A Review of the Application Research of "Blockchain + Education Resources"

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Abstract. Blockchain is a distributed database or record keeping system that has the characteristics of decentralization, traceability, and consensus. By utilizing blockchain technology to build a new ecosystem of educational resources, it can alleviate the current problems of high operating costs, weak copyright protection, difficult resource sharing, and low resource quality in the construction of educational resources, in order to adapt to the new requirements of open and shared resources in the era of smart education. Therefore, firstly, the main problems faced by educational resources in recent years and the opportunities brought by blockchain technology are summarized. Then, literature analysis methods are used to analyze and summarize the application research of blockchain technology in educational resources from two levels: time distribution and research problems. The analysis results show that blockchain is of great significance in solving problems such as educational resource sharing, copyright protection, and management.

Keywords: Blockchain; Education resources.

1. Introduction

Blockchain technology can provide decentralized and transparent data storage mode, through distributed accounting and storage, so that each data block containing relevant information of one network transaction obtains the same rights and obligations, through the use of distributed P2P network protocol for communication, when the node joins the center of the blockchain network, the node work stop will not affect the operation of the system as a whole, known as a distributed public ledger [1]. At present, blockchain technology has a wide range of development prospects in the fields of finance, Internet, electronic data and information security, but also has a greater application value in the field of education, promoting the open sharing of educational resources in the era of smart education, so as to achieve the intelligent use of the national public service platform for educational resources, the intelligent growth of teachers and the intelligent dissemination of teaching methods [2].

However, there is a lack of research reviews on the application of blockchain in education resources at home and abroad. Therefore, this paper will summarize the main problems faced by educational resources and the opportunities brought by blockchain technology in recent years, and through combing the existing literature, clarify the current status of research on the application of blockchain in educational resources and put forward the future research focus and direction.

2. Advantages of blockchain technology

2.1 Decentralisation

Blockchain is built on the basis of a P2P network, and the various nodes participating in the network participate in collaboration in a decentralised and peer-to-peer manner, maintaining data and reaching consensus together. There is no need for a centralised management body within the network. When a node fails or freely joins and leaves the network, the whole system can maintain normal operation, and the influence of a single body is greatly reduced.

2.2 Openness and transparency

Decentralisation enables each node to send and receive messages in the blockchain network equally. Except for the private information encrypted by each party, the complete data in the blockchain can be viewed and recorded by any node, and the operation of the whole blockchain system is open and transparent to the nodes.

2.3 Trustworthy data

The security of data is mainly reflected in two aspects: difficult to tamper with and forge, and traceable. Forgery is difficult due to the consensus mechanism, once the data is verified and written into the blockchain, it is difficult to tamper with it, while forged data is difficult for all nodes to reach consensus and thus not recognised; traceability refers to the blockchain's blockchain structure of storing data, which is conducive to finding out the history of all operations related to a certain state. The two points of difficulty in tampering and forgery and traceability, coupled with the open and transparent nature, make the data on the blockchain real and trustworthy.

2.4 Anonymity

Asymmetric encryption algorithms are used in the blockchain to protect the identity information of user nodes. What users publish to the public is only the encrypted hash address, and other users cannot read any valid information from the address, which provides privacy and security for users.

3. The current situation of blockchain application in educational resources

By screening the literature that matches the topic in the main search sources at home and abroad, classifying the temporal distribution of the literature, and conducting in-depth analysis of the research situation of the application of blockchain in educational resources from the level of the main research issues, we clarify the current situation of the research on the application of blockchain in educational resources. At the level of literature specific screening methods, this paper uses the terms ("educational resources" and "blockchain" and ("resources " or "educational resources") and "blockchain" were used as search terms in China Knowledge Network and Web of Science databases respectively; by reading the selected literature abstracts, the research By reading the abstracts of the selected literature, we eliminated the articles that did not focus on the application of "blockchain + education resources", and continuously expanded the scope of the literature according to the references in the process of reading the literature. Finally, 38 relevant articles were found.

