ICT SKILLS AND COMPETENCIES AMONG TEACHERS
ГОТОВНОСТЬ ПЕДАГОГОВ К ИНФОРМАТИЗАЦИИ

Features of the university's pedagogical specialties students' preparation for the blockchain technologies in professional communications use

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Abstract. *Problem statement.* The blockchain technologies properties indicate the significant potential of their application to increase the effectiveness of professional communication among teachers. However, most modern teachers do not use such technologies in all forms of professional interaction. It is necessary to conduct research aimed at solving the problem of finding approaches to the development of existing systems for training students of pedagogical specialties of universities, both in the direction of using blockchain technologies as an object for study, and in the direction of mastering additional professional communication techniques involving the use of blockchain technologies to ensure transparency, reliability, decentralization and trustworthiness of pedagogical interaction. *Methodology.* Continuous monitoring is carried out on how, in what cases and for what purpose teachers use blockchain systems, as well as studying the degree of practical effectiveness of the proposed approaches and tools, including the content of training and a system of practical tasks, to form students' needs for the use of such technologies in professional communications. *Results.* An extension of the goals, content, methods and means of training future teachers has been developed and shown using examples, aimed at familiarizing them with the possibilities and advantages of using blockchain technologies in professional communications. The features of using blockchain technologies for such communications in different forms and levels of education have been identified and systematized. *Conclusion.* The proposed training of future teachers to work with blockchain technologies helps to increase the effectiveness of their subsequent professional communications, especially those carried out in a telecommunications format. This can be achieved by increasing

transparency, stability and reliability of information exchange between all educational process participants.

Authors' contribution. *Vadim V. Grinshkun* – conceptualization (formulation of the idea, research goals and objectives). *Victoria V. Kopylova* – methodology development, a research model creation. *Fedor A. Bulin-Sokolov* – software development, computer code and auxiliary algorithms implementation, existing code components testing. All authors have read and approved the final version of the manuscript.

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Особенности подготовки студентов педагогических специальностей вузов к использованию блокчейн-технологий в профессиональных коммуникациях

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Аннотация. *Постановка проблемы.* Блокчейн-технологии имеют существенный потенциал применения и позволяют повысить эффективность профессиональных коммуникаций педагогов. Однако большинство современных преподавателей не используют такие технологии во всех формах профессионального взаимодействия. Необходимы исследования, направленные на решение проблемы поиска подходов к развитию существующих систем подготовки студентов педагогических специальностей вузов как в направлении использования блокчейн-технологий в качестве объекта изучения, так и в овладении дополнительными приемами профессиональных коммуникаций, предусматривающими обеспечение прозрачности, надежности, децентрализации и доверительности педагогического взаимодействия. *Методология.* Осуществляется непрерывное наблюдение как, в каких случаях и с какой целью педагоги используют блокчейн-системы, изучается степень практической эффективности предлагаемых подходов и средств для формирования у студентов потребности к использованию подобных технологий в рамках профессиональных коммуникаций, включая содержание обучения и систему практических заданий. *Результаты.* Разработано и на примерах показано расширение целей, содержания, методов и средств подготовки будущих педагогов, направленное на их знакомство с возможностями и преимуществами использования блокчейн-технологий в профессиональных

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коммуникациях. Выявлены и систематизированы особенности использования блок-чейн-технологий для таких коммуникаций в рамках разных форм и уровней получения образования. *Заключение*. Предлагаемая подготовка будущих педагогов к работе с блок-чейн-технологиями способствует повышению эффективности их последующих профессиональных коммуникаций, особенно осуществляемых в телекоммуникационном формате. Это может быть достигнуто за счет повышения прозрачности, стабильности и надежности обмена информацией между всеми участниками образовательного процесса.

Ключевые слова: цифровые технологии, цифровые образовательные ресурсы, распределенные цифровые ресурсы, дидактический дискурс, подготовка педагогов.

