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Education Through the Lens of Blockchain and Vice Versa

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Abstract: Blockchain is a promising global and cross-industry technology that is predicted to drive the growth of the world economy in the next few decades, but it is not limited to this application alone. Considered a technological phenomenon, blockchain has reimagined how we design complex systems, such as the education system. The author asks and answers the following questions: How can these systems be made autonomous, decentralized, reliable and capable of self-stabilization? Is blockchain the key we need to make any system efficient and perfect from a "systems theory" perspective? How should it be done? Where is blockchain technology used in education and what are its prospects? The author discusses a promising direction in which blockchain could develop, increasing the range of its application in the education sector. This article raises the problem of mainstream academia's attitude toward blockchain, which can slow down its implementation. An analysis is given of why education professionals are wary of the digitalization of education. The author advocates a balanced and sensible approach to the relationship between blockchain and education.

Key words: blockchain, education, digital technologies, benefits and dangers, promising technology

1. Introduction

The outbreak of the global pandemic has changed the education system completely. Most probably, measures that were temporarily introduced will become a new norm. The whole world is shifting toward e-learning and it will be hard to go back to the traditional format. Any abrupt changes are accompanied by difficulties and even chaos. Thus, the transition to e-learning has exacerbated several problems that were never perceived as priorities previously. It became obvious that online schooling and communication via email, Viber, Telegram and Whats App turned out to be less effective. Smart boards, laptops, high-speed internet, video lessons, virtual excursions, virtual labs and virtual libraries are not enough. Teachers are actively switching to Slack and Zoom to communicate with students and to address problems like laptop lags, mic problems, students neglecting lessons and playing video games or scrolling through social media instead. For some students, the lack of personal contact became a real challenge and they started to fail classes, while others thrive studying independently and are happy.

The education system is looking for new ways to teach so that the quality of education stays at the same level. Many people are discussing the possibility of shifting from a 4-year education system, which is common for many colleges and universities, to a modular approach. This would provide people with the tools to study and improve their knowledge throughout their whole life and to learn what they really need. People are looking for new technologies to make this happen, including ways to incorporate artificial intelligence, robotics, blockchain and

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other innovations (Aglietti, 2017).

The purpose of this research is to analyze problems in the education system from the perspective of blockchain and how technology can help reshape education.

2. Findings

2.1 Education through the Lense of Blockchain

Blockchain is an algorithm-system that is represented by a chain of blocks containing information. The technology helps to eliminate intermediaries in the agreement process between several people. Blockchain has a number of unique features: the absence of a single server, the decentralization of data, the ability to store files on a different storage medium and the guaranteed safety of information. The content stored on the blockchain is constantly being updated. New blocks of data are attached to the existing chains and the system automatically logs the time and date of each new record created. The main advantages of a distributed database are:

- its transparent and fast pace
- decentralized storage and general availability of information
- information is stored on a blockchain that is available to everyone, but no one can change it without access to private keys
- no intermediary assistance is required to exchange the information; transactions are verified by the participants of the system through all the recorded blocks of the chain.

In simple words, blockchain is one large file that you (and other users) store on your disk. All transactions are recorded in this file using a peer-to-peer networking protocol. The file is constantly growing with every transaction added to the chain.

More and more projects are being built or transferred to blockchain. Ethereum is one such example. It is a cryptocurrency and an ecosystem used for the development of decentralized online services and works on the basis of smart contracts. Ethereum distributed software can be used by anyone who needs protection from unauthorized interference. It’s not only startups that are drawn to blockchain. IT corporations like Microsoft and IBM, airlines like Lufthansa and S7, banks and even international NGOs like UNICEF are incorporating blockchain (Schmidt, 2017).

Blockchain technologies are relevant to and are gradually being introduced in the following sectors:

The financial sphere — in the process of conducting small and large transactions, e.g., brokerage services, lending, currency transactions, buying and selling shares, etc.

The healthcare industry — for improvements to patient identification systems, fixing the tests performed, patient anamnesis, electronic prescriptions, online consultations, etc.

The governmental sector — in the way governmental institutions store information on social activities, e.g., the results of social polling and elections (Alekseev, 2020).

Blockchain allows us to cut bureaucratic costs, minimize the risk of corruption, ensure the safety and security of data and eliminate unnecessary or redundant operations.

