

# Application of Blockchain in Chinese Education and Teaching

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## Abstract

Since the outbreak of COVID-19, people's working, living, traveling and education have been greatly affected and the epidemic disease lasted for a long time. In response to this widespread public health event, countries around the world have tightened their visa policies, and many offline courses have been converted online. It will lead to the largest and far-reaching educational ecological change. This historic change will inevitably result in significant revolutions in teaching mode, resources, methods, content, performance evaluation, etc. In recent years, with its unique advantages, blockchain technology has attracted more and more attention from scholars and technicians. The application of blockchain in education has also shifted from theory to practice, showing a trend of refinement and concretization. This paper introduces the concept, technology and characteristics of blockchain technology, expounds the typical application scenarios of blockchain in the field of education at home and abroad, and designs a comprehensive platform for Chinese education which based on blockchain technology. This paper discusses the possible problems and solutions, in order to provide a reference for the innovation mode of blockchain in teaching Chinese as a second language.

## Keywords

Online Chinese teaching; Blockchain technology; Intelligent education; Big data.

## 1. Introduction

In recent years, under the guidance and promotion of the United Nations, the European Union and other international organizations have issued a series of policy documents on blockchain, exploring blockchain technology and its application in depth, making blockchain one of the biggest outlets in the world. At the same time, blockchain technology is bringing subversive changes to all walks of life. Its application has gradually extended from the financial field to the medical, legal, educational and other fields. Entering the stage of informatization 2.0, the form of education and teaching is more open, ubiquitous and intelligent. There are some rapid development new technologies such as big data, artificial intelligence, 5G, VR/AR, and digital twins. The digital educational environment has brought many challenges to the quality of educational resources, tracking of learning process, and management of learning outcomes. The mode of "blockchain + education" will become the inevitable trend of future education development. More and more universities and training/educational institutions are seeking cross-school, school-enterprise and cross-border cooperation across the boundaries of schools and classes. Providing personalized guidance which according to different cognitive style, learning characteristics and motivations. How to record the learning activities at all stages and make these learning data safely shared and analyzed deserve our consider. The use of the technology, intellectual property rights can be protected and the new ecology of Chinese teaching resources would be reconstructed. There is no doubt that blockchain technology provides a safe and reliable way to solve the above problems.

In September 2016, the Organization for Economic Cooperation and Development (OECD) released the 2016 Science and Technology Innovation Outlook Report, which listed blockchain technology as one of the top ten future technology trends and proposed that it has significant

potential application value [1]. General Secretary J.P. Xi of the People's Republic of China pointed out that we should accelerate the development of blockchain technology and industrial innovation [2]. With the improvement of China's comprehensive national strength, the demand for Chinese language learning and cultural exchanges in the world has become increasingly strong, and Chinese international education plays a key supporting role. It will build a bridge between China and foreign countries and convey China's voice to the world. With the sudden outbreak of COVID-19, the epidemic prevention policies of various countries and regions have caused many obstacles to offline Chinese learning, and the "blockchain + education" model has broad application space. Based on this, this paper focuses on the concept and core technology of blockchain both at home and abroad in the field of education, outlines a teaching resource platform and analyzes the problems that may arise in the virtual promotion, which provides a reference for blockchain to innovate the using mode, so as to enable science and technology to empower Chinese international education.

## 2. Research Basis

A scholar or team who are calling themselves "Satoshi Nakamoto" published a paper called "Bitcoin: a Peer-to-Peer Electronic Cash System" in the November 2008 Cryptography Mail Group, it was the first time that the basic working mechanism of electronic cash system came into people's view. The definition of blockchain is vague, pointing out that it is only a data structure that realizes the history of Bitcoin transaction accounts. Wikipedia defines blockchain as a distributed database technology, which can achieve a growing and tamper-proof data record by maintaining the chain structure of data blocks [3]. The core technology of blockchain consists of distributed ledger, asymmetric encryption and smart contract. It can guarantee the characteristics of decentralization, non-tampering and property rights protection without introducing third-party intermediaries.

At present, blockchain technology has entered a new stage from ordinary technology research to application scenario discussion, and gradually plays a crucial part in data storage, digital authentication, data visa, financial transactions, asset management and other fields. It is found that from 2008 to 2021, the development trend of blockchain in the world is gradually increasing. It reached its peak in 2018, then slowed down and suffered a slight decline [4]. This is due to the serious imbalance between practical application and technological development after a rapid increase in such a short period, which has led to the collapse of many investments and platforms of blockchain. On the other hand, blockchain technology applies in education also attracted attention of researchers in TESOL field. The number of papers on "blockchain + education" has been increasing slowly since 2016, which also shows that blockchain technology is constantly integrating with education and teaching.

