Ways for developing digital competence in future educators within a collaborative digital environment

Klara Buzaubakova[*]
Doctor of Pedagogical Sciences, Professor
Taraz University named after M.Kh. Dulaty
080012, 7 Suleimenov Str., Taraz, Republic of Kazakhstan
https://orcid.org/0000-0002-9124-9893

Rakhat Sulaymanova
Doctor of Pedagogical Sciences, Professor
Jusup Balasagyn Kyrgyz National University
720033, 547 Frunze Str., Bishkek, Kyrgyz Republic
https://orcid.org/0009-0008-8433-939X

Abstract. The information age demands globally competitive educators who can systematically integrate digital technologies into their professional practice, manage the educational process efficiently, and engage in ongoing research to improve teaching and learning. Such professionals must possess advanced digital and creative competences. Therefore, it is essential to equip future educators with the necessary digital tools and skills. This article aimed to identify effective ways to develop digital competence in future educators in a collaborative digital environment. The research employed both theoretical and empirical methods, including abstraction, modelling, synthesis, testing, and pedagogical experimentation, among others. Key concepts examined include "digital literacy", "digital competence", "digital competence of future educators", "collaboration", and "collaborative digital environment". The study outlined the benefits of fostering digital competence in future educators; the structure of digital skills and competences by the European Framework for the Digital Competence of Educators; the concept of "collaboration" as part of the 4Cs – cooperation, coordination, communication, and creativity; as well as the structure and key features of the proposed pedagogical portal, the Digital Educational Environment. A review was conducted of scholarly and pedagogical literature concerning the development of digital competence in future educators within a collaborative digital environment. An online course entitled Digital Learning Technologies was conducted, and an international online competition, The Most Effective Digital Educational Platform, was organised for prospective educators. Based on the outcomes of the study, content and discourse analyses were carried out to classify collaboration as a form of social cooperation. A collaborative partnership was established between the Kazakhstan universities – M. Dulaty Taraz University, Kokshetau University named after Sh. Ualikhanov and Zhetysu University named after I. Zhansugurov – and the Kyrgyz university – Kyrgyz National University named after J. Balasagyn, represent a model of networked cooperation. The practical value of the study lies in the consolidation of intellectual resources from Kazakhstan and Kyrgyzstan universities into a single channel, allowing prominent academics and methodologists from these institutions to combine their efforts in jointly developing high-quality digital educational content for pedagogical disciplines

Keywords: collaboration; consortium; educational website; professional competence; digital resource; online course

◼ INTRODUCTION

The process of digitalisation is impacting the education system and calls for a reassessment of how educators' professional qualifications are enhanced in this new context.

Measures must be taken to strengthen the functionality of schools and to further improve educators' skills and social standing. Educators represent the intellectual vanguard of

*Corresponding author

the nation, laying the groundwork for its long-term progress. While excellent curricula, modern school facilities, and advanced management systems are valuable, nothing can be achieved without proficient educators. Like professionals in any other field, educators must possess digital literacy, encompassing the fundamental knowledge, skills, and attitudes required for navigating a digital society (Message from the Head of State K. Tokayev to the people of Kazakhstan, 2024).

The teaching of any subject should be contextualised within the student's future profession, serving as a means to synthesise their acquired knowledge, proficiencies, and skills. The content of professional pedagogical education possesses unique characteristics and differs significantly from professional training in other higher education institutions. Contemporary societal development trends and the quest for novel, effective teaching and learning approaches demand that future educators are capable of reflective thinking and possess a strong command of developmental pedagogy and effective methodologies (Aitenova *et al.*, 2020). Research conducted by A. Turalbayeva *et al.* (2021) indicates that prospective educators favour the use of information technologies when undertaking academic research and completing independent creative assignments.

Digital competence is underpinned by digital literacy and digital skills. Literacy, in a general sense, denotes the capacity to comprehend, interpret, generate, communicate, and calculate information using printed and written materials. Furthermore, by analysing substantial volumes of information regarding students and their activities within the digital realm, contemporary educators can provide appropriate support, and indeed, every educator can operate autonomously within the digital environment. Digital literacy and digital skills form the bedrock of digital competence. While the term "digital literacy" enjoys widespread international usage, "digital competence" remains a more fitting term, as it conveys a broader and more holistic meaning. In this comprehensive concept of digital competence, mastery over both pedagogical approaches and the subject matter itself, alongside technical skills, constitutes only a part of this complex notion. The digital competence of a future educator represents the synthesis of abilities to effectively utilise information and communication technologies and digital media when formulating and resolving tasks related to information processing, work, learning, socialisation, and the expansion of existing opportunities (Diachuk, 2024).

Digital technologies form the bedrock of contemporary technological advancement and are set to retain their pivotal role in the foreseeable future. The digital educational environment paves the way for novel opportunities: facilitating a transition from classroom-based learning to anytime, anywhere learning; enabling the development of personalised learning pathways; and transforming learners from mere consumers of electronic resources into creators of new ones. A digital educational environment constitutes an open complex of resources, conditions, and opportunities for the learning, development, and socialisation of prospective educators. According to the definition provided by UNESCO (2018), a digital educational environment is a composite of the conditions necessary for implementing educational programmes through the use of e-learning and distance learning technologies. This encompasses the functioning of an electronic information and educational environment, which includes electronic information resources and an information educational milieu comprising: educational resources that ensure comprehensive mastery of educational programmes irrespective of location; a suite of information and telecommunication technologies; and relevant digital technology tools.

According to R. Sulaimanova *et al.* (2021), the development of future educators' sociopedagogical competence is gaining particular significance within the context of contemporary professional pedagogical education. This is attributable to several factors influencing the socialisation of the younger generation: uncertainty in government policy concerning youth upbringing and education; an increase in both internal and external migration processes; the growing dependence of young people on technological devices; and the consequences of the global pandemic, which are yet to be fully comprehended. Thus, educator training must account for these factors to ensure the effective social adaptation and development of the burgeoning generation.

C. Kimm *et al.* (2020) investigated pre-service educators' confidence in their ISTE technology competencies. The findings of this quantitative study indicated that prospective educators felt they had not yet attained a sufficient level of technological competence in line with ISTE standards. Future special education educators with experience in team-based learning exhibit a significantly higher level of technological competence compared to other groups. According to the findings of research by S. Nurzhanova *et al.* (2024), the technology use skills and digital literacy of prospective educators were generally at a higher level than those of more experienced in-service educators in mainstream schools. Furthermore, the study revealed that the digital literacy of future educators is a significant predictor of their technology use skills.

The quality of an educator's professional development is largely determined by the nature of the learning content. This content should encompass a broad spectrum of issues about all areas and aspects of pedagogical education. This research aimed to identify methods for developing the digital competencies of future educators within a collaborative digital environment.