According to the Blockchain in Education report published by the European Commission's Joint Research Centre, the number of blockchain use cases in education is quite high. This is determined by the features and capabilities of the technology (Grech & Camilleri, 2017).

What can blockchain offer the education system? It's not just a matter of obstruction of corruption by making

financial transactions more transparent. The capabilities of this technology are now being taken seriously in the educational space. In 2017, the University of Nicosia (Cyprus) integrated blockchain technologies for the process of finding and storing documents like diplomas, certificates and scientific works. Blockchain is also used by The Open University (U.K.), the Sony Training Institute and Massachusetts Institute of Technology (Watters, 2016).

Thoughtful use of blockchain simplifies and speeds up processes and reduces the cost of verifying the validity and authenticity of education documents. The technology enables the tracking of each diploma and checks its authenticity. The example of Estonia as well as research conducted in Australia show that the use of blockchain technologies helps the heads of educational organizations manage the hiring process, saving money and time on information verification and protecting themselves from fraudsters. Employers can find the necessary specialists with specific qualifications while information about the applicant's identity remains confidential.

Blockchain can be used to record academic information throughout a person's whole life. This can include additional classes and online courses that a student attends outside of school or university, additional training courses, recertification as well as qualification confirmation procedures. All this information can be immediately reflected in a single system and the data will be reliable. The information can be stored for 15, 30 or even 100 years anywhere in a completely secure way. In fact, it can almost be a personal passport of lifelong learning.

This technology offers educational institutions a way to replace the enormous amount of paper documents held on graduates, which take up a lot of space and are hard to trace. Instead, every record could be kept on-chain. In the same system, institutions can store information on lectures, grades and students' test results. Furthermore, blockchain can standardize the information for several universities and in the long run, come up with a system that's common for different countries. While many universities store diplomas on their own blockchains, the Japanese giant Sony is working on consolidating education documents into a single online repository. It will create a unified workflow system for educational data and digital diplomas.

Thanks to blockchain, people from different corners of the world will have access to the Massive Open Online Course (MOOC) which provides practical knowledge and has lower tuition fees than regular, face-to-face courses. Blockchain enables users of educational services to combine individual courses into blocks and thus implement personalized learning strategies.

Blockchain also solves the problem of the lack of communication between parents and schools (which is urgent in online education) through the creation of a digital archive. A distributed metadata system is also a promising tool for libraries.

Universities around the world carry out scientific activities. However, the lack of cooperation among universities leads to uncoordinated research. The problem even occurs between universities in the same country. Further instances of this problem arise when research is conducted in the wrong area; when it is not checked immediately and compared with data from related scientific spheres; and when it contradicts research in other parts of the world (Layne, 2021).

Blockchain can serve as a barrier for pseudo-scientific works. A global scientific database would allow researchers to compare their findings with knowledge from other fields. This would also allow them to generate more and better conclusions than they otherwise could within the framework of a single branch of science. The incorporation of new knowledge as a new block in the chain would check the information. Findings and discoveries, even from the earliest days, would become available for applied use. The scientific knowledge base formed on blockchain technology can lead to a qualitative and quantitative leap in fundamental and applied knowledge - it can be a catalysis for progress and intensive development of almost any industry.

Blockchain can be used to track intellectual property and as encouragement for its multiple reuse. It allows scientists to notarize publication dates and copyrights as well as to track the extent to which it is reused. The unification of a database of research work and a database of specialists, professors, pupils and students is a promising initiative that would ease the process of multi-stage accreditation.

2.2 Blockchain From The Educational Perspective

Today, the possibility of using blockchain for educational purposes causes a controversial reaction among teachers. Feedback from teachers from different countries (...) shows that many of them firmly associate blockchain technology solely with its use in the financial industry and with Bitcoin. The general population in many countries is still skeptical about it. Besides this, many teachers perceive blockchain not just as an approach to information management but also as a synonym for the full-on digital transformation of the educational process, which can lead to a reduction in live communication between students and teachers. Pedagogy and educational psychology have always focused on the interpersonal nature of education. Human psychology has its own laws of development which have evolved over centuries and are a direct result of evolution. The new information environment is a serious challenge that requires one to be cautious. Scientists believe that it takes at least ten years of a broad front of medical, psychological, ergonomic, pedagogical research in order to determine the framework for working safely with gadgets and digital technologies. To what extent can computers and artificial intelligence replace interpersonal communication? How can education fulfill its main function? We are not talking about the development of the competencies required by employers but rather the formation of culture, culture of self-identification, humanistic values and personal qualities — everything that distinguishes a person from a machine. At the same time, there is a danger that expensive fundamental education will remain only to a few “gifted” children and that cheap distance education will become widespread (Shirochenko & Gusyatnikov, 2018).

