
Prospects for the Application of Block chain Technology in the Educational Process

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Abstract: The article discusses possible scenarios of using blockchain technology in education. The possibilities for solving a number of problems in education and science based on the advantages of blockchain technology, which can be used as a support for the development of real projects, are identified.

A brief description of blockchain technology is given, modern directions for its development are put forward. The article analyzes the possibilities and prospects of using blockchain to solve some problems in the education system, describes the features and advantages of using blockchain technology in the field of education that are known today. The positive changes in the educational process, which may result from the use of this technology, are defined. The article discusses the shortcomings and problems associated with the use of blockchain technology in education.

The author outline that most projects using the blockchain in education are under development. Currently, there is already data on the implementation of blockchain technology in the form of confirmation of the authenticity of documents on education, a student's personal card, confirmation of accreditation of an educational organization and intellectual property, student identification.

Keywords: blockchain, blockchain technology in education, information technologies in education, digital economy, intellectual property, student identification.

For the first time, the use of blockchain technology became known thanks to the development in 2009 of the Bitcoin cryptocurrency by a programmer under the pseudonym Satoshi Nakamoto. Bitcoin offered independence from government or any other centralized influence. This property was achieved through the use of blockchain technology.

Blockchain technology is gradually changing the world in the same way as the Internet did relatively recently. Interest in this technology is growing with each during the day and there is an opinion that in the near future everything industries on the planet will be forced to use technologies related to blockchain.

Blockchain technology is constantly being updated. These features, in addition to its decentralized nature, have led to the technology being embraced across several industries, most notably the financial sector. According to the International Data Corporation (IDC), worldwide spending on blockchain technology across all industries is projected to grow from more than \$4 billion in 2020 to more than \$14 billion by 2023.

The blockchain database is integrated not only for financial transactions, but also for workflow. This feature can be implemented based on the Bitcoin node and the *op_return* function. This approach was proposed by Philipp Schmidt and colleagues at the Massachusetts Institute of Technology. One industry where blockchain is just beginning to

make a mark is education. The use of blockchain in education is still in its infancy, with only a handful of institutions adopting the technology.

Currently, the institutions that have adopted blockchain primarily use it to store and share academic records and credentials. However, researchers believe that the technology could revolutionize education in a number of ways.

In order to improve the education system, today we have to start implementing block data storage. With the help of blockchain, it is possible to avoid manipulations with certificates, diplomas, scientific papers, and articles. For scientists, researchers and even ordinary students, this is a great opportunity to preserve and safely distribute original works, learn about current developments even in a narrow specialization.

The technology allows you to track changes and the authors of these changes. In this way, the identity of the author can be identified and the level of responsibility increased.

For the first time, blockchain technology was officially applied in education in 2017. It was the University of Nicosia (Cyprus), which decided in a similar way to modernize, simplify the process of searching and storing any documents on specialization (diploma, certificate, scientific work). It was the first university to accept Bitcoin for tuition.

The university has opened MOOC (Massive open online course), which are available for distance learning to students from more than 83 countries. Getting a diploma, you can not doubt its value. The University of Nicosia is a member of the EAU (European Association of Universities). Both diplomas and certificates of an educational institution are authentic and recognized in any country.

MOOC courses can be taken from anywhere in the world, having successfully passed the exams and received a real diploma that meets international standards. Advantages over standard education:

- Cheap tuition fees compared to full-time form.
- Large selection for narrow specialties with the best professors and doctors.
- Independent choice of a combination of subjects studied, selection of learning strategies based on your own requirements / wishes.
- Direct contact between the teacher and the student, which will significantly increase the efficiency of the process of obtaining knowledge.

Blockchain is able to shake the hierarchy of pseudoscientific works, and other moments unacceptable for a quality education system.

- ✓ With the help of decentralized storage and the general availability of information, it will be possible to track each diploma, check it for authenticity.
- ✓ Students will independently choose a qualified teacher, which will significantly reduce the level of scientific illiteracy.
- ✓ Teachers will also benefit, who will be able to receive honest percentages from lectures and seminars held, regardless of a clearly fixed university salary.

One of the successful examples of such work is the ODEM (On-Demand Education Marketplace) platform. This is a unique startup that represents the educational services market. Students apply for a specific course. They are offered for a fee to listen to a course from one of the famous teachers.