■ MATERIALS AND METHODS

General theoretical, empirical, and statistical methods of scientific inquiry were employed to effectively implement the experimental research on the formation of future educators' digital competencies within a collaborative educational environment based on the interaction of higher education institutions in the Republic of Kazakhstan and the Kyrgyz Republic. To measure, determine, and record the results of the conducted scientific investigations, the

following theoretical and empirical research methods were utilised: abstraction, modelling, synthesis, survey, testing, online testing, pedagogical experiment, induction, and deduction. For the sorting and processing of the data obtained during the research, statistical methods were applied, including data selection and collection, ranking, mathematical-statistical methods, pedagogical monitoring, and others.

In the studies focused on developing digital competence in future educators within a collaborative educational environment supported by partnerships between Kazakhstan and Kyrgyzstan universities, interactive methods were used, which are considered effective among contemporary research approaches. The online course Digital Learning Technologies was conducted. In addition, as part of the modernisation of the higher education system, online testing and online surveys entitled What I Know and What I Have Learned were conducted to assess the level of digital competence among future educators within this collaborative context. The results were systematically organised. A total of 102 future educators from universities in Kazakhstan and Kyrgyzstan participated in the survey after completing the online course Digital Learning Technologies. As part of the modernisation of the higher education system and in line with the collaborative efforts between Kazakhstan and Kyrgyzstan universities, indicators and criteria for assessing levels of digital competence among future educators were identified, and diagnostic monitoring was conducted. The survey was carried out following the ethical standards of scientific research outlined in The Guidance Note of the European Commission on Ethics and Data Protection (2021). The online survey, focusing on the topics What I Know and What I Have Learned, was conducted within the framework of the research project AP19680242 Establishing a Joint Digital Educational Environment in Higher Education Institutions as Part of the Modernisation of the Pedagogical Education System in the Republic of Kazakhstan, funded by the Committee of the Ministry of Education and Science of the Republic of Kazakhstan. Participants were asked to reflect on what they had learned about digital learning technologies, whether their digital skills had improved upon completion of the course, and what specific competencies they had developed (Online survey, n.d.). The survey was conducted entirely anonymously.

■ RESULTS AND DISCUSSION
Digital competence of future educators
The term "skills" has gained international recognition through the evolution of related concepts. The 21st Century Skills are considered a constituent element of any competence. According to the OECD (2016), "digital skills are those skills related to the safe use of digital technologies in the process of managing and exchanging information, digital interaction, creating and transforming digital content, and solving problems in a digital context". Digital technologies empower future educators to refine existing methods for monitoring and evaluating students' educational attainment and to develop new, more advanced approaches.

The establishment of a digital economy necessitates an appropriate orientation of the education system and the preparation of specialists who utilise modern digital technologies in their work. Research by C. Redecker & Y. Punie (2017) suggests that "digital competence" is one of the unique competencies that must be cultivated in the new generation of educators. Regardless of the complexity of the competence set required for future educators, there exists a baseline of specific competencies that prospective educators must acquire during their training. These include: a knowledge base for teaching and learning; cognitive skills; social skills; personal orientations; and professional suitability (European Commission, 2013; Blömeke *et al.*, 2015). Cognitive skills encompass metacognition, critical thinking, and the capacity to effectively resolve diverse problems. Social skills refer to interpersonal, reflective, and research proficiencies necessary for fostering dialogue and collaboration within the pedagogical community to enhance the working environment. The personal orientations of future educators are defined as encompassing enthusiasm, self-confidence, universal human values, commitment to continuous professional development, building partnerships, and embracing diversity and inclusion. Professional suitability pertains to adaptability, stability, and stress management per the context and needs of prospective educators.

According to research by R. Metsäpelto *et al.* (2021), pedagogical competencies are categorised into three levels: the individual and group level, the organisational level, and the regional, national, and global level. The individual and group level is characterised by supporting student engagement in the learning process; employing personalised methods and dialogic teaching; organising group work; and providing emotional and pedagogical support. The organisational level is defined by planning and preparing the teaching process; collaborating with parents; cooperating with the professional community; and fostering the professional development and leadership of future educators. The regional, national, and global level entails promoting students' civic engageme nt; facilitating rational discourse; encouraging dialogue; cultivating students' global awareness and universal competence; and possessing high civic virtue.

Digital competence refers to educators' capacity to effectively utilise information technologies during their leisure time and for communication, to store and exchange information, to select information and communication technologies securely within the digital sphere, to work efficiently with digital content in a reliable digital environment, and so forth. R. Krumsvik (2011), a researcher in the phenomenon of digital competence, posits that digital competence involves educators possessing a sound understanding of information and communication technologies (ICT) within a professional pedagogical context, grasping their significance for teaching strategies and the digital foundation of learners, and being able to integrate this understanding into their practice. Research conducted by A. Turalbayeva *et al.* (2021) indicates that effective engagement with digital devices (proficiency in using

educational websites and portals) is a crucial characteristic in the formation of a future educator's digital competencies.

The development of digital competence in contemporary prospective educators offers several advantages: it enables future educators to independently enhance their professional qualifications; it fosters their critical thinking skills; it cultivates research competence; and it encourages future educators to seek novel solutions to problems. Instead of serving merely as tools for optimising the delivery of educational content to students, digital technologies are becoming instruments for creating personalised development environments. These environments allow learners to seek out and make sense of information, make decisions, collaborate in groups, and solve problems. Engaging with non-standard, creative tasks empowers the learner to become an active constructor of their own knowledge.

The European framework for digital competence of educators

K. Pelletier *et al.* (2021), in their EDUCAUSE Horizon Report, propose a classification of digital competence comprising five areas: information literacy; communication and collaboration; digital content creation; safety; and problem-solving. Currently, this definition is expanding to encompass the digital transmission of information.

From a cognitive standpoint, "digital literacy" is analogous to traditional literacy (the 3 Rs – Reading, WRiting, and aRithmetic). According to the definition provided by UNESCO (2018), "digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital devices and networked technologies for participation in economic and social life". At the G20 summit in Berlin in 2017, K. Chetty *et al.* (2018) identified the components of digital literacy: approach to innovation; computer literacy; information literacy; communication literacy; media literacy; and digital literacy (Fig. 1). Standards developed by ISTE, the International Society for Technology in Education, also define the ICT competence and digital competencies of participants in the educational process, based on the evolving role of digital technologies in education.

At the end of 2017, the Education Committee of the European Union developed the EU Digital Competence Framework for Educators (DigCompEdu, n.d.). It is founded on the principle of integrating innovative technologies into established pedagogical practice and addresses digital competencies across three key areas: enhancing the use of digital technologies in teaching and learning; developing the skills necessary for digital transformation; and utilising data-driven analysis and forecasting in education (Fig. 2).