Problem statement. Communications as a various types of information interaction have been and remain the basis of the professional activity of any teacher. It is well known that schoolteachers, college and university lecturers devote most of their working time to face-to-face and telecommunication communication with colleagues, students, and the public. Obviously, the professional communications of a teacher include not only the communication during which he directly explains or shows educational material to schoolchildren or students. Such communications include, for example, checking the results of students' completion of educational assignments, communication within the framework of various extracurricular activities, communication with schoolchildren's parents, and many other forms of teachers' work.

In this regard, the formation of high-quality communicative competence in teachers is one of the primary tasks for modern pedagogical education. Various approaches to the formation of communicative competence in a wide variety of teachers were reflected in the publications of A.I. Artyukhina, I.A. Budina, V.N. Vlasova, S.I. Maslova and others [1–5]. All of them emphasize not only the importance of mastering effective methods of professional communication for high-quality work of a teacher, but also the relevance of updating and expanding the systems of training current and future teachers for professional communications with colleagues and students.

In parallel with this, numerous studies are being conducted on the implementation of modern digital technologies in all types of educational activities [6–8]. In such scientific works, the authors note the need to develop appropriate training for teachers, determine the ways of using new technologies that lead to increased efficiency of training and education, emphasize that, as a rule, the emergence of each new information technology initiates a new direction in the development of the education system based on its use.

Against this background, it is no coincidence that various attempts arise to apply certain technologies not only within the framework of pedagogical communications, but also for the appropriate training of teachers. An example of such a study are the publications of L. Jingjing [9]. Special attention should be paid to special ways of introducing digital technologies into the interaction of teachers and students when it comes to didactic discourse, when communications carried out within the framework of the educational process or outside it is aimed at achieving learning goals. Several previously published articles consider the possibility and approaches to using modern digital technologies to improve the effectiveness of such discourses [10; 11].

One of the newest digital technologies that have penetrated many areas of human activity is blockchain technology, which provides another, usually more reliable and efficient way of storing, transmitting and distributing information. Such technologies are based on the fact that any information is divided into chains of fragments-blocks. The links between the blocks are such that it is impossible to change fragments of data without changing the entire chain. The main thing in the described technology is that digital data divided into blocks is stored not on one server, but in a decentralized manner – on computers of a large number of participants in the telecommunications network. As a rule, stored and transmitted data within the framework of blockchain technology are protected using cryptography. All this together ensures the practical impossibility of loss, distortion, substitution or forgery of data. It is already known that the use of blockchain technologies has several properties, including transparency (all network participants receive the same information), reliability (data cannot be deleted or changed "retroactively"), decentralization (the system has no owner, it functions autonomously and independently), trust (network participants can exchange valuable information directly with each other without intermediaries). By now, it has been proven that one of the areas of human activity in which such technologies can be used quite successfully is the field of education. Research into the methods of using blockchain technologies for the development of education is being carried out quite intensively by both domestic and foreign specialists. In this regard, it is enough to note the scientific works of L.A. Klimova, D.V. Lukashenko, V. Ma, M. Milovanovich, U. Rahardzha, A.A. Sakhipov, E.P. Fedorova and others [12–18]. It has already been shown that for education this can provide increased reliability and additional convenience in the implementation of most educational processes. The obvious advantages of using blockchain technologies in education, which are already actively used by teachers, are the ability to distribute the digital portfolio of each student, reliable,

counterfeit-free storage of data on diplomas, certificates, learning outcomes, the ability to verify the authenticity of educational documents, additional methods of "digital" rewarding students for the results achieved (points, tokens), automation of student movement processes, distributed maintenance of a progress log accessible without distortion, for example, to parents, secure storage of personal data of all participants in the educational process, and much more.

