Journal of Education and Educational Research
ISSN: 2957-9465 | Vol. 6, No. 3, 2023

Exploring the Mode of Inter-university General Education Consortium Based on Blockchain Technology

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Abstract: Blockchain technology has found widespread adoption in all walks of life in China today due to its high security and tamper resistance. However, its application in the realm of education has seen limited notable successes. With the continuous advancement of undergraduate education reform in Chinese universities, general education has garnered increasing attention from colleges and universities, triggering a wave of exploring new general education models. In this paper, we introduce the consortium blockchain to analyze the existing general education models of colleges and universities in China and propose building a consortium blockchain-based general education course management platform. The present work aims to facilitate the collaboration of general education among colleges and universities, promoting the "self-organizing" operation of online learning communities and the exploration of a decentralized education system, ultimately driving the high-quality development of education.

Keywords: Blockchain; Consortium Blockchain; General Education.

1. Introduction

The current social environment has elevated the expectations for personal qualities of the labor force across various industries, making it demanding to meet the dynamic demands of social progress by relying solely on professional and technical education within schools. In this context, strengthening the talent training capability of colleges and universities to enhance the comprehensive quality of students has become an urgent task. After the issuance of "Opinions on Accelerating the Construction of High-level Undergraduate Education and Comprehensively Improving the Ability of Talent Training" by the Ministry of Education of the People's Republic of China, general education has attracted significant attention from colleges and universities as a key point to improve talent training ability and optimize talent training system [1].

The construction of general education in colleges and universities should factor in both students' free and full development and social demands. Existing research on general education models in China grapples with three difficulties: the prolonged professional training-oriented talent training models, which contradicts the training concept of general education [2]; the limited credits and credit hours endowed to general education courses, which relegates them to secondary positions in the course system of colleges and universities [3]; and the uneven quality of general education courses, which is not so much of a real integration as a "hodgepodge" [4].

Under such circumstances, if colleges and universities collaborate to share their premium general education courses, they can not only break through the above obstacles but also promote the transition of general education from being school-centered to student-centered. To this end, it is imperative to design an interconnected, distributed information management platform that can exchange the supply and demand information between colleges and universities, integrate their general education course resources, and promptly meet the demand of all students, thus realizing the student-centered school-running concept. Blockchain, well-known for its decentralized and tamper-proof features, has solved the problem of multi-party trustworthy collaboration by capitalizing on consensus protocols, smart contracts, and other technologies. Hence, this paper aims to leverage blockchain technology to establish the framework of an inter-university general education course management platform based on the consortium blockchain [5-7].

2. Application of Blockchain Technology in Inter-University General Education Consortium

Blockchain is a term in the field of information technology that combines professional technologies involving mathematics, cryptography, the Internet, and computer programming. Simply put, it is a distributed shared database that connects data blocks in chronological order, links them into a chain-like structure, and prevents them from being tampered and unforged cryptographically [8]. The blockchain structure is shown in Figure 1.

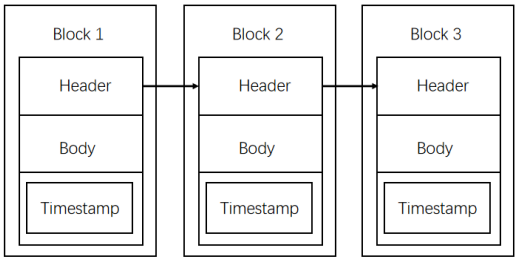


Figure 1. Schematic diagram of blockchain structure

In light of the above analysis, it is feasible to establish a management platform based on blockchain technology to facilitate the sharing of existing premium general education course resources among colleges and universities, maximize the utilization rate of these courses, and realize the individualized development of students. Currently, three

major types of blockchains are widely recognized, namely, public blockchains, consortium blockchains, and private blockchains, each serving specific purposes and having distinctive characteristics in the field of blockchain. A public blockchain is one where anyone involved is free to read, submit transactions, and participate in the consensus process. In contrast, a private blockchain is one whose write permission is controlled by an organization or institution, and the qualifications of participating nodes are strictly limited [9-11]. Given the large number and wide distribution of colleges and universities, the existing incentive mechanism is not universally recognized; therefore, the adoption of public blockchains is not viable. On the other hand, private blockchains, being closed to the outside world, are also unsuitable for the management platform of colleges and universities. Therefore, consortium blockchains are chosen for constructing the inter-university general education course management platform.

Offering a balance between public and private blockchains, consortium blockchains are often controlled by more than one center. This blockchain is restrictive and must be accessed with permissions, which can be regarded as "partially decentralized" [12-13].

3. Functions of the Consortium Blockchain-Based Inter-University General Education Course Management Platform

The inter-university general education course management platform based on the consortium blockchain should be "open" and "bidirectional." Here, "open" means that the platform should be able to leverage the consortium blockchain to collect premium general education courses from universities in a wider region. This move can be piloted within a single province first, then radiated to the whole country, and finally realize the sharing of premium courses globally. "Bidirectional" suggests that colleges and universities on the platform serve as both users and providers of general education course resources. This indicates they can use other universities' premium general education courses while sharing courses of their own. These two features not only enable the continuous expansion of the user base of the platform, but also effectively broaden the avenue of premium general education courses and improve the utilization rate of these courses. To achieve this, the consortium blockchain-based general education course management platform should have the following functions:

1) Acquisition of students' demands for general education courses. By analyzing students' major and course selection history data, the platform can utilize data mining to provide general education course resources that align with their requirements, thus improving users' satisfaction.