	Acquiring knowledge	Gaining knowledge	Creating knowledge
The role of digital technologies in education	Understanding policy	Applying policy	Policy innovation
Curriculum and assessment	Foundational knowledge	Applying knowledge	Skills necessary for knowledge acquisition
Pedagogical practice	Using digital technologies in education	Performing complex tasks	Ability to self-organise
Digital skills	Application	Integration	Transformation
Organisation and management of the educational process	Traditional educational activity	Collaboration	Organisation of the educational activity
Educator professional development	Digital literacy	Establish a network connection	Innovation

Figure 1. Structure of future educators' digital competence
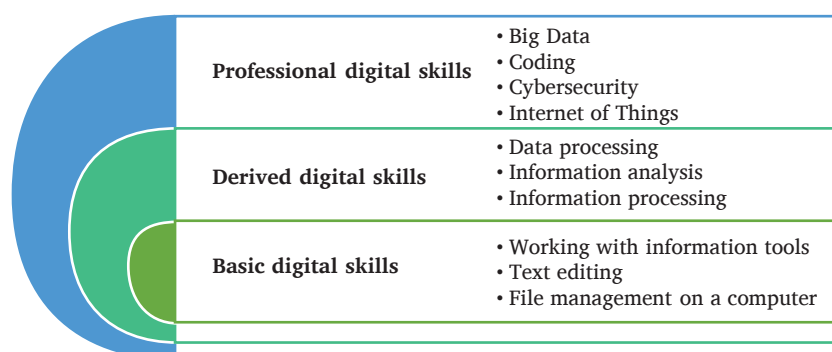*Source: developed by the authors based on research by K. Chetty et al. (2018)*

Figure 2. Structure of digital skills
Source: developed by the authors based on data from DigCompEdu (n.d.)

The goal of the DigCompEdu platform is to demonstrate and describe digital competencies relevant to learners. It comprises 22 competencies categorised into six thematic areas: "Professional engagement", "Digital resources", "Teaching and learning", "Assessment", "Empowering learners", and "Facilitating Learners' Digital Competence". The selection of content for diagnostic instruments is based on established standards for pedagogical ICT competence. All international standards typically incorporate two groups of digital competencies. The first is concerned with developing knowledge, skills, and abilities within the realm of ICT, while the second is necessary for educators to prepare students for life in the information society and the knowledge-based economy. The UNESCO (2018) recommendations examine all facets of pedagogical activity and structure them within six multi-level modules: "Understanding ICT in Education Policy", "Curriculum and Assessment", "Pedagogy", "Application of Digital Skills", "Organisation and Administration", and "Teacher Professional Learning" (Fig. 3).

Professional competence

Professional engagement:
- organisational communication;
- professional collaboration;
- reflective practice;
- digital continuous professional development.

Pedagogical competence

Digital resources:
- selecting digital resources;
- creating and modifying digital resources;
- managing, protecting and sharing digital resources.
- teaching;
- guidance;
- professional guidance;
- collaborative learning;
- self-regulated learning.
Assessment:
- assessment strategies;
- feedback and planning.
Empowering learners:
- accessibility and inclusion;
- differentiation and personalisation;
- actively engaging learners.

Learner competencies

Facilitating learners' digital competence:
- information and media literacy;
- communication;
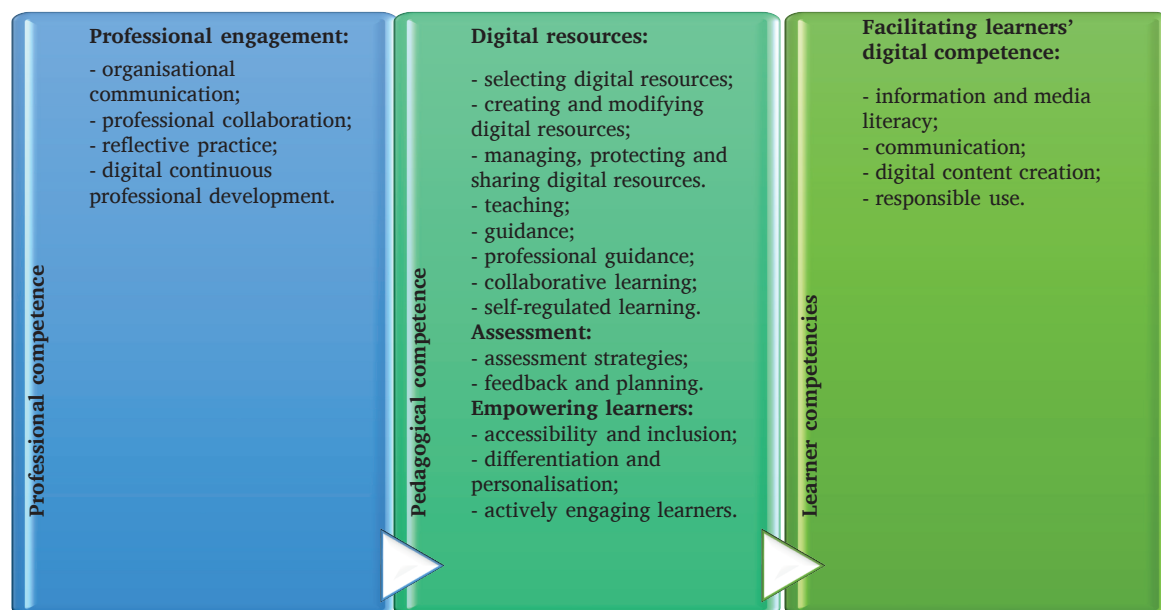- digital content creation;
- responsible use.

Figure 3. European framework for the digital competence of educators
Source: developed by the authors based on data from DigCompEdu (n.d.)

DigCompEdu (n.d.) and ISTE Standards (n.d.) establish a unified measurement and broad directions for assessing educators' professional activities. Within the DigCompEdu framework, an educator's digital competence is mapped across six levels of proficiency: Newcomer, Explorer, Integrator, Expert, Leader, and Pioneer. DigCompEdu defines 22 competencies, grouped into six areas. The ISTE Standards delineate seven roles for educators and enumerate the corresponding competencies. The standard structure proposed by UNESCO is presented as a two-dimensional matrix and already establishes certain levels of ICT competence not only for the individual educator but also for the general educational organisation.

Collaborative digital educational environment
"Collaboration" is a term of English origin signifying "co-operation", "joint effort", "partnership", "collective", or "group". D. Engelbart (1984) was among the first to articulate a contemporary understanding of "collaboration", positing that a community guided by a defined set of actions fosters participants' success, cultivates requisite competencies, and integrates them into a group process underpinned by effective relationships to achieve a shared objective. The universal competencies of future educators are influenced by cultural, social, and pedagogical contexts (Berliner, 2001). While some educator characteristics are universally applicable, others are specific to particular educational and political cultures (Klassen *et al.*, 2018). In the research by L. Biggiero & P. Angelini (2015), collaboration is regarded as "joint actions by two or more individuals or organisations to achieve a common goal in any field, aimed at a specific agreement and knowledge exchange". Collective collaboration is identified in studies by E. Antipina (2014) and C. Wang *et al.* (2015) as a form of social organisation whose members "pool the results of their intellectual labour and other resources to create a common product based on the vision and efforts of specialists from various fields of activity".