Such properties of blockchain technologies clearly indicate the potential usefulness of the corresponding digital systems for increasing the effectiveness of professional communications of teachers. At the same time, it is well known that almost all modern schoolteachers, college and university professors do not use or very rarely use such technologies in all forms of professional interaction. This is due to several factors, including the lack of suitable domestically produced computer tools, specially developed methodological and technical materials and guidelines, and illustrative practical examples. The key factor here is the lack of teachers' familiarity with blockchain technologies, the lack of practical skills in working with modern blockchain platforms, and their unwillingness to carry out professional communications using such technologies and tools. It is necessary to conduct research aimed at solving the problem of finding approaches to the development of existing systems for training students of pedagogical specialties at universities, both in the direction of using blockchain technologies as an object of study and in the direction of mastering additional techniques of professional communications (and, in particular, didactic discourses), which involve the use of blockchain technologies to ensure their transparency, reliability, decentralization, and trust. Without building an appropriate training system, teachers will continue to be limited in their communications using traditional centralized tools for information interaction, such as social networks, e-mail, instant messengers, corporate portals, and video-conferencing tools. It is obvious that the use of all these means does not have the advantages described above.

This article describes some components of the study aimed at developing systems for training students – future teachers to use blockchain technologies in professional communications.

Methodology. To find approaches to solving the designated problem, pedagogical, technological and research methods are used in the course of the work. In particular, the possibilities and prospects of using blockchain technologies in telecommunication didactic discourses were discussed with Moscow school teachers and lecturers at the Moscow State Pedagogical University familiar with the described technology. During such discussions, it was possible to identify several additional advantages described further in this article. The fundamental thing was the confirmation that blockchain technologies can be integrated into the educational process and professional communications of teachers and lead to a positive effect.

As part of the application of quantitative research methods, the level of knowledge of teachers and students about the technology being studied, the possibilities

and advantages of its use at different levels of the education system are measured. Particular attention is paid to determining the level of readiness of future teachers to improve the effectiveness of didactic discourses based on the use of blockchain technologies. In the future, the impact of such use on the general level of readiness of teachers to carry out their professional activities could be of particular interest.

The study involves continuous monitoring of how, in what cases, and for what purpose teachers use blockchain systems, as well as studying the degree of practical effectiveness of the proposed approaches, including the content of training and the system of practical tasks, to develop the need for students of pedagogical specialties of universities to use the latest information technologies in the framework of professional communications.

Results and discussion. The study consistently considers the expansion of the goals, content, methods and means of training future teachers, aimed at familiarizing them with the possibilities and advantages of using blockchain technologies in professional communications. The content of training related to the specifics of the structure and functioning of blockchain systems, as well as standard examples and advantages of such use, uniform for all areas of human activity, is obvious. Of interest are the elements of content and examples demonstrating the specifics of using blockchain technologies in education, in general, and in didactic discourses, in particular. Unfortunately, at present, it is difficult to name open domestic blockchain systems that would be fully suitable for solving educational problems. To form an idea of such systems "for the future", you can use mixed information, constantly updating it. In particular, at first, as an example, it is possible to have a general acquaintance with foreign blockchain platforms for communications *Open University Blockchain*, *Blockchain for Education*, *Odem*, *Disciplina* and blockchain messengers *Status* and *Matrix*, decentralized identifiers NFT and DID, created to acquire the ability to verify identity in communication, the *Blockcerts* system for storing and verifying educational documents.

Among domestic systems related to blockchain technologies, one can highlight the Russian blockchain messengers *CallBox* and *Molniya* created in different years. Of unconditional interest for use in professional communications in education can and should be the domestic messenger *MAX,* which currently cannot be considered as a blockchain system. It is important to consider that there is already information about plans to create subsystems in such a messenger for working with digital currency using blockchain technologies. Most likely, such technologies will be extended to other subsystems and functions of this messenger. As part of the development of teacher training systems, the content of the relevant training of students includes their detailed acquaintance with the positive effect that can be acquired in the case of active use of blockchain technologies in the framework of didactic discourses and other types of professional communications. In abbreviated form, examples of such effects identified during the analytical part of the study for different forms and levels of education are given in Table.

