclusion was the need to develop more reliable and valid tools for assessing teachers' digital literacy, taking into account various aspects of digital competences. This conclusion was consistent with the results of the study, which showed that one of the key factors in the effectiveness of digital educational models was the quality assessment system of digital education (8.2 points in China and 4.8 points in the Kyrgyz Republic). However, unlike the mentioned researchers, who considered assessment tools in an abstract context, the study revealed the need to adapt assessment systems to national educational traditions and the institutional features of specific educational systems. This conclusion of the experts must be supplemented in the context of the national specificity of assessing teachers' digital literacy.

One of the promising areas for the development of digital educational models identified during the study was the introduction of artificial intelligence technologies for the personalisation of learning. This approach proved particularly effective at Xi'an Jiaotong University, where the components of the experimental model related to the use of artificial intelligence demonstrated the highest effectiveness. This result is interesting to compare with the study by Bond et al. (2024), devoted to a meta-systematic review of artificial intelligence in higher education. The researchers revealed the significant potential of artificial intelligence in the personalisation of learning, assessment, and feedback, but at the same time discovered serious ethical problems associated with its implementation. The conclusion about the need for a more systematic and ethical approach to the integration of artificial intelligence into the educational process partially corresponded to the results of the conducted study, which showed that the effectiveness of digital educational models was determined not only by technological capabilities but also by the compliance with national educational traditions and ethical standards. However, the research group did not pay sufficient attention to cultural and institutional barriers to the introduction of artificial intelligence into the educational process, whereas the conducted study revealed the significant influence of these factors on the effectiveness of digital educational models.

The results of the study showed that the personalisation of the educational process using digital technologies was one of the key factors in the effectiveness of digital educational models (7.5 points in China and 4.6 points in the Kyrgyz Republic). It is advisable to analyse this aspect in the context of the study by Rane et al. (2023), devoted to the integration of artificial intelligence and machine learning within the framework of the concepts of Education 4.0 and 5.0. The authors argued that the future of education was associated with a high degree of personalisation and adaptability of the educational process based on artificial intelligence, which would take into account the individual characteristics, needs, and pace of learning of each student. This assertion was consistent with the results of the study, which showed that the components of the experimental model related to the personalisation of learning based on artificial intelligence proved the most effective in Chinese universities. However, within the

framework of the presented study, personalisation of education was considered as a universal trend without taking into account the context of specific national and institutional educational systems. The study, on the contrary, revealed significant differences in the effectiveness of personalisation of education depending on the national context: in China the personalisation of the educational process was assessed at 7.5 points in terms of influence, while in the Kyrgyz Republic only 4.6 points. This indicated the need for a differentiated approach to the implementation of adaptive learning in different educational systems.

The study considered the digital transformation of higher professional education in the context of the specific national educational systems of the Kyrgyz Republic and China. It is advisable to compare the results with the study of Oliveira and De Souza (2022) on digital transformation in the context of Education 4.0. The scholars analysed global trends in the digital transformation of education and concluded that Education 4.0 was characterised by the integration of digital technologies into all aspects of the educational process, the blurring of boundaries between formal and non-formal education, as well as a high degree of personalisation and adaptability of learning. This conclusion was only partially consistent with the results of the study. The data for China confirmed the thesis about comprehensive digital transformation covering all aspects of the educational process, as evidenced by the high assessments of the influence of technological (8.7 points for the availability of high-speed Internet), economic (9.2 points for state financing of digitalisation), and institutional (9.0 points) factors. However, for the Kyrgyz Republic significant barriers were identified to the implementation of the concept of Education 4.0, related to technological limitations (5.6 points for the availability of high-speed Internet) and a low level of state support (5.3 points for state financing of digitalisation). Thus, the concept of Education 4.0, presented by the authors as a universal model, required implementation taking into account the national specifics of educational systems and a differentiated approach to the digital transformation of education.

4 CONCLUSIONS

The study of the features and effectiveness of learning models using digital technologies in the system of higher professional education in the Kyrgyz Republic and China made it possible to form a comprehensive understanding of the factors determining the effectiveness of the introduction of digital educational models in countries with different socio-economic conditions and educational traditions.

During the analysis of the current conditions and contextual specificities of using digital technologies in higher professional education, significant differences were identified in the approaches to the digitalisation of vocational education in the studied countries. China demonstrated a systematic approach to the introduction of digital technologies with developed infrastructure, national educational platforms, and mechanisms for improving the digital competence of teachers. In the Kyrgyz Republic, the digital transformation of education was of a more fragmented nature: significant technological limitations, especially in rural and remote regions, created barriers to the uniform implementation of digital educational models.

The study identified five key groups of factors influencing the effectiveness of the introduction and functioning of digital educational models: technological, economic, cultural, pedagogical, and institutional. In China, the most significant were technological (8.7 points for the availability of high-speed internet), economic (9.2 points for state funding of digitalisation), and institutional factors (9.0 points for state educational policy), whereas for the Kyrgyz Republic cultural (8.4 points for traditional educational values) and technological limitations (5.6 points for the availability of high-speed internet) were decisive. A special role in both countries was played by the digital competence of teachers (7.8 points in China and 5.1 points in the Kyrgyz Republic), which determined the quality of digital educational content and the effectiveness of the applied pedagogical strategies.

The developed and tested experimental model of digital learning demonstrated varying effectiveness depending on the national and institutional context. At Bishkek Humanities University, the effectiveness of the model was manifested in an increase in students' motivation to study (an increase of 42% compared to the control group) and an improvement in academic performance (an average increase in grades of 0.8 points on a 5-point scale). At Osh State University, an increase in the level of students' digital competencies was observed (an increase of 53% according to the results of the final test), while indicators of students' professional competence increased by 32% compared to the control group. At Peking University, the effectiveness of the model was manifested in a 21% reduction in the time required to master the material while maintaining the quality of learning and in the development of students' independent work skills (an increase of 25% in the share of independently completed assignments). At Xi'an Jiaotong University, the average increase in indicators of students' professional competence in the experimental group amounted to 32% compared to the control group.

The obtained results made it possible to formulate practical recommendations for optimising learning models using digital technologies, taking into account the specifics of the educational systems of the Kyrgyz Republic and China. For the Kyrgyz Republic, the development of digital infrastructure, the creation of a national digital educational platform, and a multi-level system for improving the digital competence of teachers were of paramount importance. For China, the priority was the further development of national educational platforms, the improvement of mechanisms for the integration with local higher professional education institutions, and the development of hybrid learning models combining the advantages of digital technologies with traditional pedagogical approaches.

The limitations of the study were related to the time frame of the instructional experiment itself (15 weeks), which did not allow for a full assessment of the long-term effects of the model's introduction. The heterogeneity of the student sample in terms of the initial level of digital literacy and technical problems, especially in Kyrgyz universities. The prospects for further research included expanding the sample of educational organisations participating in the experiment at various levels and geographical locations, increasing the duration of the experiment to 2-3 years to obtain data on the sustainability of the results, as well as developing methods for adapting digital educational models to specific professional fields and cultural contexts.

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