Cooperation as a contemporary mode of collaboration within the global knowledge economy is expounded upon in the articles of O. Inshakov (2013) and S. Yakunaeva & Yu. Koshurnikova (2013). Research into the specific characteristics of collaboration in the domains of science and education is reflected in the study of scholars such as R. Belderbos *et al.* (2015). According to research by S. Amara *et al.* (2016), "collaboration" is defined as a form of

joint activity, an interactive process uniting two or more participants working together towards a goal unattainable individually, based on technological attributes. The objectives of cooperation and its scope are identified as creative and distributive forces, along with forms of cooperation, while a novel objective for participants in cooperation is the creation of a new intellectual product. E. Polat (2023) and other scholars contend that when an educator's digital competence is well-established, they can readily assume roles such as moderator, mentor, facilitator, and coach.

According to research by O. Maksimenkova & A. Neznanov (2019), the term "collaboration" is used in conjunction with "cooperation" to encompass the concepts of "joint activity", "joint action", "group form of interaction organisation", and "cooperation in education". The concept of collaboration within the educational environment is more extensive. A. Kulikov (2012) notes that "collaboration is a philosophy of education, a foundational concept of joint action, learning, and professional-academic interaction". M. Laal & S. Ghodsi (2012) define collaboration as a philosophy of learning interaction wherein students assume responsibility for their actions and respect the abilities and contributions of their peers. The concept of "collaboration" unites the "4Cs": cooperation – collectivisation (union); communication – interaction; coordination – organisation; creativity – successful activity (Fig. 4).
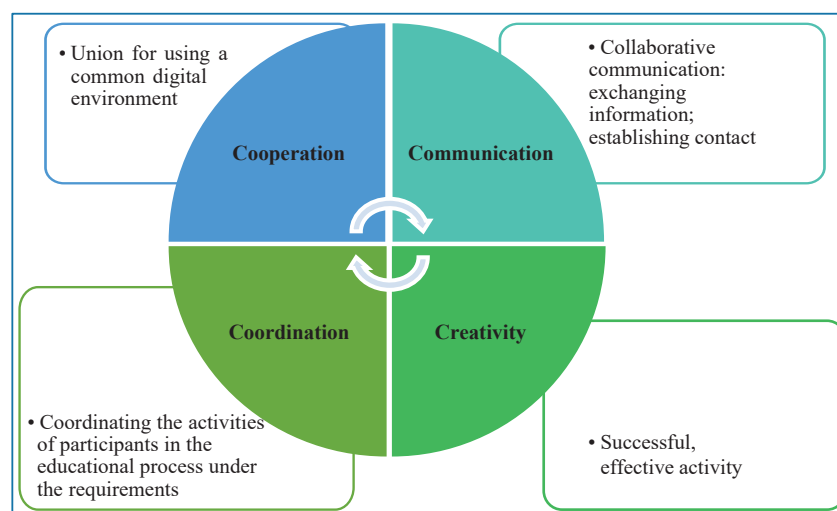

Figure 4. The 4Cs: Essence of the concept of "collaboration"
Source: developed by the authors based on data from DigCompEdu (n.d.)

Fundamentally, as noted by D. Johnson *et al.* (1990), collaboration in the educational sphere is predicated on the constructivist theory of learning: a) knowledge is constructed and transformed by the learners themselves; the role of educators is to establish appropriate pedagogical conditions through the application of active learning methods and the organisation of group learning interaction; b) the educational process is not a unidirectional influence from educator to student, but rather an active, purposeful interaction among all participants in a subject-subject and subject-object dynamic. In the digital age, the creation of a joint collaborative digital educational environment for higher education institutions within the framework of modernising the pedagogical education system of the Republic of Kazakhstan and Kyrgyzstan is essential.

Collaborative learning is defined as joint learning undertaken interactively, aimed at facilitating the achievement of a final outcome or goal: 1) learning is transformed into an active process wherein students fully assimilate information and connect it with their existing knowledge; this necessitates completing tasks, processing and generalising information, rather than merely memorising and repeating, which is achievable through the active engagement of each learner; 2) future educators recognise the value of understanding the perspectives of experienced educators and derive benefit from this; prospective educators gain practice in articulating their ideas and successfully defending their projects, fostering their social and emotional development; 3) learning is enhanced within a social environment where information and new knowledge are exchanged; future educators augment their intellectual capacity based on constructive thinking; they become capable of communicating effectively, presenting and defending ideas, exchanging diverse information, challenging alternative concepts, and participating actively; 4) the establishment of a collaborative environment will facilitate: a tangible shift towards novel forms of active learning; significantly improved methodological support for subjects at the forefront of scientific and technological advancement; this will not only create a more comprehensive digital footprint for the institution but also broaden opportunities for utilising tools for personal and collective digital memory management.

Based on the research undertaken by the authors of this article, the distinctive features involved in establishing a joint collaborative digital educational environment between higher education institutions in the Republic of

Kazakhstan and the Kyrgyz Republic were identified. It was determined that the internal academic mobility between Kazakhstan and Kyrgyzstan universities increased, allowing future educators to participate in online courses, enhance their digital competence without incurring costs, and result in savings for the state, the universities, and the prospective educators themselves. Each participating higher education institution provided extensive access to the digital educational resources of both Kazakhstan and Kyrgyzstan universities. Furthermore, by conducting online courses, classes, competitions, and webinars, it became feasible to elevate the professional qualifications of both university professors and future educators. This initiative also facilitated the preparation of highly qualified, globally competitive future educators possessing advanced digital competence, thereby addressing the current requirements of the New Kazakhstan and Kyrgyzstan.

The authors of this article identify several goals for creating a digital environment: 1) for the learner: to expand opportunities for shaping their own educational trajectory; to provide access to the latest educational resources; to broaden the range of accessible educational institutions; to enhance the transparency of the educational process; 2) for the educator: to reduce bureaucratic workload through automation; to improve the convenience of monitoring the learning process; to create new conditions for motivating learners during task creation and completion, thereby fostering conditions for the development of the learner's personal educational trajectory. Within a collaborative digital educational environment, the roles of participants undergo a transformation: the educator shifts from an explanatory-narrative teaching method towards action-oriented approaches; the educator becomes an organiser and coordinator of educational activities; and each student becomes an active participant in the learning process.

Within the framework of modernising the pedagogical education system in the Republic of Kazakhstan and the Kyrgyz Republic, a consortium has been established between Kazakhstan and Kyrgyzstan universities to create a joint collaborative digital educational environment for higher education institutions. As part of this initiative, online presentations of scientific studies prepared by scholars from the consortium's member universities have been conducted, and joint online and offline seminars, conferences, forums, methodological workshops, webinars, and coaching sessions in schools have been organised. The contribution of each university to the preparation of digital educational content for specific subjects has been defined, and the quality and characteristics of digital platforms effectively used by universities in the educational process have been evaluated and studied.

