Advances in Educational Technology and Psychology (2020) 4: 48-51
Clausius Scientific Press, Canada
DOI: 10.23977/aetp.2020.41009
ISSN 2371-9400

Technical Challenges & Countermeasures of Blockchain Technology Application in Lifelong Education

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Keywords: Education Informatization 2.0; Blockchain Technology; Lifelong Education; Technical Challenges; Countermeasures

Abstract: The Ministry of Education of China released the Action Plan of Education Informatization 2.0 which put forward the blueprint and prospect of the application of information technology including blockchain in the open lifelong education. For the existing blockchain technology, there are still limitations and challenges in solving the problems of large amount of educational resources data and huge scale of learning groups which are unique to the open lifelong education. In this paper, five aspects are analyzed and corresponding countermeasures are put forward.

1. Introduction

The Action Plan of Education Informatization 2.0 issued by the Ministry of Education of China puts forward the idea of actively promoting "Internet plus Education", insisting on the core concept of deep integration of information technology and education, adhering to the basic principle of application driven and mechanism innovation, establishing and improving the sustainable development mechanism of educational informatization, and building a learning society in which everyone can learn everywhere and can learn from time to time. The plan puts forward the blueprint and pospect of the application of information technology including blockchain in open lifelong education, but this study believes that there will still be many challenges in the application and implementation process. For the existing blockchain technology, there are still limitations and challenges in solving the problems of large amount of educational resources data and large scale of learning groups unique to open lifelong education. This paper analyzes and puts forward corresponding countermeasures.

2. Contract Modeling and Implementation Methods for Educational Rules and Regulations Need to be Developed Urgently

Compared with the strict supervision of the traditional education system, the open lifelong education based on the Internet lacks strict administrative constraints and unified standards, which may be difficult to achieve in the short and medium term. Even though the blockchain smart contract technology can ensure the transparent and compliant implementation of education rules and

regulations, the implementation only has a unique and irreversible result, so the correctness of its code becomes the key. In other industries, there are successful templates for smart contracts, but there are obvious differences between education and other industries, so we can't simply copy contract templates directly. At present, the contract modeling method and code correctness verification mechanism are specially suitable for the rules and regulations in the field of education have not yet appeared. The efficiency of the serial execution method of the existing blockchain smart contract technology is low, so it is difficult to popularize and apply in the field of open lifelong education. Therefore, it is necessary to develop a suitable and efficient intelligent contract modeling and execution method for the real situation of the development education field [1]. In order to improve the efficiency of the blockchain system applied in the field of lifelong education, we can consider using concurrent execution to improve the execution efficiency of smart contracts [2].

3. Single Node Storage Capacity Will Limit the Storage of Data

Blockchain is a distributed ledger maintained by many parties. In order to effectively prevent one party from tampering with data, the system adopts the data distribution mode of full replication, and each participant maintains a complete copy of data. This data distribution mode results in the storage capacity of a single node, which limits the overall storage capacity of the system. In the field of open lifelong education, most of the learning resources are in the form of courseware, pictures, video, audio and other multimedia, which has a huge demand for storage space. However, the full replication data distribution mode of the existing blockchain system is difficult to meet the demand. In the face of the large demand for storage capacity of open lifelong education resources, it is necessary to redesign the storage and distribution mode of block data [3][4].

4. The Number of Nodes Supported by Consensus Protocol Is Insufficient

In order to ensure the data consistency among untrusted parties, voting based PBFT consensus protocol is generally used in coalition chain to achieve multi-party consensus. However, due to the limitation of the complexity of PBFT algorithm, the existing PBFT consensus protocol can only support no more than 20 nodes [5]. However, the open lifelong education system based on the internet has a large number of educational subjects, training institutions and learners of various types. The existing consensus agreement of blockchain is difficult to form a strong support for large-scale nodes. Therefore, it is necessary to design a consensus protocol for large-scale nodes.

5. The Privacy of Learning Users Is Not Well Protected

It is the core requirement of open lifelong education for blockchain system to record learners' learning behavior and learning achievements. At the same time, in order to realize the mutual recognition of learning achievements between different education platforms, it is also necessary to share the academic credit archives through the blockchain system. In order to ensure the openness and transparency of data and process, the existing blockchain system uses digital signature to prevent tampering of data, but the data itself is stored in plaintext [6][7]. This is not conducive to the protection of learners' privacy, but if the data is stored in cipher text, it will affect the efficiency of data use and analysis. Therefore, it is necessary to balance the security and availability of data, and design a user privacy protection strategy suitable for open lifelong education application scenarios [8].

6. The Verification Query Function of Light Client Needs to be Improved

For the large-scale open lifelong education system, the existing blockchain has limited computing and storage capacity, which makes it difficult for all education participants to save a complete block data as a whole node. Usually, learners use mobile devices such as mobile phones or personal computers to participate in blockchain activities in the form of light users, while the light users only partially save the verification information. When users query, the information is forwarded to the whole node for execution, and then the results are returned. Finally, only the completeness and correctness of the returned results need to be verified [9]. The existing design of light client only supports simple payment verification, which is not suitable for the complex query faced by the developmental lifelong education system. Therefore, it is necessary to improve the design and enhance the query verification function, so as to ensure that light users can effectively participate in the operation of the whole blockchain system.

7. Conclusion

With the rapid development of open lifelong education, the activities of teaching and learning are becoming more and more flexible, gradually getting rid of the constraints of time and space, bringing convenience to learners. But at the same time, open lifelong education has the characteristics of less administrative constraints and complicated data access, which is easy to cause various problems and face many technical problems. This paper analyzes five technical challenges, and puts forward the corresponding countermeasures, in order to promote the sustainable development of lifelong education.

Acknowledgements

This work was supported by Guangdong Province Educational Science Planning Project “Study on Blockchain Technology Application Mode in Lifelong Vocational Education under Perspective of Education Informatization 2.0” (No. 2018GXJK311), Educational Reform and Research Project of China Society of Logistics (No. JZW2020214).

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