Features of the use of blockchain technologies for pedagogical communications in various forms and levels of education

Forms and levels of education	Ways to use blockchain technologies in educational communications	Possible effect of using blockchain technologies
School education	Blockchain technologies in the communications of teachers, school administrators and parents of students: secure channels and journals for telecommunication communication, objective voting in the selection of learning paths, clubs, sections and projects. Blockchain technologies in telecommunication didactic discourses of teachers and students – ensuring confidentiality	Transparency and accessibility of communications, increasing trust in telecommunication communication formats. Involvement of parents and students in the educational process. Making decisions that meet the wishes of the majority. Exclusion of fakes and distortions in the work with information
Secondary vocational education; Higher education	Blockchain technologies in the telecommunication interaction of a teacher with students: verification of completed works sent with digital signatures, confidential chats and forums recording the contribution of each participant to the overall development, automation of notifications of participants in the educational process, distribution and confirmation of information about passed tests and exams. Blockchain technologies in university and employer communications as part of the confirmation of graduates' diplomas, qualifications, and specialties	Objective identification and fixation of the contribution of each participant in didactic discourses, educational projects and research. Increasing the degree of automation of telecommunication communication and project execution. Objective, non-distorted information about the learning outcomes of each student. The possibility of verifying the authenticity of educational documents. Collecting and storing data for students' portfolios
Education received through online courses	Blockchain technologies in the student's telecommunication interaction with curators, tutors and mentors: confidentiality of communication, receiving objective advice and feedback, confirmation of learning outcomes. Automating and expediting access to the training course after payment and other formal procedures. Organization of closed forums for students who have completed their studies and their personal profiles	Reliable collection and storage of digital footprint data as part of an online course. Efficiency of telecommunication communication. Increased protection against false information. Motivation to learn through the collection of personal digital assets and points (tokens). Formation of digital communities of students and graduates

Source: compiled by Vadim V. Grinshkun, Victoria V. Kopylova, Fedor A. Bulin-Sokolov.

Examples of the use of blockchain technologies by teachers in communications with students, included in the content of student training, may be situations like the following.

An example of the use of blockchain technologies in communications between a teacher and a student. A student, while studying computer science, participates in an educational project to create a mini application for a computer with specified properties. The teacher needs to check the completed work, send the student information about the result of the work, issue a certificate of the fact and result of the project, which cannot be deleted or changed. The use of blockchain technologies in such communication is carried out in several stages. The student uploads the result of the project to a special digital platform, the functioning of which is based on blockchain technologies. In this case, any such upload is recorded in the blockchain with a reflection of the date and time of the upload, as well as the personal identifier of the student, which cannot be subsequently changed. The teacher receives the

result of the student's work through the said platform, checks its completeness, functionality and quality, leaving a comment on the platform that the project has been completed correctly or requires some revision. It is noteworthy that such comments, thanks to blockchain technologies, are guaranteed to remain unchanged and official for all participants in the communication. After possible revision, the student uploads the final version of the developed mini application to the platform, the teacher confirms the successful completion of the project, the platform generates a digital certificate, which is recorded and remains unchanged thanks to the use of blockchain technologies. As a result, the student receives a verifiable authentic certificate confirming the completion of the project, which he can present, for example, to the employer. The teacher acquires a transparent and objective journal containing unchangeable records of the student's work and can use such information for reporting or subsequent adjustment of the educational process.

In addition to developing the content of training, a series of educational tasks for students of pedagogical specialties of universities was developed during the study as part of the creation of training tools for the use of blockchain technologies. Several examples of such tasks can be given.

Task 1. The purpose of the task is to learn how to use blockchain technologies to confirm the achievements of students obtained during didactic discourses. Task: find 2–3 examples in which blockchain technologies are used to store educational documents during university studies or online courses, make a short summary (6–10 sentences) describing why and how this is done. Register in one of the open services for creating blockchain certificates. Create one digital certificate (for example, 'Certificate for participation in a discussion on a certain topic'), save it and try to confirm its authenticity through the blockchain system. Think of and describe how exactly you could use such certificates in your teaching activities and professional communications. Present the results of the work done in the form of a short report.