When analyzing the literature data, the following promising areas of blockchain use

implemented to date for solving some tasks in the education system:

1. Changing the general current model of education. Today's students are educated in a variety of ways, and not just in traditional university lecture halls. Currently, there are various online courses, seminars and conferences, places for joint learning. The traditional centralized model of modern learning is no longer the only one. Online learning can be done through the blockchain, making it easy to test and transfer skills and authority [6].
2. Storage of education data (Storing Permanent Records). If education data is permanently stored on the blockchain, documents such as diplomas or certificates of education, academic degrees can be protected and verified regardless of whether the user has access to the record keeping system of the educational institution.
3. Identity verification and information security. Using blockchain, students and other learners can identify themselves online while maintaining control over the storage and management of their personal data. Currently, students are required to regularly identify themselves to their learning organization. As a result, tens or hundreds of people may have access to a student's personal information. With blockchain, only a select few, namely the parties responsible for verifying the student's identity, as well as the student himself, can access the data [7].
4. Student's personal data (Student Ownership of Learning). Blockchain allows personal data to be just personal. Students gain control and ownership of all their educational data, including accreditation and portfolio of work, in a secure place, accessible to anyone who needs to verify it, and for life [8; 9].
5. Interactive learning and analytics. If every learning activity is recorded on the blockchain, including informal learning along with informal feedback, then all test scores will be displayed in learning environments around the world. As a result, this will make it possible to determine the best lecturers, teaching will become much more interactive, and the rating of educational institutions and teachers will be built on more specific data [10, 11].
6. Automatic Transfer of Credits. Using the blockchain, credit recognition agreements can be written as smart contracts, whereby when the terms of the contract are met, the learning credits will be automatically transferred [12].
7. Copyright for educational content. Blockchain can allow educators to openly publish content, earn rewards based on the level of actual use and reuse of their learning materials. Students and institutions can decide which study materials to use. Teachers can announce the publication of their resources and link to these resources, or announce what other resources they have used in creating the material [6; 13].

Blockchain has the potential to transform the education landscape by opening up new, more affordable pathways to learning and disrupting the existing relationship between schools and students. Managing student tuition payments is a labor-intensive process that involves multiple parties – students, parents, scholarship foundations, private loan companies, federal and state institutions, and the often-massive bureaucracy of university financial departments. Blockchain can streamline this process, reducing administrative overhead and potentially lowering tuition costs as a result. The technology has already been used for pay-as-you-go courses and other types of open learning scenarios, relying on the deployment of smart contracts and using cryptocurrency as a payment method.

Blockchain in university research. The twin goals of higher education are to pass on

knowledge to the next generation of students and to increase current knowledge with new research. Professors spend much of their time conducting original research and publishing their findings, pushing the boundaries of their fields and illuminating areas of research that will lead us into the future. Crucially, the spread and influence of those publications can affect professors' ability to secure important grants to fund future work. Authors have a vested interest in monitoring how their research is used and protecting it against outright piracy. Blockchain would enable researchers to publish without restrictions, but in a way that would allow them to monitor their research's reuse, including how often a work is cited and used as teaching materials, thereby tracking its influence in the field – important since that can translate into accolades and future funding.

Despite the potential benefits of blockchain, adoption is still relatively limited in the field. Nearly 50% of higher education respondents in the Gartner survey cited a lack of interest in using blockchain. Much of this reluctance may stem from the challenges associated with implementing the technology, including issues of security, scalability, adoption rate, and cost.

Though security is one of blockchain's defining features, that doesn't mean it is invulnerable. Because of the sensitivity of the information stored on the blockchain – students' educational records and academic credentials – institutions must be mindful about what data they store and how they choose to store it. Universities may need to implement stronger privacy measures by using private or permissioned blockchains, or encrypting data on the blockchain.

Educational institutions possess a vast amount of data on their students and alumni, which can make scalability an issue for blockchain use. As the scope of data involved expands, the number of blocks required increases, which slows down the speed of transactions occurring on the blockchain, as each transaction requires peer-to-peer verification. When adopted on a wide scale, this can be a significant impediment. On the bright side, permissioned blockchains have a higher rate of transactions per second compared to permissionless blockchains.

Like other technologies before it, blockchain only works when enough institutions and employers come to rely on it; graduates only benefit from ownership of their credentials if the schools or companies they are applying to accept their validity.

Although it can lead to savings in other areas, adopting and implementing any new technology can be quite costly. Costs related to computing power and changing existing infrastructure can add up. Additionally, many institutions may lack the knowledge and skills necessary to manage student data on a blockchain platform, so they may need to invest in educating school administrators on how to use the technology, which costs both money and time.

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