

Theoretical basis and practical challenges of integrating blockchain into education

Hao Tao

(Anyang Normal University, China)

Corresponding Author: Hao Tao

Abstract: As an important representative of modern information technology, blockchain has the technical characteristics of peer-to-peer transmission, data fidelity, smart contract and so on, which provides a feasible technical scheme for educational reform. Following the analytical framework of "technology and system", this paper makes a systematic investigation and Reflection on "blockchain + education". It is found that there is multiple coupling between the blockchain and the structural reconstruction and process reengineering needs of traditional education, which can promote the reengineering of learning environment, the transformation of educational methods and the optimization of educational management. However, the autonomy and uncertainty of the blockchain itself may bring technical hidden dangers, and the improper application of technology will also lead to data security problems, the risk of breaking the law of smart contract and the criticism of digital copyright protection.

Key words: Blockchain; Educational informatization; Digital education resources; Algorithmic Education Governance

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I. INTRODUCTION

At present, the continuous development of blockchain technology is in line with the strong reform needs of traditional education and has become a strong technical support for educational innovation. In view of this, China's education informatization 2.0 action plan requires that we make full use of intelligent technologies such as blockchain to accelerate the modernization of education and the construction of an educational power. However, the blockchain is not perfect. Its destructive innovation will lead to the rebalancing and even reconstruction of rights, obligations and responsibilities. In other words, the risk of "blockchain + education" should not be underestimated. However, at present, the academic research on "blockchain + education" mostly stays at the level of application mode, but less attention is paid to the possible order imbalance and regulation failure. To avoid the "governance deficit" of "blockchain + education", we must conduct in-depth research on its risks and challenges, and use legal thinking and legal methods to relieve them. Therefore, based on the analysis of the coupling between blockchain and educational reform, this paper will analyze the risks and challenges faced by "blockchain + education", and put forward targeted legal regulation suggestions, in order to develop strengths and avoid weaknesses and better serve the modernization of education.

II. PRINCIPLE OF BLOCKCHAIN TECHNOLOGY

As a new judgment and measure of China's economic and social development, the new urbanization construction urgently needs to develop rural vocational education, cultivate "new vocational farmers", increase the transfer of rural surplus labor force, alleviate the income gap between urban and rural areas, and truly achieve high-quality and high-level urbanization construction.

Here is no consensus on the definition of blockchain, which mainly forms three perspectives: first, regard blockchain as the development of distributed ledger technology; Second, regard blockchain as a combination of a series of technologies; Third, regard blockchain as an innovation of Internet technology [1]. In October 2016, the Ministry of industry and information technology of the people's Republic of China, in the white paper on China's blockchain technology and application development (2016) prepared under its guidance, defined blockchain as a chain data structure composed of data blocks in chronological order, and a tamper proof and forgeable distributed ledger guaranteed by cryptography. This is the authoritative definition of blockchain made by China from the technical level. Blockchain has undergone many evolutions since its birth. In 2009, the

emergence of bitcoin announced that the blockchain entered the 1.0 era; In 2013, Ethereum blockchain provided a script language for developing smart contracts, and the blockchain entered the programmable 2.0 era; In 2016, with the development and application of artificial intelligence, big data and other technologies, blockchain entered the 3.0 era, that is, the deep integration of blockchain and other emerging technologies. At present, blockchain is developing towards 4.0, that is, it is widely used in government affairs, people's livelihood and many other fields.

In practice, after a blockchain node generates a new data record, it will broadcast it to the nodes of the whole network. After receiving the data, the receiving node will conduct preliminary verification and encapsulate the verified data into a block. Then, other nodes will execute the consensus algorithm to reach a consensus on the legitimacy, reliability and correctness of the block. After that, the block will be officially written into the blockchain, And update synchronously in the whole network [2]. It can be seen that blockchain has the technical characteristics of Distributed Accounting, multi-party consensus, tamper proof and programmability, which make it have the potential of enabling education.

III. INTERNAL COUPLING BETWEEN BLOCKCHAIN TECHNOLOGY AND EDUCATIONAL REFORM

Education reform based on blockchain will take informatization as the core driving force to promote innovation in the form, function and management of education. In turn, the traditional education model also needs a technical mechanism to promote its process reengineering and structural remodeling. Therefore, there is an internal coupling between the two. From the basic structure, learning environment, teaching methods and educational management are the three core areas of educational informatization. "Blockchain + education" is the advanced stage of educational informatization. Therefore, the above three dimensions can provide an entry point of view to clarify the internal coupling between blockchain and educational reform.

3.1 Blockchain and learning environment Reengineering

Learning environment reengineering is an important path of educational informatization. Blockchain can provide learners with more advanced learning environment and learning resource support, and promote the generation of intelligent learning environment.