3.1 Time distribution

In terms of time distribution, the earliest literature related to "blockchain + education data" appeared in 2018, and the application of blockchain in education resources has only started to develop in recent years, which is a relatively new field. In recent years, the number of literatures has increased year by year, which also reflects that with the rapid development of blockchain technology, the research field of "blockchain + educational resources" is gradually receiving the attention of scholars.

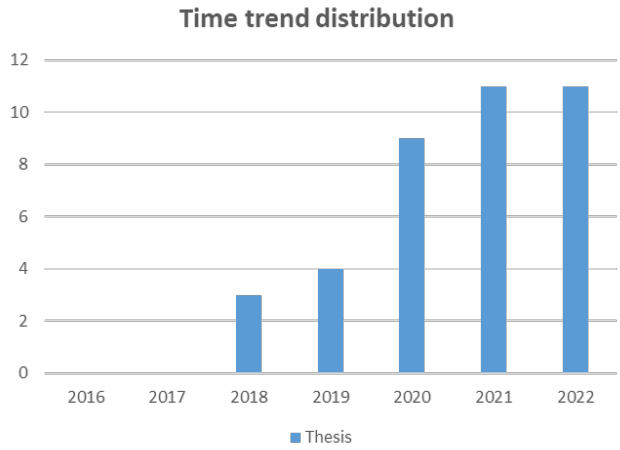


Figure 1. Time distribution

3.2 Main Research Problems

From the perspective of research issues, the application of blockchain in education resources is mainly aimed at solving three problems, namely education resource sharing, education resource copyright protection and education resource management. The research on "blockchain + education resources" is summarized in Table 1, and the largest proportion of articles is about the solution of education resources sharing, which indicates that education resources sharing is the most significant advantage brought by blockchain applied to education resources.

3.2.1 Education resource sharing

The current problems of digital education resource sharing include the relative lack of quality resources, insufficient sharing awareness, barriers to sharing technology, and the lack of dynamic monitoring and evaluation systems, etc. Based on the decentralized characteristics of blockchain technology, the previous phenomenon of asymmetric information exchange between learners and the disseminators of learning content has been improved. Liu Fengyuan [3] et al, analysed the problems in sharing digital education resources and attempted to build a framework and model for sharing digital education resources based on the blockchain concept, providing a theoretical reference for effective sharing of digital education resources and proposing a future outlook on how to improve the incentive mechanism for resource providers after they have provided resources. By analyzing the role of blockchain technology in education resource sharing, Zhou Jiping [4] et al. proposed a blockchain platform for education resource sharing and applied it in credit banking to build a digital education resource alliance blockchain, and the application has achieved the expected results after a period of stable operation. Xia Yu [5] designed a blockchain-oriented fine-grained access control and sharing model for learning resources, combining the advantages of traditional access control methods, the advantages of distributed file systems and the advantages of blockchain technology, which greatly improves the efficiency of sharing learning resources, reduces the cost of file sharing, and enhances user privacy. Based on the cloud platform, SHUKUN LIU [6] analyses the concept and importance of double precision teaching in smart teaching and constructs a basic framework for online and offline smart teaching based on blockchain technology. Based on the features of blockchain such as security and decentralization, an accurate teaching model of learning resources based on the knowledge representation of learners and teaching resources is proposed. A dual precise and collaborative strategy of precise demand perception and precise resource supply for smart teaching is proposed. A framework for smart teaching is constructed, and the accurate perception of smart teaching needs and accurate supply of resources based on big data technology are analysed.

In the future, the education resource sharing platform still needs further publicity and promotion to prompt more resource providers and resource applicants to join and enrich the platform's resource ownership and number of users. Third-party education service providers can also make use of the

credible data recorded by the platform to provide various customised services, such as: accurately recommending learning content for learners to improve their learning efficiency; connecting with education assessment agencies and introducing a certification mechanism for learning outcomes to bridge the multiple links in education and provide useful ideas for building a learning society.

