

# Exploration of the Credit Recognition Mechanism Led by O2O Education Model under the Background of Blockchain

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**Abstract:** This article addresses the issue of insufficient trust in online learning platforms, particularly the lack of recognition of online learning by universities. By analyzing the characteristics of online education platforms, it proposes the integration of blockchain technology, utilizing its decentralized and tamper-proof nature. The idea is to form an online learning certification alliance with online learning platforms, universities, and authoritative organizations, jointly developing and certifying credit recognition rules. This approach aims to break down trust barriers between different organizations, enabling the recording of student learning processes on the blockchain. This results in a secure, transparent ledger that is difficult to alter, facilitating the sharing of resources and traceability of learning records. The establishment of an O2O learning model recognized by the alliance will promote the integration of online and offline education models in universities, offering significant practical significance and broad application prospects for inter-university credit recognition in China.

**Keywords:** Blockchain Technology; O2O Education Model; Information Security; Data Trustworthiness; Inter-University Credit Recognition

## 1. Introduction

Blockchain technology is a distributed ledger system that uses decentralized infrastructure, encryption, and distributed storage consensus technology to prevent tampering. Since the concept of blockchain was proposed in the 2008 Bitcoin white paper, it has attracted widespread global attention. In recent years, sectors like banking, insurance, the Internet of Things, and healthcare have begun actively

exploring blockchain applications. Amidst this surge, the field of intelligent education is also facing an industry transformation based on blockchain. Although the application of blockchain in education is still in its early stages, its three key features - authenticity, decentralization, and traceability - are set to bring an era of more precise, refined, and high-quality learning services.

The O2O (Online To Offline) teaching model, a combination of "Internet+ classroom" education, integrates the advantages of both online and offline teaching methods. In recent years, China has established many online teaching platforms such as MOOCs (Massive Open Online Courses) and SPOCs (Small Private Online Courses), gathering a large number of high-quality educational resources. Especially during the uncertain phases of the global pandemic, online teaching platforms have played a crucial role. However, the changes that online teaching has brought to traditional university education are limited. Upon examination, the issue appears to be a lack of trust. Analyzing online MOOC platforms like "Chinese University MOOC", it's evident that although they have a distinct resource advantage, learning is only certified by online platforms and not recognized by offline universities, still constrained by inter-university credit transfer issues.

## 2. Characteristics of Blockchain Technology and its Current Application in the Field of Education

### 2.1 Characteristics of Blockchain Technology

Blockchain technology is a distributed database that stores data in a chain-like structure in chronological order. It adds data through consensus mechanisms and uses cryptographic technology to ensure data authenticity and immutability. Furthermore, it

sets the logic for data operation through smart contracts. Blockchain has several core features, including being distributed, decentralized, immutable, traceable, smart contracts, and encrypted protection [1]. The technology stores data across multiple nodes in the network, avoiding the risks of single-point failures and centralization. Every node possesses equal rights and status, which enhances the blockchain's security and credibility, preventing single-point failures and manipulation. Data is recorded on continuously growing, immutable blocks, each containing a batch of transactions linked in chronological order. Each block includes the hash value of the previous block, forming a time-sequenced chain-like structure [2]. No one can modify the transaction information once it is recorded on the blockchain.

## 2.2 Current Research on Blockchain in the Field of Education

In the field of education, in 2017, the Hobton School of Software Engineering in the United States granted course-oriented certification data through blockchain technology, and began to share education-related information on the public chain; the Institute for Future Education (IFTE) and the American College Entrance Examination (ACT) Foundation proposed the "Learning As Earning" project, which aims to use the distributed storage technology of blockchain to record the learning trajectory of students at various stages, as a resume for job interviews, and to become the selection of talents by employers important reference[3]. In 2017, the European Commission Joint Research Center released a report titled "Blockchain in Education", stating that the application of blockchain technology may change the traditional operation mode of educational institutions, improve work efficiency, reduce operating costs, and improve related records. Authenticity and security can be specifically applied to digital authentication, multi-step authentication, automatic recognition and credit transfer, on-campus payment, and financial aid to students. Sony Global Education has partnered with IBM to develop a blockchain platform that can support educational institutions to record students' academic achievements and other appropriate information on the platform's ledger, creating an undeniable record of learning. In the 22nd