On the one hand, Distributed Accounting promotes the construction of EFA ecosystem. "After the extreme expansion of government functions and powers, human society formed a typical bureaucratic structure in the 1950s." [7] in the field of education, this expansion is mainly reflected in the formation of a bureaucratic education system in which educational services and educational management power are monopolized by schools and the government, that is, under the leadership of the government, schools provide educational services and carry out diploma certification [8]. Under the "overall responsibility" of the government, "inseparable management" and "no separation between government and schools" have become the norm of the development of public education, which not only makes public education lack the vitality of connotative development, but also destroys the fair competition environment in the field of Education [9]. With the help of the distributed accounting characteristics of the blockchain, we can build a decentralized learning environment, get rid of the abuse of the monopoly of educational power by the government and schools, and promote the effective separation of "management, management and evaluation", so as to create an integrated education system with the participation of the whole people and collaborative construction, and promote the all-round opening of Education [8]. This means that learning is not necessarily in school, and education is not equal to school education. Multiple subjects such as museums and community organizations will become suppliers of professional education services [10]. The transparency and high fidelity of distributed accounting will make the learning certificate issued by the multi education service subject have the same certification effect as the traditional diploma certificate. In this way, it is beneficial to the construction of lifelong learning system and learning society.

On the other hand, programmability promotes the intelligent circulation of digital education resources. Digital educational resources refer to the collection of educational resources that can operate in the information-based teaching environment after digital processing [11]. The circulation of digital education resources is the key to promoting the reconstruction of learning environment. At present, China's digital education resource sharing system based on sharing platform and content platform has also exposed some problems in realizing the open sharing and cross domain circulation of digital education resources: single form, uneven quality, weak personalization, weak self growth, difficult management, difficult property right protection and poor openness [12]. Blockchain provides technical guarantee for digital education resource sharing. Firstly, the hash algorithm can compress any size of educational resources into a fixed length string, so that digital educational resources can flow quickly and safely in the blockchain system, so as to enrich the form of digital educational resources. Secondly, the coded and compiled digital education resources cannot be copied at will. Only users with corresponding keys or established smart contracts can obtain relevant information.

3.2 Blockchain and improvement of teaching methods

Blockchain subverts the traditional means of knowledge dissemination and provides support for the improvement of teaching methods and teaching strategies [13]. Peer to peer transmission promotes the personalized formulation of teaching content. Personalized learning refers to taking appropriate teaching strategies according to each student's learning habits, giving targeted teaching content and providing appropriate learning support services [10]. Personalized learning is of great significance because it is related to the lifelong development of students and the long-term development of society. However, the traditional exam oriented education is deeply rooted in China. The learning objectives and contents, teaching strategies and even evaluation index system are uniformly formulated and strongly promoted by the school, and most of the relevant data are presented in written form, which is not personalized. Although this model has its rationality, facing the needs of innovative spirit training and educational system reform, it is an inevitable trend to change from exogenous learning to endogenous learning. The introduction of blockchain can enable learners to personalized learning. On the one hand, peer-to-peer transmission mechanism can automatically and historically record each learner's learning experience, learning content, learning effectiveness and other personalized data. At the same time, with the help of big data and artificial intelligence technology, these personalized data can be intelligently analyzed to establish a learner "user portrait" to accurately match the learning demand and service supply. On the other hand, peer-to-peer transmission mechanism provides a communication platform that can be created across situations for teaching and learning, which is convenient to provide "student-centered" dynamic and personalized learning services in the dialogue.

Second, the chain structure promotes the deepening development of borderless education. In the context of globalization and informatization, the boundary of teaching is being broken, and borderless education has become a new trend [14]. Borderless education is an educational form that crosses the boundaries of time and space. It helps to share and optimize the allocation of educational resources and provides more learning and exchange opportunities for learners from developing countries and poor families. However, there are some problems in borderless education, such as fragmentation, randomness, disorder and so on. Blockchain can promote the in-depth development of borderless education. First of all, blockchain is open-source, and learners have the opportunity to go online. It is naturally the technical basis of borderless teaching. Secondly, the chain structure makes all data stored and traced by the whole network, so as to supervise the healthy development of borderless education. Finally, block chain storage can form a complete learning record, which is convenient to adjust the learning content in time to overcome fragmentation and optimize the learning process to ensure learning effectiveness.

3.3 Blockchain and education management optimization

The technical characteristics of blockchain can make education management flexible, accurate and reliable, which provides support for the optimization of education management.

First of all, tamper proof enabling education records trusted management. In recent years, academic fraud has occurred frequently. How to prevent it has become a thorny problem. The crux lies in the centralized storage of academic information by the school. Centralized management makes the information less transparent, more tamperable and higher verification cost. The blockchain is tamper proof, and the data on the chain can prove itself, which can be a good medicine to solve the problem of academic fraud. Firstly, blockchain can be used to record and save various formal or informal, online or offline learning experiences and processes, and this storage can be read and updated synchronously between different application terminals, so as to form a long-term effective, open, transparent and tamper proof learning data chain. Secondly, if an educational institution chooses to use blockchain to store academic certificates, the recruitment unit can verify the authenticity of the applicant's academic qualifications with one click only by using the corresponding verification tools, and obtain its reliable full history learning data, so as to simplify the process, save costs and prevent academic fraud

