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Article

Research on the Application of Vocational Education Informatization from the Perspective of Blockchain Theory

Lianchao Zhang [1,*]

[1] Graduate School, University of the East, 2219 Recto Ave, Sampaloc, 1008, Manila, Philippines
* Correspondence: Lianchao Zhang, Graduate School, University of the East, 2219 Recto Ave, Sampaloc, 1008, Manila, Philippines

Abstract: Action plan for education informatization 2.0 the Ministry of Education puts forward actively explore block chain technology application, to promote vocational education informatization goal task, a new chapter of teaching vocational education informatization, with the aid of block chain technology can make the professional education in the teaching management information opaque, vocational education "1 + X" certificate of authentication, such as teaching evaluation risk problem is resolved. How to use blockchain technology in vocational education and teaching needs further thinking and research. On the basis of expounding the connotation and significance of the application of block chain technology in vocational education, this paper analyzes the current situation and problems of the application of block chain technology, and makes a strategic analysis on how to better realize the application of block chain technology in vocational education.

Keywords: blockchain technology; vocational education; teaching system; "1 + X" certificate

1. Introduction

The "Education Informatization 2.0 Action Plan" (Education Technology [2018] No. 6), released by the Ministry of Education in 2018, clearly proposes the active exploration of blockchain technology application and the promotion of vocational education informatization. As an emerging technology in the field of informatization, blockchain technology is developing rapidly. In 2016, the State Council issued the "13th Five-Year Plan for National Informatization", which emphasized the strategic importance of blockchain technology as a frontier technology. In October 2019, the Chinese leadership studied the development of blockchain technology and discussed its future trends, pointing out the need to accelerate the integration of blockchain with cutting-edge technologies such as artificial intelligence, big data, and the Internet of Things. The plan also highlighted the importance of exploring the application of "blockchain+" in areas such as people's livelihoods, education, employment, targeted poverty alleviation, and healthcare.

Currently, the application of blockchain technology in vocational education worldwide is still in its infancy, with only a few vocational institutions having actively explored its use. As one of the major technological fields, blockchain has gradually received widespread attention in vocational education and teaching. However, certain challenges are inevitable in the process of applying blockchain technology, and its core value has not been fully explored. In response to this situation, this article briefly discusses the application of blockchain technology in vocational education and teaching informatization, comprehensively analyzes its effectiveness and existing problems, and proposes improvement strategies to promote the deeper integration of blockchain technology into vocational education teaching.

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2. Overview and Significance of Blockchain Technology and Vocational Education Informatization

2.1. Overview of Blockchain Technology

Since Satoshi Nakamoto introduced blockchain in his 2008 paper, blockchain technology has evolved over just over a decade from being mistakenly associated with "pyramid schemes" to gaining worldwide popularity. Various industries have invested significant manpower, material, and financial resources in blockchain research, aiming to integrate its core advantages into their fields and bring new opportunities. Blockchain technology utilizes a chain-like data structure to verify and store data and employs distributed node consensus algorithms to generate and update data [1]. This information management approach has five main advantages, as shown in Figure 1.

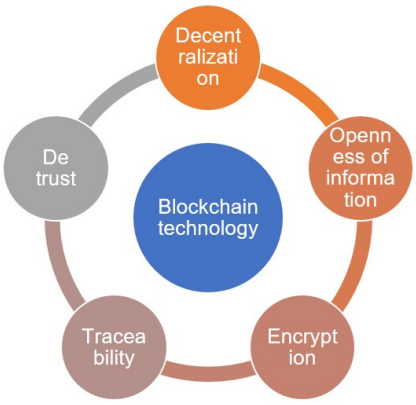

Figure 1. Advantages of blockchain technology.

1) Decentralization: Blockchain technology does not have a central node and does not require regulatory agencies. All nodes are peer nodes, and peer-to-peer transactions can be directly agreed upon by all parties involved.
2) De-trust: Blockchain technology adopts a consensus mechanism, and every transaction is witnessed by all participants. Neither party can revoke or modify the transaction.
3) Openness of information: The data on the blockchain is collectively maintained, with only the private data of the parties involved in the transaction being encrypted and stored. All other data is publicly transparent.
4) Traceability: Data on the blockchain is stored in a distributed manner, and each transaction is stamped with a timestamp, ensuring that every transaction is traceable.
5) Encryption: The chain data storage structure encryption method makes the data in the blockchain less susceptible to tampering, enhancing data reliability, effectively preventing information distortion, and enabling parties to quickly establish trust [2].