Global Chinese Computer Education Application Conference (GCCCE2018) in 2018, Professor Hu Qintai, Vice President of South China Normal University in Guangzhou, China, expressed in his keynote speech that the era of Industry 4.0 will bring new changes in education. "Blended learning will go mainstream and students will move from consumers to creators". Inevitably, the field of intelligent education will also usher in an industry change based on blockchain. Although the application of blockchain in the field of education is still in its infancy, its three important characteristics of authenticity, decentralization and traceability will make education enter a "more accurate and refined high-efficiency and high-quality learning service" era". In recent years, multiple measures have been introduced to actively promote credit mutual recognition among universities, and gradually improve the mechanism for online credit recognition. The ministry is exploring effective methods based on new technologies such as blockchain for recording, transferring, exchanging, and certifying intelligent learning outcomes. This is part of the effort to develop a ubiquitous and intelligent learning system, advancing the deep integration of information and intelligent technology throughout the teaching process, and creating a new growth pole in international competition for educational development. Universities are encouraged to recognize credits inter-institutionally, actively promoting online credit recognition, guiding students to actively choose high-quality online courses during the pandemic control period, and formulating measures for the recognition and conversion of credits earned through online courses.

In summary, the integration of blockchain and education has already garnered significant attention and focus from the Important departments and educational institutions. Although the application of blockchain in the field of education is still in its preliminary stage, with the maturation of technology and measures support, blockchain is expected to bring more credible, transparent, and efficient solutions to education. This advancement will drive educational reform and innovation, creating more value and opportunities for students and educational institutions [3].

### 3. Issues with Credit Recognition in Online Education

Credit recognition, to some extent, helps in integrating high-quality resources, coordinating allocations, and promoting the balanced development of higher education in China. In recent years, Chinese universities have actively advanced pilot projects for credit recognition and have made certain progress in their implementation and exploration. However, the widespread promotion of credit recognition still faces challenges and limitations, primarily due to constraints in course quality, recognition technology, and geographical locations. Most credit recognition activities are limited to elective courses within the same city or similar institutions. With the rapid development of MOOCs in China, online platforms have amassed a large number of quality resources. Literature review [4-6] indicates that utilizing online MOOCs for inter-university credit recognition is becoming a hot issue of universal concern among universities. However, credits earned through traditional MOOCs are not widely recognized by universities, and seldom can they be converted into university credits. The main reasons are as follows:

(1) Lack of standardized norms in the credit recognition mechanism. Universities have not formed alliances, and the standards for credit allocation and quality are not standardized. There is no uniform standard, and a lack of regulation exists both across institutions and within them. Discrimination and inequality among different levels and types of universities pose additional challenges in cross-university credit recognition [7].

(2) "Insufficient trust" between universities and platforms. Firstly, the data information in various stages of MOOCs is fragmented, with low security, limited information exchange, and prone to creating information silos and risks of tampering. When issues with learning records arise, it is difficult to quickly identify the source of the problem. Secondly, regulatory oversight of MOOC learning platforms is still insufficient. Issues such as students gaming the system for grades [8], indiscriminate course selection, video autoplay, and cheating in online exams are still unaddressed.

(3) Low participation in cross-university courses. Students lack trust in the model of

earning credits through cross-institutional study. The platform lacks feedback information [9], and university administrators and teachers are unable to understand student needs online. Students participating in cross-institutional studies are less active in online courses. They mainly watch videos and browse information, occasionally expressing personal opinions but rarely initiating questions or engaging in course discussions [10].

### 4. Establishing an Online Education Alliance to Address "Trust" and Credit Recognition Solutions

#### 4.1 Integrating Blockchain Technology to Foster Mutual Trust between Universities and Online Learning Platforms, Facilitating Online and Offline Credit Exchange

Implementing a blockchain-based online education system ensures the security of the online education system and increases the credibility of the learning process, grade recognition, and certificate information. To adapt to the online and offline teaching models of universities, university teachers initiate online course selection applications, which are reviewed by academic administrative staff. Teachers organize offline tutorial classes and exams, and activities like scanning test papers into the system. All offline learning activity grades are uploaded, reviewed by academic administrators, and then submitted to the blockchain for storage. This process ensures that learning outcomes are jointly certified by universities and platforms, traceable, and immutable, resolving the certification issues of online learning platforms. Consequently, it establishes mutual trust in online and offline education, provides technical support for the exchange of online and offline credits in universities, promotes changes in the existing educational structure, and makes universities more adaptable to the development of information technology.

#### 4.2 Adopting Distributed Learning to Overcome Geographical Limitations in Inter-University Credit Recognition

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Similar universities form alliances, where one university provides online learning and homework resources, and the others provide certification. This promotes the sharing of

high-quality online resources and prevents the duplication of similar resources across universities. Utilizing distributed ledger technology, customized connections between learners and resources are established based on specific characteristics of learners. In educational resource transaction processing, the distributed nature of the technology is used for decentralized network storage, realizing a peer-to-peer link between learners and resources based on blockchain, reducing unnecessary access and resource waste. In a distributed learning environment, the traditional focus of educational services in a single university setting is broken, enabling learners to study at any location, record their complete learning process, and obtain effective learning certification. This promotes a transformation in the education system. For course assessments, universities in the same city can utilize their geographical advantage to complete exams and record them on the blockchain. Provincial alliance universities can jointly establish rules for offline exam recognition. This effectively overcomes geographical limitations in university credit recognition, promoting balanced development among Chinese universities, and aiding in the promotion of national and even international inter-university credit recognition.