The authors identified several advantages stemming from the pedagogical consortium and collaboration. Firstly, it facilitates the concentration of the scientific and intellectual resources of the Kazakhstan and Kyrgyzstan universities within a single channel, enabling leading academics from these institutions to combine their efforts for the joint and high-quality preparation of digital educational content for relevant subjects. Secondly, it provides the opportunity to share high-quality digital educational content for disciplines, such as textbooks, teaching and learning materials, pedagogical cases, electronic portfolios, and teaching practice diaries. This, in turn, ensures the qualitative and substantive preparation of digital educational content for subjects and prevents the unauthorised copying of the results obtained. Thirdly, this collaboration contributes to the activation of both internal and external academic mobility within the Kazakhstan and Kyrgyzstan universities. Fourthly, it opens up significant avenues for the study, research, utilisation, and promotion of innovative practices from Kazakhstan universities in a collaborative setting. Fifthly, the joint research undertaken by scholars from the Kazakhstan and Kyrgyzstan universities makes a substantial contribution to enhancing the quality of pedagogical education and augmenting the competitiveness of the universities.

The digital educational environment pedagogical portal
With the aim of fostering the digital competence of future educators within the collaborative educational environment of pedagogical universities, an innovative information bank fund has been established. Furthermore, to strengthen the pedagogical educational potential of higher education institutions, a joint pedagogical consortium has been formed between M. Dulaty Taraz University, Zhetysu University named after I. Zhansugurov, Arkalyk Pedagogical Institute named after I. Altynsarin, and Kokshetau University named after Sh. Ualikhanov. A new Kazakhstan pedagogical education portal, the Digital Educational Environment (n.d.), has been launched based at Dulaty University. The objectives of this pedagogical education portal are to cultivate a systematic approach to professional activity among future educators; to enhance prospective educators' preparation for self-directed learning; to empower future educators to effectively utilise digital technologies in the educational process; to foster the development of future educators' cognitive activity and their information and creative competencies; to facilitate the formation of digital and creative competencies in future educators; and other related aims.

Advantages of the new pedagogical education portal: creating opportunities for digital communication with students and colleagues; developing skills in exchanging and creating materials with educators in a digital environment; utilising digital content for developing teaching materials and adapting existing ones; deepening knowledge regarding methods of information protection; evaluating the reliability of information and identifying false or biased content; promoting the safe and responsible use of digital technologies; fostering the creative application of digital technologies to address educational challenges; employing digital technologies in the educational process and monitoring students' online activity; and providing training in the use of digital tools for assessing and monitoring students' academic progress and intellectual growth, as well as their creative application.

The pedagogical education portal operates in three languages: Kazakh, Russian, and English. Located in the upper left section of the portal is a "Search" button, which allows users to find necessary materials. The portal's main menu comprises four sections: an "About Us" section, an "About the Project" blog, a "Contact" section, and a "News" section (Fig. 5).
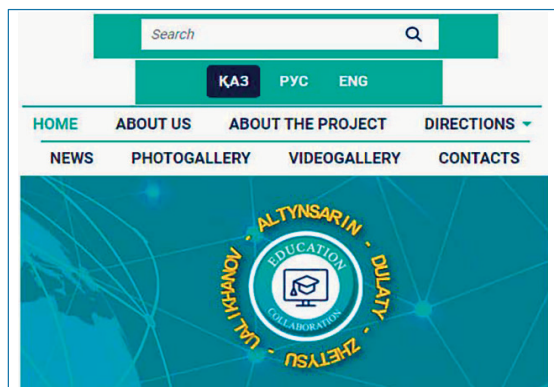

Figure 5. The main page of the pedagogical education portal
Source: *screenshot from the Digital Educational Environment website (n.d.)*

The Digital Educational Environment pedagogical portal (n.d.) familiarises future educators with the intricacies of the pedagogical process within a digital environment, fostering a systematic approach to their professional activities and cultivating professionally significant personal qualities in prospective educators. Future educators are introduced to the types and nuances of digital platforms and study digital technologies. The "Gallery" section of the pedagogical education portal features photographs and video clips documenting the activities conducted as part of the Project. The best submissions from future educators who participated in the international online competition organised within the project have been uploaded to the "Pedagogical Technologies" blog on the pedagogical education portal. Any prospective educator can enhance their knowledge and develop their digital competence by viewing the video content available on the portal.

According to research by A. Amirova *et al.* (2018), the development of digital competence in future educators within a collaborative digital environment offers the following advantages: the future educator independently enhances their professional qualifications and can independently seek and promptly locate necessary material and new information; the cognitive activity of the future educator is heightened: throughout the learning process at various levels, the future educator can effectively address tasks arising from their interests and needs; the creative thinking of the future educator is fostered: enabling them to find answers to the most complex questions, identify solutions, and think critically; the future educator learns to evaluate their own viewpoint and that of others, thereby developing critical thinking; the future educator learns to identify

logical connections between previously covered material and new knowledge through comparison; the future educator's creative search skills are cultivated: the ability to pose questions, seek answers, sort results, and so forth; research competence is developed; as a result of critical thinking, the future educator finds the optimal solution to a problem and substantiates it with scientific experiments; they conduct comprehensive, in-depth research (monitoring and analysis of the pedagogical process); they endeavour to substantiate their perspective; most importantly, the future educator independently acquires innovative knowledge and develops autonomously. Figure 6 visually presents the "Directions for project development" section of the pedagogical education portal.
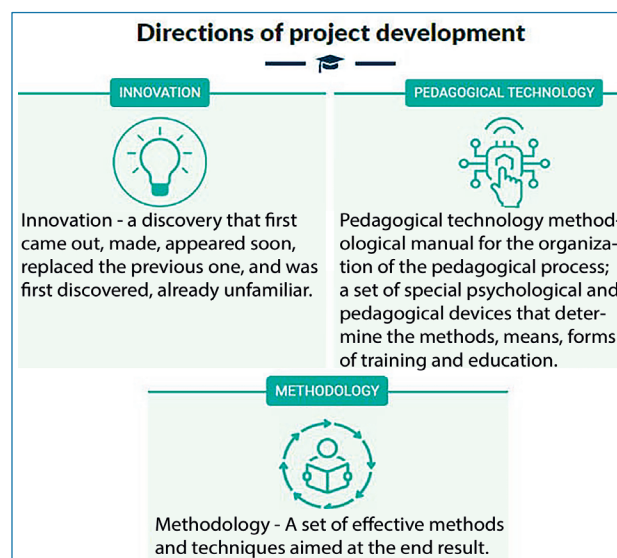

Figure 6. "Directions for project development" section of the pedagogical education portal
Source: *screenshot from the Digital Educational Environment website (n.d.)*

The "Methodology" section of the pedagogical education portal presents the regulations for the Digital Learning Technologies online course, specifically organised within the framework of the new Project, along with resources for each scheduled topic. This includes theoretical material and topic outlines. Test questions were incorporated to evaluate and verify the new knowledge regarding digital technologies and digital platforms acquired by future educators who participated in the online course. Based on the findings of the conducted research, the portal familiarises future educators with the nuances of digital platforms and equips them with digital technologies. It cultivates a systematic approach among prospective educators towards their professional activities and professionally significant personal qualities. It prepares future educators for undertaking creative scientific research and engaging in self-innovation in their study of digital technologies. Furthermore, it enables future educators to effectively utilise digital technologies within the educational process,

encourages an action-oriented approach to teaching and learning, contributes to enhancing students' cognitive activity, supports the use of interactive teaching methods, and ultimately fosters the development of future educators' digital competencies.