3.2.2 Copyright protection of educational resources

As education informatization layout achieved its milestones and the nationwide construction of the public service platform for education resources was completed, problems in the development of digital education resources also emerged, and the increasingly serious problem of copyright is one of them. Blockchain technology is considered to be a natural fit for copyright protection due to its characteristics of being tamper-proof, easy to store and trustworthy. The following studies have been conducted on blockchain and copyright protection of educational resources:

Junqiguo [7] proposed a blockchain-enabled digital rights management system that includes a novel network architecture for sharing and managing multimedia resources for online education based on a combination of public and private blockchains, as well as three specific smart contract schemes that enable the recording of multimedia digital rights, the secure storage of digital certificates and non-mediated verification, respectively.

Ganna [8] In order to solve the problem of open teaching resource infringement in MOOC platforms, the paper proposes a blockchain-based digital copyright protection model for teaching resources. The paper's model forms an extensive intellectual property protection tracking mechanism in the MOOC platform through the decentralization, traceability and timestamp features of blockchain technology, with intelligent intellectual property data traceability to strengthen the copyright protection of open access resources. Sun Li [9] achieved fine-grained isolation of privacy information of alliance members through the channel and privacy data protection mechanism of Fabric blockchain. The next work will improve the practical application of the Fabric blockchain privacy protection mechanism. Xiong Bilin [10] takes fine-grained digital education resources copyright protection as the starting point, summarises the specific copyright protection needs of the deposition, transaction and supervision links through detailed demand analysis, constructs a fine-grained digital education resources copyright protection system for the education sector, and uses blockchain, digital fingerprints, smart contracts, cryptography and alliance chains to design a fully functional and better-performing digital education resources copyright protection chain.

In the future, the specific privacy protection needs of different scenarios in the operation of the resource alliance can be analysed and various privacy security needs can be met by formulating a series of flexible combination of privacy protection mechanisms.

3.2.3 Educational resource management

Currently, blockchain is becoming increasingly mature and has different potential applications in different aspects. How to use blockchain to optimize educational resource management for the development of education is an important issue that needs to be seriously studied. According to the different characteristics of blockchain, analyse the application value of blockchain in the management of education resources in colleges and universities, explore the problems that may be encountered in the application of blockchain and propose corresponding solutions, so as to improve the quality and efficiency of the management of education resources in colleges and universities.

Yujiao Hou [11] proposed a new architecture for smart university data collection and management based on a blockchain network, enabling faculties, students, teachers and external organisations to access data in real time, while ensuring data authenticity and privacy. In future work, we will further explore the implementation of the proposed architecture through the integration of the Fabric federated chain to develop an advanced data sharing and storage network to improve the management of smart universities. Yadu Yang [12] proposed the concept of a resource blockchain to express a concrete form of knowledge that can be expressed through a conceptual model - online learning resources - in an immutable and tamper-proof manner. This paper discusses the general structure, building elements and basic functions of the resource blockchain, and gives a prototype

implementation of an online learning resource blockchain within an enterprise or organisation, discussing the basic functions it has for resource management, based on a fully considered and selected modelling implementation environment. In her master's thesis, she also designed the operational mechanism of a digital education resource management system based on the Fabric federated blockchain. It enables the secure storage and sharing of digital education resources.

The introduction of blockchain technology into digital education resource management systems is currently a new exploration. Currently, there are problems such as loopholes in technical security and risks on the way of implementation, insufficient storage space and reduced network performance, weak technical standards and incomplete regulatory system, etc., which need to be overcome one by one.

4. Conclusion

This paper summarizes the main problems of educational resources and the opportunities brought by blockchain technology in recent years through a structured literature review, and analyzes and summarizes the research on the application of "blockchain + educational resources" from two levels: time distribution and research issues. The analysis results show that the research on blockchain + education resources is increasing year by year, and blockchain technology is important for resource sharing, copyright protection and resource management of education resources. Most of the available literature is about the simple application of blockchain technology, which is not combined with the current big data, machine learning and intelligent education.

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