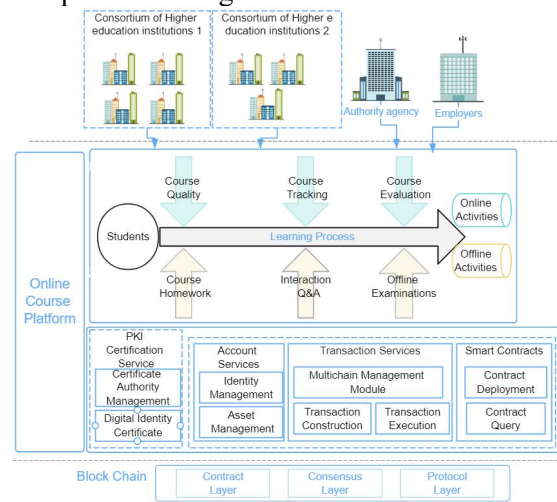
### 4.3 Construction of Online Learning Credit Recognition Mechanism

To implement credit recognition for online learning, the collaborative efforts of authoritative institutions, learning platforms, universities, and enterprises are required. Learning platforms offer technical and data support through consortium blockchains, and universities ensure the outcomes of offline activities. These combined efforts support a credit recognition mechanism for online learning, centered around the student learning process, as illustrated in Figure 1.

In this mutual recognition mechanism, centered around the student learning process, multiple organizations collaborate to break down trust barriers between them. This forms an online and offline course learning alliance certification platform, which is reflected in the following aspects:

(1) Important departments support for Comprehensive Regulation of Online Credit Recognition

Credit recognition should be guided by Important departments and regulated by authoritative institutions. In the absence of specific requirements, universities should independently explore credit recognition. Inter-university, intra-university, or online credit recognition work requires the establishment of scientific and reasonable credit recognition systems and standards, along with comprehensive regulation.



**Figure 1. Alliance Credit Recognition Mechanism**

(2) Establishment of a Multi-Entity Alliance, Flexible Formation of Alliances by Similar Institutions

Guided by the goal of student development, similar institutions should form certification alliances, building a multi-chain, multi-channel consortium blockchain model. Universities within the alliance establish mutual trust and recognition. A distributed system model is constructed among the participating entities, with identity authentication and data encryption applied between nodes. Consensus algorithms and smart contract engines are utilized to resolve the integration of online platforms and offline classroom exams of similar institutions. The student's learning process and outcome data are recorded separately, addressing the coordination of on-chain and off-chain data. This achieves the association and consistency between blockchain data and all traditional trusted information systems [11].

(3) Focusing on Recording the Student Learning Process to Meet Individual Development Needs

Utilizing blockchain technology, cryptographic principles, and distributed consensus

mechanisms, information such as student identity, teacher qualifications, course quality certification, and learning records that require validation are recorded on the blockchain. This creates a secure, transparent ledger that is extremely difficult to alter. The approach adapts online teaching content to university training programs, ensuring that students' online and offline learning, homework, and assessment records are traceable and verifiable. This promotes the integration of online and offline educational methods in universities and advances the improvement of the O2O education model to facilitate the exchange of online credits with university credits [12].

#### (4) Based on Course Quality, Guaranteed by Assessment Mechanisms

Online courses involve the joint certification by alliance members in aspects such as student identity verification, teacher qualification authentication, course quality certification, learning process verification, and learning outcome certification. These are recorded on the blockchain, forming a secure and transparent ledger that is difficult to alter, ensuring the quality of online courses. This establishes a credible model of consensus learning across universities, both online and offline. The student's learning process, outcomes, and the validation process of these outcomes are preserved. After student applications and verifications, the results can be entered into the corresponding university's grade database, achieving a combined storage method that integrates on-chain and off-chain elements.

### 5. Conclusion

The establishment of a credit recognition and conversion mechanism within university learning platforms provides students with a bridge to broaden their knowledge paths and promote personal growth. Detailed information such as the learner's basic information, learning process, temporal characteristics of learning, cognitive process, and learning evaluation records are stored in the system using a distributed recording method. While ensuring information security, this data can be shared with employers, providing reliability and credibility for inter-university credit recognition. Utilizing the characteristics of blockchain technology is beneficial in reflecting the equitable development of

education, making a positive contribution to the development of China's educational cause.

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