The pedagogical education portal familiarises future educators with the intricacies of the pedagogical process within a digital environment, fostering a systematic approach to their professional activities and cultivating professionally significant personal qualities. Prospective educators become acquainted with various digital platforms and their nuances and study digital technologies. The following distinctive features of the proposed pedagogical education portal are noteworthy:

1) based on the development of mutually complementary relationships, the intellectual resources of the Kazakhstan and Kyrgyzstan universities will be concentrated within a single channel. Prominent scholars and methodologists from the Kazakhstan universities will collaborate on the preparation of high-quality digital educational content for subjects, thereby opening avenues for the shared use of this expertly prepared digital teaching content;

2) significant opportunities will emerge for the study, research, utilisation, and promotion of innovative pedagogical practices from both Kazakhstan and Kyrgyzstan universities. For instance, as part of joint university research, a collaborative textbook titled "Digital Educator" was published by distinguished academics from M. Dulaty Taraz University and Zhetysu University named after I. Zhansugurov.

Crucially, innovative cooperative relationships have been established between the Kazakhstan and Kyrgyzstan higher education institutions, leading to an enhancement in the quality of education. This collaboration has facilitated free access to foundational knowledge and banked information, client-server, multimedia, and computer learning systems, digital learning resources, and digital content for academic subjects. Furthermore, unrestricted access to teaching and learning materials, electronic textbooks, and computer programmes has been ensured.

In the 21st century, digital competence is defined by the ability to seek information within the information space, establish social partnerships, critically evaluate professionally relevant information, and cultivate a personal trajectory of continuous professional development within an open information environment. The results of the content and discourse analysis presented in this study facilitate the classification of the collaboration between M. Dulaty Taraz University, Zhetysu University named after I. Zhansugurov, Arkalyk Pedagogical Institute named after I. Altynsarin, and Kokshetau University named after Sh. Ualikhanov as a form of social cooperation. It was ascertained that this mode of mutual network interaction possesses several characteristics that distinguish it from the broader concepts of collaboration, cooperation, and collectivity. Analysis of the scientific and pedagogical literature revealed a connection between the typology of socio-pedagogical interaction and the selection of subject-subject interaction acts as a basis for classification. An open digital educational environment empowers future educators to compete, collaborate, engage in mutual learning, conduct objective evaluations, provide information and communication services within the digital space, and effectively utilise digital tools, technologies, platforms, and so forth during the learning process. It enhances creative capacities, fosters collaborative communication skills for teamwork, and facilitates the development of digitalcreative competencies.

Online course Digital Learning Technologies
Digital competence is characterised by a sufficiently high level of proficiency in modern information and communication tools among future educators, coupled with the development of constructive thinking and a critical disposition. Contemporary educators extensively engage in seeking, selecting, sorting, and processing information within a collaborative digital environment, enhancing their knowledge and professional qualifications, developing themselves, and consequently advancing their professional standing. An online course titled Digital Learning Technologies was conducted for future educators as part of this research. The aim of the online course was to elevate the digital competence of prospective educators enrolled in pedagogical education programmes, introduce them to digital learning technologies and platforms, and thereby improve the quality of educator training.

To assess the level of digital competence in future educators who participated in the online course, specifically concerning the digital technologies and platforms they were familiar with prior to the course and those they studied during the course, an online survey was administered on the themes What I Know and What I Have Learned, focusing on digital learning technologies (Online survey, n.d.). The results of the experimental research are presented in Table 1.

Table 1. Indicators of future educators' mastery of digital learning technologies

No.	Future educators' level of mastery of DLT	Dulaty University (DU), 26 students		Zhetysu University (ZU), 25 students		Kokshetau University (KU), 26 students		Balasagyn University (BU), Kyrgyzstan, 25 students	
		Before course	After course	Before course	After course	Before course	After course	Before course	After course
1	Low	6 (23.1%)	2 (7.7%)	7 (28%)	3 (12%)	8 (30.8%)	5 (19.2%)	10 (40%)	6 (24%)
2	Medium	19 (73.1%)	16 (61.5%)	16 (64%)	15 (60%)	17 (65.4%)	15 (57.7 %)	14 (56%)	15 (60%)

Table 1. Continued

No.	Future educators' level of mastery of DLT	Dulaty University (DU), 26 students		Zhetysu University (ZU), 25 students		Kokshetau University (KU), 26 students		Balasagyn University (BU), Kyrgyzstan, 25 students	
		Before course	After course	Before course	After course	Before course	After course	Before course	After course
3	High	1 (3.8%)	8 (30.8%)	2 (8%)	7 (28%)	1 (3.8%)	6 (23.1%)	1 (4%)	4 (16%)

Source: developed by the authors

Based on the research conducted, the 102 future educators who participated in the Digital Learning Technologies online course demonstrated a significantly increased desire to master digital learning technologies after completing the course. For instance, among the 26 prospective educators from M. Dulaty Taraz University, the high level of mastery of digital learning technologies before the course was 3.8%. Following the course, the high level of mastery among these future educators rose by 27.9%, reaching 30.8%, representing an eightfold increase. For the 25 future educators from Zhetysu University named after I. Zhansugurov, the high level of mastery of digital learning technologies before the course stood at 8%. After the course, the high level of mastery among these prospective educators increased to 28%, a rise of 20 percentage points or a 3.5-fold increase. The high level of mastery of digital learning technologies among the 26 future educators from Kokshetau University named after Sh. Ualikhanov increased sixfold. Among the 25 future educators from Kyrgyz National University named after J. Balasagyn, the high level of mastery of digital learning technologies before the course was 4%. Following the course, the high level of mastery among these prospective educators reached 16%, an increase of 12 percentage points or a fourfold increase (Fig. 7).
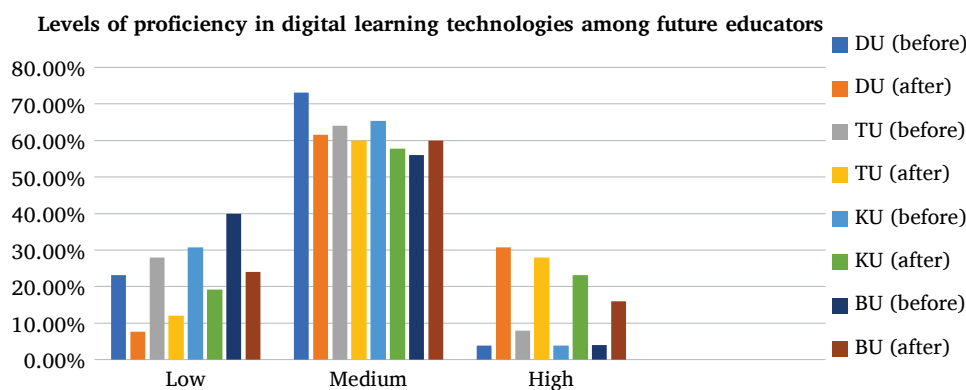