The digitalization of education is still terra incognita, leaving many questions unanswered. Today, science is unable to provide definite answers to all these questions. Positive reviews of digitalization are met with reasonable caution from teachers. Therefore, countries follow the path of balanced decisions and avoid the extremes: a combination of face-to-face and distance modes of education, with e-learning being supplemented by student visits to educational organizations.

When it comes to blockchain, it is not a new pedagogical technology. It is a technical solution that enables us to update the forms and means of solving several problems in regards to transferring, storing and using information that has accumulated in the educational system. The use of blockchain does not diminish the role of the teachers nor does it automate pedagogical tasks or call for abandoning full-time education. The scope of blockchain application in education directly depends on the goals set by the institutions.

Using blockchain in education will first and foremost result in increased transparency and trust from society - the reduction of corruption and fraud. The humanistic outcomes of incorporating blockchain in education are the reduction of routine work, time saved for studying and development, increased confidence that all information about education will be saved and that nobody from the outside will be able to take advantage of it. Further important advantages of blockchain technology are its ability to maintain confidentiality, elimination of psychological stressors and the comparison of learning outcomes (Boyko, 2020).

We want to emphasize that blockchain is an actively developing technology. Problems arising in the course of its application are being resolved. The psychological discomfort may be associated with the fact that information that enters the system cannot be changed; that is to say, every mistake remains in history forever,

which could increase the level of stress in the educational system. Scientists are concerned about how reliable the database is and whether it can be manipulated. Parents may be concerned about the number of jobs lost as a result of eliminating intermediaries, for example, in the process of document management, money transfers, insurance, etc.). People are also worried that operating blockchain systems requires huge amounts of electricity. Amid the growing environmental crisis and climate change, it could become a critical issue. In this article, we will not list the technical problems of blockchain. As with other technologies, blockchain has its shortcomings which are gradually being resolved (e.g., storage of private keys, protection of encryption algorithms, transaction speed, cost of energy and shadow market). Still, it is foolish to think about stopping technological progress. Instead, it is important to learn how to use technology wisely and how to minimize the effect of possible risk factors. Blockchain is a revolutionary and actively developing technology. It is not a frivolous statement, Bennett said... "Only the most promising and reliable projects survive and thrive" (Bennett, 2020).

3. Conclusion

The perception of blockchain technologies within educational institutions varies from enthusiastic to skeptical. This is largely due to the stereotypes that are present in society. Not everyone wants to accept the idea that the world has changed and will never be the same. "In my opinion, a certain level of negativity in regards to blockchain can be explained with the fact that many expected it to be a real miracle, while it is just a distributed storage system" — says Vladimir Alekseev, a leading system architect at an IBM branch in Russia and CIS. Blockchain is a new technical answer to many problems in the education system, a technology that needs to be implemented, embedded, adapted and maintained. It is important to look at blockchain realistically and with a bit of skepticism.

According to many experts in the field, blockchain will be most effective in:

- creating a record of life-long education
- creating a professional portfolio
- standardization of documents, easing the issuing process and the recognition of certificates
- providing access to educational credentials to different parties, e.g., when an employer wants to verify
- information
- protecting and managing intellectual property (in particular for open educational resources)
- managing educational grants as well as strengthening the security of students' and institute's personal
- data
- detecting pseudo-scientific works
- creating personalized education programs
- verification of accreditation
- making libraries more accessible
- facilitating communication

If used correctly and responsibly, blockchain can increase the level of security and the stability of the education system while ensuring its sustainable development.

How quickly society will be able to restructure largely depends on the education system. Software used in the field must correspond to the complexity of the tasks being carried out. Blockchain is at the forefront of these technological advancements.

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