While completing such a task, the student – future teacher forms an idea that blockchain technologies are not an abstract concept but can serve as a real help in pedagogical communications, including for recording the educational achievements of students. In addition, the student acquires his first digital certificate, which is stored decentralized and can be officially verified. The future teacher has various ideas about the possibilities of using blockchain technologies in education.

Task 2. The purpose of the task is to master the techniques of using blockchain technologies to record, systematize and store schoolchildren's grades, as well as to ensure the transparency of information about the class's academic performance. Future teachers are provided with information about a situation in which classroom activities and communications with schoolchildren are accompanied by keeping a digital academic performance diary on a blockchain platform so that comments and grades cannot be forged or distorted, parents and schoolchildren could study them and verify their authenticity, all information about communications in the classroom would be transparent. Students are asked to find any open accessible blockchain platform for storing information in the form of discrete records. As part of the

task, future teachers must create a new or use an existing record template in which the student's name, academic discipline, topic of didactic discourse, comment, grade, date of entry, additional information are recorded. Then the students create and subsequently present examples of such records for 4–6 schoolchildren of a fictitious class. As a result of completing the task, future teachers complete a written assignment, reflecting the advantages that, in their opinion, such a digital journal provides compared to conventional electronic diaries, such as those included in popular educational digital collections and systems. In addition, students are asked to describe the risks that may arise when implementing such approaches and software in a domestic school, as well as possible ways to overcome such risks.

Practice shows that while completing similar tasks, students of pedagogical specialties of universities begin to understand that grades and comments on the results of communications can be stored not only in digital form, but also in a decentralized, more reliable and transparent manner. Future graduates become owners of the simplest personal digital journal of academic performance on a blockchain platform, which can be expanded and modernized in the future. Teachers begin to better understand the advantages and risks of using blockchain technologies in professional communications. As an experiment, such classes have been conducted for several years with students studying at the Department of Linguodidactics and Modern Technologies of Foreign Language Education of the Moscow State Pedagogical University. During the testing, it was confirmed that it is possible to expand the existing training in the direction of familiarizing future teachers with the use of blockchain technologies in didactic discourse. The results of the projects carried out by students show that the elements of educational content and practical tasks created during the described study are quite effective for this purpose.

Conclusion. The conducted research demonstrates the feasibility and possibility of using various digital technologies to improve the efficiency of didactic discourses and other forms of professional communications of teachers. The described development shows the advantages of the appropriate use of blockchain technologies. This, in turn, confirms the importance of teaching the specifics of using such technology to future teachers at the university.

Targeted and systematic training of students of pedagogical specialties of universities to work with blockchain technologies helps to increase the efficiency of subsequent professional communications of graduates, especially those carried out in a telecommunications format. This is achieved by increasing the transparency, stability and reliability of information exchange between all participants in the educational process.

Because now most teachers have limited knowledge and skills in the field of mastering this technology, a corresponding expansion of their training systems at universities is significant. Possible approaches to such expansion are described in this article. It is substantiated that the presence of the necessary professional qualities in teachers and their use of blockchain technologies contribute to increased information security and the level of trust in communications with students, administration, parents and the public. With this approach, employees of educational

organizations receive additional tools for the development of educational, extracurricular and other types of educational activities using decentralized information platforms and data. Students at the same time acquire new opportunities to form objective personal portfolios reflecting the history of communication and academic achievements. Thus, the development of systems for training future teachers for their more effective familiarization with blockchain technologies is an urgent task for pedagogical universities. The expansion of relevant training courses and pedagogical practice can significantly increase the level of digital competence of teachers and, as a result, the effectiveness of their professional communications, opening new opportunities for exchanging experience with colleagues and students in the digital educational environment.

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