2.2. Informationization of Vocational Education Teaching

Informationization has become one of the most important productive forces across various industries, and vocational education teaching informatization is a core component of vocational education. Teaching informatization is not simply the addition of information technology to education, but the integration of modern technologies into every stage of vocational education, from course design to assessment.

As the core task of vocational colleges, teaching work, vocational education informatization provides reliable support for teachers to improve their teaching abilities. The informatization of vocational education teaching includes the application of information technologies such as computer technology, multimedia networks, blockchain,

big data, and cloud computing in course design, classroom teaching, homework submission and grading, after-school tutoring, mid-term and final assessments, teaching evaluations, and educational research. Examples of emerging technologies used in vocational education and teaching in the era of big data include remote vocational education, situational teaching, virtual experiments, and cloud classrooms [3].

2.3. The Significance of Applying Blockchain Technology to Vocational Education and Teaching

As a new model of computer technology, the application of blockchain technology is still in its early stages but is poised for significant growth. Its value is increasingly recognized by various industries and plays an important role in solving industry-specific problems. In October 2016, the Ministry of Industry and Information Technology issued the "White Paper on the Development of Blockchain Technology and Applications in China", which pointed out that "the transparency and tamper-proof characteristics of blockchain systems are fully applicable to areas such as student credit management, enrollment and employment, academia, qualification certification, and industry-university cooperation, with significant value for the healthy development of education and employment". Therefore, exploring the application of blockchain technology in vocational education and teaching and improving the quality of vocational education is both urgent and full of potential [4].

3. The Application of Blockchain Technology in Vocational Education Teaching

3.1. Establish a Vocational Education Teaching Management System Based on Blockchain Technology

In the process of vocational education teaching, various types of information are generated, such as student training programs, student training plans, curriculum standards, curriculum plans, teaching process records, student homework data, attendance records, regular grades, mid-term and final grade reports, and teaching achievement analysis. Some of this information needs to be made available to all teachers and students, while others are internal materials that should remain confidential. Managing such vast amounts of teaching information can be cumbersome. The technological transformation of vocational education can be addressed by constructing an information management platform based on blockchain encryption technology. Communication among various teaching departments and the exchange of information between different educational links can be facilitated through a teaching management system based on blockchain technology. All teaching management tasks can be centralized within this system, and various teaching data can be classified. To prevent information leakage, permissions can be assigned according to the responsibilities of each department within the vocational colleges. Ordinary teaching users and student users will only have access to publicly available materials, as shown in Figure 2 [5].

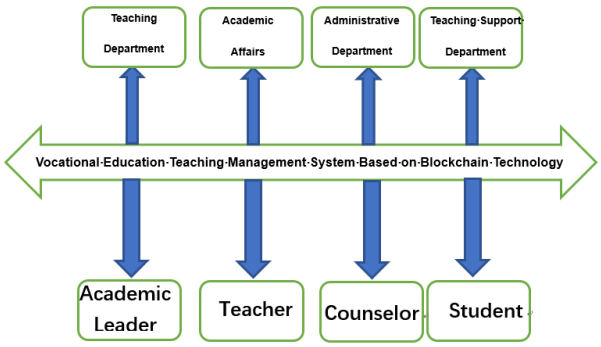

Figure 2. Structure diagram of vocational education teaching management system based on blockchain technology.

3.2. Exploring New Teaching Models for Vocational Education Based on Blockchain Technology

The decentralization, trustlessness, openness, encryption, and traceability features of blockchain can transform the teaching philosophy in vocational education. By integrating blockchain technology into the development of vocational education resources and the evaluation of educational processes, vocational education teachers and students can build blockchain-based vocational education teaching resources.

Teachers can utilize blockchain's distributed data storage structure to treat each chapter or knowledge point as a node in the vocational education system, publishing it within the blockchain teaching platform. This ensures the sharing of classroom resources. Furthermore, every activity of vocational education students in their classes becomes a node in the system, with blockchain technology stamping every node to prevent tampering. This teaching model not only captures the process of student learning but also guarantees the authenticity of the learning outcomes [6].