Figure 7. Levels of future educators' mastery of digital learning technologies
Source: developed by the authors based on data from R. Kalimzhanova et al. (2024)

Following the specifically conducted online course with future educators, there was a notable increase in their desire to master digital learning technologies. During practical sessions, prospective educators introduced students to the learning technologies with which they were familiar and participated in the in-depth exploration of new digital learning technologies by their peers. Each future educator can enhance their knowledge and elevate their digital competence by accessing the video content and didactic resources uploaded to the portal at any time. The online course made a significant contribution to fostering the cognitive activity and the information, creative, and digital competencies of future educators. One hundred out of the 102 respondents indicated the benefit of the Digital Learning Technologies online course for the development of future educators' digital competencies, while 94 survey participants reported that as a result of engaging with the online course programme, their digital competencies had expanded and improved. An international online competition titled The Most Effective Digital Educational Platform was also organised for future educators (Dulaty University, 2024). This international online competition aimed to foster the digital competence of students enrolled in pedagogical education programmes, stimulate the creative activity of future educators, enhance the quality of educational activity and improve the scientific and methodological support for the educational process, increase the digital competence and creative potential of future educators, and facilitate the learning, research, dissemination, promotion, and collection of innovative practices from creative educators within the sphere of digital collaboration. Future educators who participated in the online competition were able to discover the advantages of platforms such as Educaplay, ROQED, Genially, Flippity, Learningapps.org, Classroom Screen, Classroom, Wordwall, Canva, Learningapps, and others. Table 2 presents indicators of digital platform mastery among future educators from the four universities in Kazakhstan that participated in the international online competition The Most Effective Digital Educational Platform.

Table 2. Indicators of future educators' mastery of digital platforms

No.	Name of digital platform	Dulaty University, 26 students	Zhetysu University, 25 students	Kokshetau University, 26 students	Balasagyn University, Kyrgyzstan, 25 students
1	Wordwall	6 (23.1%)	7 (28%)	3 (11.5%)	5 (20%)
2	Educaplay	2 (7.7%)	3 (12%)	1(3.8%)	2 (8%)
3	Classroom Screen	1 (3.8%)	2 (8%)	–	1 (4%)
4	Learningapps.org	2 (7.7%)	3 (12%)	2 (7.7%)	2 (8%)
5	ROQED	1 (3.8%)	–	–	–
6	Genially	2 (7.7%)	2 (8%)	1 (3.8%)	1 (4%)
7	Interacty	1 (3.8%)	–	–	1 (4%)
8	Artificial Intelligence	1 (3.8%)	2 (8%)	1 (3.8%)	1 (4%)
9	Spinthewhell	1 (3.8%)	–	2 (7.7%)	–
10	Magigschool	1 (3.8%)	–	2 (7.7%)	–
11	Classroom	2 (7.7%)	2 (8%)	2 (7.7%)	3 (12%)
12	Zoom	1 (3.8%)	2 (8%)	3 (11.5%)	1 (4%)
13	Classroomscreen	2 (7.7%)	–	–	2 (8%)
14	Flippity	2 (7.7%)	2 (8%)	2 (7.7%)	2 (8%)
15	Clideo	2 (7.7%)	–	–	–
16	PowerPoint	1 (3.8%)	–	7 (26.92%)	4 (16%)

Source: developed by the authors based on data from R. Kalimzhanova et al. (2024)

As revealed during the experiment, the future educators who participated in the international online competition demonstrated proficiency with the Wordwall platform. For example, 28% of the future educators from Zhetysu University who took part in the competition, 11.5% of those from Kokshetau University, and 23.1% of participants from Dulaty University indicated competence in using the Wordwall platform. Overall, prospective educators exhibited limited familiarity with platforms such as ROQED, Clideo, Classroomscreen, Spin the Wheel, and Magicschool. The best submissions from the future educators who participated in the competition were uploaded to the "Pedagogical Technologies" blog on the Digital Educational Environment pedagogical portal (n.d.), which was specifically established for conducting scientific research. Consequently, future educators gained the opportunity to enhance their knowledge and develop their digital competence by viewing the video content available on the portal.

CONCLUSIONS

The modern educator must be adept at utilising network interaction to facilitate collaborative learning. This necessitates possessing competencies in interacting with students, parents, and colleagues and engaging with them as equal participants in the educational process. As professionals, modern educators must continually strive for professional growth and actively participate in online communities. The research revealed that the contemporary collaborative form of pedagogical interaction is characterised by the network-based nature of interaction and communication among the stakeholders in the educational process. The findings presented in this study allow for the consideration of the collaboration between the Kazakhstan universities – M. Dulaty Taraz University, Kokshetau University named after Sh. Ualikhanov, Zhetysu University named after I. Zhansugurov, and Kyrgyz National University named after J. Balasagyn, as a form of social cooperation.

Analysis of the scientific and pedagogical literature facilitated the identification of a connection between the typology of socio-pedagogical interaction when selecting the nature of subject-subject interaction acts as the basis for classification. Based on a comparative analysis, "collaboration" in digital education (collaborative learning) is recommended to be understood as a distinct type of pedagogical interaction. The results obtained from the specifically organised international online competition The Most Effective Digital Educational Platform and the online course Digital Learning Technologies with future educators indicate the considerable specificity of the new open pedagogical educational portal as a form of educational cooperation among educators, positioning it as a distinct subcategory of pedagogical education. As part of the modernisation of the higher education system, indicators and criteria for assessing the levels of digital competence formation in future educators were defined based on the mutual cooperation between Kazakhstan and Kyrgyzstan universities.

A digital collaborative educational environment facilitates the automation of education quality management processes and the development of learners' digital learning skills within the digital environment. One avenue for enhancing the effectiveness of the educator training system lies in consolidating and integrating the informatisation tools and technologies of pedagogical universities into a unified digital educational environment, given that these are often fragmented at present. Future research should further investigate the domain of School-University collaboration.