2) Real-time collection and storage of general education course provision evidence of colleges and universities. Many colleges and universities have their own premium general education course resources and are willing to share them with their counterparts [14]. Such sharing, however, is limited to those with frequent exchanges or in close proximity rather than on a large scale. This situation can be accounted for by a lack of an intermediary trusted by both parties. For example, while colleges and universities are willing to share paid resources, a third-party transaction platform is absent, or while they are ready to offer free resources, the property rights of their courses cannot be protected due to a paucity of effective supervision means[1]. Therefore, the platform must also play the role of an intermediary that maintains trust among colleges and universities and collects their provision evidence of general education courses.

3) Evaluation and management of colleges and universities that use the general education course resources. This involves two major aspects. First, the quality of general education courses provided by colleges and universities should be scored both by students who select these courses and by professionals within the industry. Second, the contract fulfillment rate of all universities that use the resources should be accessed. All universities that use the platform need to strictly abide by the consensus protocol, and the consortium blockchain will regularly exclude those who violate the protocol from the blockchain. To achieve this, the consortium blockchain-based inter-university general education course management platform should be able to evaluate the quality of the course resources and the contract fulfillment rate of all colleges and universities that use the course resources. Rooted in the evaluation results, these colleges and universities can be managed better, and their respective rights and obligations can be determined accordingly[14].

4) Payment and account settlement for using general education course resources. For premium course resources that incur costs, colleges and universities that utilize these resources should pay corresponding fees to the providers to facilitate their students' free access to these resources. Whether the resources are paid or unpaid, if colleges and universities that use these resources have breached the contract, they must be prepared to incur fines as a consequence of such violations. Therefore, the platform should incorporate the functions of payment and account settlement.

5) Credit recognition of the inter-university general education consortium. For students, selecting their favorite courses and earning corresponding credits are of equal importance. Education consortiums of colleges and universities must consider the problem of credit recognition. Students are allowed to select general courses among multiple universities in the consortium blockchain. To deter them from hastily pursuing credit recognition at prestigious universities, online credit recognition and application for related certificates are instrumental. Hence, the platform should encompass not only the functions of course selection, online classes, and examinations, but also incorporate capabilities for online credit recognition applications and certificate issuance. Figure 2 details how students acquire credits and certificates through elective course study.

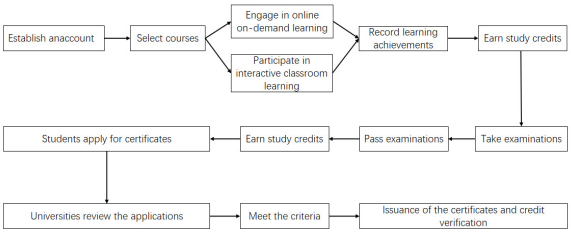


Figure 2. The process of students acquiring credits and certificates through elective course study

4. Challenges in Applying Blockchain Technology in the Education Sector

Currently, blockchain technology in China finds its

primary application in the financial sector. However, the education sector has its inherent complexity as compared to the financial field, which brings about multiple challenges to the promotion of blockchain technology in this domain.

4.1. Insufficient Relevant Laws and Regulations

China has not yet formulated relevant laws and regulations on the application of blockchain technology in the education sector, which encompasses educational data ownership and distribution of benefits, among others. Moreover, the decentralized and self-governing nature of blockchain dilutes the concept of state supervision [15-18].

4.2. Potential Constraints on Data Storage Space

At present, the adoption of blockchain technology in the field of education is still in its infancy. As the application gains momentum, there will be a surge in the volume of data. Failure to properly resolve the problem of data storage space may pose risks to data preservation, subsequently impacting users' experience.

4.3. Challenges Regarding Personal Record Privacy

Looking ahead to the future development of blockchain, the ideal scenario is one where users can find their personal records decentralizedly stored in the blockchain through a single pointer. However, the crisis of trust remains a problem that currently exists. In the current cryptocurrency framework, users may store all of their personal data online. Once their private keys are stolen or exposed, their identities can be filched [19-22].

5. Conclusion

Blockchain technology has achieved wider adoption beyond the financial sector due to its decentralized, cost-effective, and traceable features, and its application in China's education field is actively in progress. Utilizing consortium blockchains, this paper explores the sharing of general education course resources in China and proposes establishing a general education course management platform based on the consortium blockchain. The proposed platform is expected to fulfill the growing individualized needs of students and promote the sharing of resources among colleges and universities, thus contributing to the high-quality development of education.

Acknowledgments

This paper was funded by the Teaching Reform Project of Nanjing University of Finance and Economics (Project number: HLFXW22007).

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