3.3. Building a "1+X" Certificate Authentication System for Vocational Education Based on Blockchain Technology

The growth and development of vocational education students differ from other education systems, with academic and vocational qualification certificates (the "1+X" mechanism) serving as important indicators of a student's abilities. In recent years, employers have increasingly preferred to hire vocational education graduates with vocational qualification certificates. However, many employers lack the ability to verify the authenticity of these certificates. Currently, vocational education graduates are required to register with the relevant industry authority after obtaining their qualification certificates. This process has led to concerns regarding the authenticity of certain vocational qualification certificates. Additionally, due to the broad range of student groups in vocational education, various industries are conducting vocational qualification certifications, making it difficult to fully record and securely verify these qualifications in a way that is tamper-proof and accessible to employers. These challenges currently plague the vocational education "1+X" certification process.

Blockchain technology's openness, traceability, and encryption capabilities can be applied to the "1+X" certificate authentication process, providing a secure and transparent record of vocational education students' learning progress, internship performance, training experience, and vocational qualifications. As shown in Figure 3, this certification system allows employers, schools, students, and vocational qualification authorities to access comprehensive records of students' academic achievements and practical abilities. This system offers a potential solution to the issues faced by vocational education students in obtaining recognized vocational qualification certificates, reducing the risk of fraud, loss, substitution, and other forms of malpractice. It guarantees the authenticity of vocational education "1+X" certificate certifications [7].

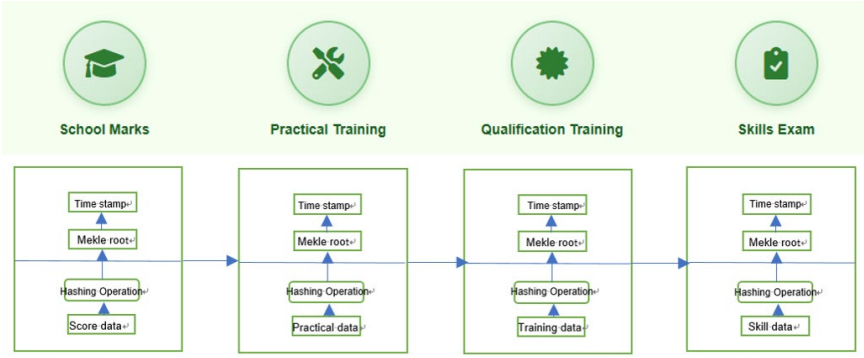

Figure 3. Blockchain Structure of Vocational Education "1+X" Certificate Authentication.

3.4. Establishing a Risk Management Framework for Vocational Education Teaching Based on Blockchain Technology

The decentralized nature of blockchain technology can mitigate risks in vocational education and teaching. By recording all teaching and management information in real time within a blockchain-based management system, and stamping each entry with a timestamp, the system can identify any discrepancies between the teaching materials and actual files at various stages of education. If discrepancies are detected, the system will automatically notify the management team and issue a warning. Management personnel can review the flagged issues according to system prompts, identify the cause of the problem, contact the relevant teaching units for resolution, and once corrections are made, the system will automatically remove the warning [8].

4. The Problems Faced by the Application of Blockchain Technology in Vocational Education and Teaching

4.1. Exaggerating the Concept of "Blockchain"

When new technologies emerge, they are often idealized or seen as all-powerful, leading to phenomena such as "application fever" and "learning fever" Concepts like "blockchain technology is at the forefront" are commonly heard. In reality, however, blockchain technology is not a single, unified technology; rather, it is made up of a range of technologies and is still in its infancy. While blockchain holds great potential, its application in vocational education and teaching is still in the exploratory stage, and it will take time before it can be widely implemented [9].

4.2. Weak Awareness of New Technologies

The application of blockchain technology plays a crucial role in advancing modern vocational education. However, some vocational education institutions focus primarily on traditional education and teaching, neglecting the development and integration of modern technologies, particularly blockchain, which is not fully recognized within the industry. As a result, blockchain is often overlooked and excluded from the scope of exploration and research. Traditional teaching methods continue to dominate the vocational education process, which may lead to a gradual disconnection between vocational colleges and the rapidly evolving demands of society [10].