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Коллоборативдүү санариптик чөйрөдө болочок педагогдордун санариптик компетенцияларын калыптандыруунун жолдору

Клара Бузаубакова

Педагогика илимдеринин доктору, профессор

М.Х. Дулати атындагы Тараз университети

080012, Сулейменов көч., 7, Тараз ш., Казакстан Республикасы

https://orcid.org/0000-0002-9124-9893

Рахат Сулайманова

Педагогика илимдеринин доктору, профессор

Ж. Баласагын атындагы Кыргыз улуттук университети

720033, Фрунзе көч., 547, Бишкек ш., Кыргыз Республикасы

https://orcid.org/0009-0008-8433-939X

Аннотация. Маалыматтык доор өз практикасында санариптик технологияларды системалуу пайдаланууга жөндөмдүү, билим берүү процессин рационалдуу башкара билген, билим берүү процессин өркүндөтүү максатында дайыма илимий изилдөөлөрдү жүргүзгөн, өнүккөн санариптик жана чыгармачылык компетенцияларга ээ глобалдуу атаандаштыкка жөндөмдүү педагогдорду талап кылат. Ошондуктан келечектеги заманбап мугалимдерди санариптик технологиялар менен жабдуу маанилүү. Макаланын максаты кызматташуу чөйрөсүндө болочок педагогдордун санариптик компетенцияларын калыптандыруунун натыйжалуу жолдорун аныктоо болгон. Изилдөөдө изилдөөнүн теориялык жана эмпирикалык методдору пайдаланылды: абстрагирлөө, моделдөө, синтездөө, тестирлөө, педагогикалык эксперимент ж.б. Иште «санариптик сабаттуулук», «санариптик компетенттүүлүк», «болочок педагогдордун санариптик компетенттүүлүгү», «кызматташуу», «коллоборативдүү санариптик чөйрө» түшүнүктөрү изилденген. Келечектеги мугалимдердин санариптик компетенттүүлүгүн калыптандыруунун; санариптик көндүмдөрдүн структурасы жана келечектеги мугалимдердин санариптик компетенттүүлүгү европалык мугалимдердин санариптик компетенттүүлүгүнүн алкагында; 4К катары «кызматташуу» түшүнүгүнүн маңызы: кооперация-координация-коммуникация-креативдүүлүк; КМТУнун сунушталган педагогикалык билим берүү порталынын түзүмү жана өзгөчөлүктөрү сыяктуу артыкчылыктары ачылды. Биргелешкен санариптик чөйрөдө болочок педагогдордун санариптик компетенттүүлүгүн калыптандыруу боюнча илимий-педагогикалык адабияттар талданды. «Окутуунун санариптик технологиялары» онлайн-курсу өткөрүлдү жана болочок мугалимдер үчүн «эң натыйжалуу санариптик билим берүү платформасы» эл аралык онлайн-конкурсу уюштурулду. Изилдөөнүн жыйынтыгы боюнча социалдык кызматташтыктын бир түрү катары кызматташууну классификацияло боюнча контент жана дискурс-анализ жасалды. Казакстандын М.Х. Дулати атындагы Тараз университетинин Ш. Уалиханов Кокшетау университети, Жансугуров атындагы Жетисуу университети, Ж. Баласагын атындагы Кыргыз улуттук университети менен тармактык өз ара аракеттешүүнүн формасы катары кызматташтыгы орнотулду. Изилдөөнүн практикалык мааниси казакстандык жана кыргызстандык ЖОЖдордун интеллектуалдык ресурстары бир каналда топтолуп, ЖОЖдордун белгилүү окумуштуулары жана методисттери педагогикалык дисциплиналар боюнча сапаттуу санариптик билим берүү контентин биргелешип даярдоо үчүн күч-аракеттерин бириктиришет

Негизги сөздөр: кызматташуу; консорциум; билим берүү сайты; кесиптик компетенттүүлүк; санариптик ресурс; онлайн курс

Пути формирования цифровых компетенций будущих педагогов в коллаборативной цифровой среде

Клара Бузаубакова

Доктор педагогических наук, профессор

Таразский университет имени М.Х. Дулати

080012, ул. Сулейменова, 7, г. Тараз, Республика Казахстан

https://orcid.org/0000-0002-9124-9893

Рахат Сулайманова

Доктор педагогических наук, профессор

Кыргызский Национальный университет имени Ж. Баласагына

720033, ул. Фрунзе, 547, г. Бишкек, Кыргызская Республика

https://orcid.org/0009-0008-8433-939X

Аннотация. Информационный век требует глобально конкурентоспособных педагогов, способных системно использовать цифровые технологии в своей практике, умеющих рационально управлять образовательным процессом, постоянно проводящих научные исследования с целью совершенствования образовательного процесса, обладающих развитыми цифровыми и творческими компетенциями. Именно поэтому важно оснащать современных будущих педагогов цифровыми технологиями. Цель статьи состояла в определении эффективных путей формирования цифровых компетенций будущих педагогов в коллаборативной среде. В исследованиях использованы теоретические и эмпирические методы исследования: абстрагирование, моделирование, синтезирование, тестирование, педагогический эксперимент и др. Были исследованы понятия: «цифровая грамотность», «цифровая компетентность», «цифровая компетентность будущих педагогов», «коллаборация», «коллаборативная цифровая среда». Были раскрыты преимущества формирования цифровой компетентности будущих педагогов; структура цифровых навыков и цифровой компетентности будущих педагогов в рамках Европейской системы цифровых компетенций педагогов; сущности понятия «коллаборация» как 4К: кооперация-координация-коммуникация-креативность; структура и особенности предлагаемого педагогического образовательного портала Digital Educational Environment. Проанализирована научно-педагогическая литература по формированию цифровой компетентности будущих педагогов в коллаборативной цифровой среде. Проведен онлайн-курс «Цифровые технологии обучения» и организован международный онлайн-конкурс «Самая эффективная цифровая образовательная платформа» для будущих педагогов. По результатам исследования сделан контент и дискурс-анализ по классификации коллабораций как вида социального сотрудничества. Установлена коллаборация казахстанских вузов – Таразского университета им. М. Дулати, Кокшетауского университета им. Ш. Уалиханова, Жетысуского университета имени И. Жансугурова с кыргызским вузом – Кыргызским национальным университетам имени Ж. Баласагына как форма сетевого взаимодействия. Практическая значимость исследования заключается в том, что интеллектуальные ресурсы казахстанских и кыргызских вузов будут сконцентрированы в одном канале, а известные ученые и методисты вузов объединят усилия для совместной подготовки качественного цифрового образовательного контента по педагогическим дисциплинам

Ключевые слова: коллаборация; консорциум; образовательный сайт; профессиональная компетентность; цифровой ресурс; онлайн-курс