Secondly, multi-party consensus promotes the accuracy of educational evaluation. Educational evaluation is an important post reflection and evaluation mechanism. At present, China has established an education evaluation mechanism organized and implemented by the education administrative department and by means of qualitative and quantitative analysis, including qualification evaluation, school running level evaluation and school internal evaluation, which has played a positive role in improving the quality of education. However, it pays too much attention to the evaluation index system and ignores the school running characteristics and teaching construction levels of different schools; Mainly through fixed and static written materials to evaluate the education situation, it is easy to be one-sided, and the materials themselves are easy to be forged; The administrative color of educational evaluation is strong, and the inherent defects of administrative make the fairness and effectiveness of educational evaluation questionable. In this regard, through the blockchain consensus mechanism, we can first collect education data from many aspects, grasp and evaluate teaching activities and students' learning, and will rely more on accumulated education big data. Their

evaluation will change from result oriented evaluation to process oriented fine regulation, forming a dynamic, comprehensive and green evaluation mechanism. Secondly, multi party consensus can comprehensively excavate the school's historical data, analyze local characteristics and advantages, establish a diversified evaluation system, and promote the formulation of characteristic schemes suitable for the school's own development under the condition of ensuring the reliability of the data. Finally, multi party consensus also means group policy and wisdom, which provides an opportunity for calm and value independent third-party institutions in the education industry to intervene in education evaluation, and can make the problem demonstration more scientific, transparent and fair.

IV. RISK AND CHALLENGE OF BLOCKCHAIN TECHNOLOGY TO EDUCATION

At present, the rural vocational education should take the new urbanization construction as the development opportunity, take the market demand as the guidance, start with the actual situation of the rural vocational education, optimize the setting of the rural vocational education in the professional structure, talent training, talent training and other aspects, in order to meet the actual needs of the rural labor force for vocational education to the maximum extent.

4.1 Risks of technology itself

The risks of blockchain itself are mainly reflected in: first, algorithm bias is easy to cause digital Leviathan. In the technical dimension, blockchain can be regarded as a set of algorithm integration system, because the transaction of its digital resources needs to be run through encryption algorithm, information verification and recording need to be realized through consensus algorithm, and smart contract is also supported by algorithm rules. Therefore, the core element of "blockchain + education" is the algorithm that governs its operation. Based on the blockchain algorithm, we can create a more convenient, efficient and virtuous educational ecology, but the objective existence of the algorithm black box makes the traditional issues such as educational fairness and efficiency more prominent [19]. Algorithm discrimination and algorithm manipulation will infringe the public's right to choose education, which has aroused widespread concern about the educational application of blockchain [20]. In addition, the algorithm pursues simplicity and attempts to deduce and simplify complex social affairs with a complete model, which may lead to the risk of hard regularization, formulation, de skilled and formalization of education.

4.2 Possible challenges of technology embedding

As a destructive technological innovation, blockchain embedded in the field of education may produce a series of institutional challenges, which should be paid attention to:

First, the data security crisis. The blockchain converts the personal data contained in the transaction record into hash value through encryption algorithm, so as to realize the anonymization of personal data [24]. If the blockchain node does not interact with the real world, the anonymity of hashed data is high enough, but it is difficult for the blockchain to leave the network. The personal data and records retained by each node on the blockchain service platform will become a breakthrough for reference identification of specific natural persons. At present, platform enterprises control citizens' communication, search and financial methods, and can independently collect and process users' personal data, resulting in the threat of personal data leakage. Therefore, the current legislation generally establishes the "centralized protection" mode of personal data with the limitation of platform responsibility and supervision as the core [26]. This model gives the data subject full right of data self-determination. If the data controller wants to collect and process personal data, he must obtain the consent of the data subject, and fulfill the obligations of data deletion and modification according to the requirements of the data subject. However, in the context of blockchain, it is impossible to judge whether the private key holder is himself, so it is difficult to define the data ownership; The tamperability of the blockchain also conflicts with the right of data correction and deletion; The same subject can also have multiple virtual identities, which will challenge the effectiveness of the informed consent rule. In addition, article 1034 of China's civil code establishes the "binding" element defined by the law of personal data, but its specific standards are not specified, which brings difficulties to explore the legal attributes of hashed data .

Second, smart contract challenges. Although smart contract is a kind of agreement, its autonomy of will is limited to the stage of contract conclusion, and contract execution cannot be interrupted or terminated through autonomy of will. Smart contract code is prone to loopholes, which will leave an opportunity for criminals. The anonymity of smart contract makes the identification of the specific identity of the parties weak.

V. CONCLUSION

With its technical characteristics, blockchain can promote the construction of education for all ecosystem, promote the intelligent circulation of digital education resources, promote the personalized

formulation of education content, enable the trusted management of education records, and promote the accurate realization of education evaluation, so as to drive the transformation of learning environment, education methods and education management to intelligence. However, when developing "blockchain + education", we must guard against the algorithm risk and autonomy awakening threat of blockchain itself, as well as the challenges that blockchain applications may bring in personal data protection, smart contract regulation and digital copyright protection. Therefore, it is necessary to establish blockchain technology risk supervision mechanism, improve personal data protection mechanism, construct smart contract system and optimize digital copyright system, so as to systematically and pertinently solve the risk challenge of "blockchain + education" and make it develop orderly within the framework of the rule of law.

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