4.3. Insufficient Implementation Foundation

To fully leverage the unique advantages of blockchain technology, a solid foundation of extensive data support and timely data collection is required. These factors are also essential for realizing big data informatization in vocational education and teaching. However, in China, the basic data infrastructure for big data in vocational education is still underdeveloped and of low quality. Information asymmetry remains a significant issue, affecting the accuracy and real-time nature of data, which are critical for effective teaching management, evaluation, and achievement recognition. Collecting this basic data requires significant time and financial investment, and such efforts need to be accumulated gradually from various teaching processes [11].

4.4. Lack of "Blockchain Technology" Talent

The application of blockchain technology in vocational education is still in its early stages, and vocational colleges differ from traditional higher education institutions in that they prioritize vocational skills training over scientific research cultivation. As a result, many vocational colleges lack professionals with expertise in blockchain technology. Blockchain requires knowledge in areas such as cryptography, operations research, computer science, mathematics, and software development. Most of the professionals with blockchain expertise are recruited from high-paying institutions like universities and

research organizations. Moreover, the long development cycles of systems like vocational education and teaching platforms make it unrealistic to expect the recruitment of specialized talent at short notice. Blockchain technology and computer software are distinct fields, and simply understanding how to use computers or software is far from sufficient. At present, the lack of specialized technical talent makes it difficult for blockchain technology to fully realize its potential in vocational education [12,13].

5. Improvement Strategies for the Application of Blockchain Technology in Vocational Education Teaching

5.1. Properly Viewing "Blockchain Technology"

As an emerging technology in its early stages, blockchain technology cannot solve all the problems in vocational education and teaching. However, we should not overlook its value and significance in the research and development of vocational education and teaching simply because of its current limitations. A balanced approach should be adopted: we need to maintain a critical yet encouraging attitude toward blockchain technology. In exploring its application in vocational education, we must correct our perspective, find its appropriate role, and embrace the transformative potential of emerging technologies with an open and optimistic mindset [14].

5.2. Enhance Awareness of the Application of Blockchain Technology

Vocational colleges should give full attention to the application of blockchain technology in vocational education by establishing corresponding teaching management systems and professional departments. In response to the influence of emerging technologies, vocational colleges should focus on strengthening the training of new, multidisciplinary talents, providing solid support for their initiatives. Only by improving the overall teaching quality of vocational education in the era of big data can blockchain technology make a significant contribution [15].

5.3. Accelerating the Construction of Blockchain Infrastructure

The rise of blockchain technology is set to bring substantial changes to vocational education and teaching. Vocational colleges should recognize the potential of blockchain in vocational education, increase investments in both human resources and funding, and strengthen collaboration with universities and research institutions. They should promote the research and development of new technologies and encourage vocational education teachers to acquire knowledge in big data and blockchain. This may involve recommending that teachers pursue further studies at universities and research centers specializing in these areas. Additionally, efforts should be made to improve the collection of foundational information in vocational education, which will lay the groundwork for the construction of a blockchain-based teaching management platform [16].

5.4. Cultivate Blockchain Technology Talents

Universities and research institutions should offer blockchain-related courses and train high-level professionals in this emerging field. The integration of blockchain technology into vocational education is not simply a matter of merging two fields; it requires specialized knowledge and theoretical expertise in blockchain, as well as proficiency in areas such as cryptography, operations research, computer science, mathematics, software development, and more. Cultivating these talents is essential to ensuring the effective application of blockchain in vocational education [17].

6. Conclusion

With the continuous advancement of modern technologies such as 5G, blockchain, big data, artificial intelligence, the Internet of Things, and cloud computing, it is expected

that blockchain technology will play an increasingly important role in vocational education in the near future. A vocational education teaching management system based on blockchain architecture can make vocational education practices more open and transparent. Teachers and students will be able to access the data they need through this system. In the certification process of the "1+X" vocational education certificate, blockchain will oversee the entire process, involving enterprises, schools, students, and vocational qualification authorities. The decentralized nature of blockchain technology can also reduce the risks associated with vocational education and teaching. The widespread application of blockchain in vocational education will not only enhance the informatization of vocational education but also improve teaching quality and foster the healthy development of the field.

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