Researchers' discussion on the applying of blockchain technology in the field of education mainly focuses on the learning certificate record platform. In fact, blockchain technology has more using space. T.Xu believes that blockchain technology can coverage societies, increase the educational investment both in less developed and developing countries, and help to improve the competitiveness and career ability of individuals in the labor market, thereby promoting educational equity and social entrepreneurship [5]. X.M.Yang and others proposed a decentralized management platform for open educational resources based on blockchain technology, which can greatly promote the evolution of open educational [6]. Z.M.Liu solved the problems of sharing learning data and non-transparent evaluation of teaching by using Consortium Blockchain as the underlying technology and the application which called DAPP derived from Ethereum improved the security and credibility of data. It greatly optimizes students' learning experience [7]. It can be seen that blockchain technology has broad

development space and application value in the field of education, which deserves our further research and exploration.

### **3. Typical Application Cases of Blockchain Technology in the Field of Education**

Many countries have successfully applied some "blockchain + education" projects, mainly in the fields of electronic certificate, academic qualification, teaching management. The projects which are called EDUBLOCS of Barcelona University and Sony "blockchain + language proficiency certification" project related to optimize the teaching process and language learning. The analysis of these two projects will provide technical vision for the development of Chinese international education in the post-epidemic era.

#### **3.1. Application 1: EDUBLOCS Project, University of Barcelona**

The EDUBLOCS project is an educational blockchain project developed by the Educational Research Society of the University of Barcelona. The project uses blockchain technology to manage the evaluation, analyzes students' motivation and abilities through algorithms, then forms a system which can record the whole process of learning activities. In this project, students can select modules such as group discussions, participatory meetings, seminars, personal presentations, writing academic articles, etc. Using these modules could generate a personal learning schedule, and group tutors can give suggestions for supplementing or replacing the learning schedule. Throughout the course, mentors participate in the establishment of formative assessment and accreditation. The facilitator will oversee team members' learning behavior by Technology Enhanced Assessment (TEA) application. The system includes resources for quantitative and qualitative assessment, and valuable information will be uploaded to the blockchain. The data record of the whole education process mainly depends on the EGB (Edublocs Grade Book) of the project education blockchain. The data is transmitted by logging in the Ethereum account, so that the score information can be verified, permanent, unchangeable and undeletable.

#### **3.2. Application 2: Sony "Blockchain+ Language Proficiency Certification" Project**

Sony cooperated with Fujitsu and Human Academy, has created a program based on blockchain technology to manage students' language learning and competency certification. This program designs variety ways to help foreign students study Japanese and language skills. In this project, in order to support foreign students to obtain Nihongo Kentei Japanese qualification, "Sony Global Education" also organizes students to participate in the "Nihongo Dojo" course which offered by the Japan Education Development Research Center, conducted by Fujitsu's Fisdome online course platform. In this process, Fisdome course platform will collect learning process data such as test score, conversation ability and learning time, then provide certifiable education process and learning certificates. Making digital transcripts securely stored in the blockchain forever. As an educational institution that accepts and provides counseling for foreign students, the Human College will verify and compare the data on the blockchain with the certificates submitted by students, which greatly improves the efficiency and reliability of Japanese language grades. In the future, not only course records and grade would be managed, learning process and attitude will also be assessed through the collection of learning logs and performance. This project has great significance to Chinese international education, because many Chinese learners are unable to participate into offline classes for some reasons. In this way, his or her online academic achievements, diplomas and certificates won't be faced with the problem of whether they are reliable. Sony believes that as the field of education becomes more and more internationalized, the application of blockchain technology will gradually progress

which is conducive to improving the overall experience. It also can provide data and technical support for the "smart plus" course in the 5G era.

To sum up, the educational blockchain project expands the time and capacity information, extends from result-oriented certification to process-oriented evaluation, so as bring comprehensive information to real practices. It is also good for learners and enterprises to match in the job market.

## **4. Construction of Chinese Education and Teaching Resources Platform Based on Blockchain Technology**

### **4.1. Platform Design Framework**

The growing technology of blockchain and its unique advantages are expected to play an important role in the construction of new ecology in Chinese education, and become a "sharp weapon" to solve existing problems. In the assumption, educational institutions could create a blockchain platform collaboratively, to record, share and verify the achievements of scientific research and professional training. As well as learner information, qualification diploma, cognitive style, practical activities and so on.

The main participants in the programme are individual learners and educational institutions. As P2P network, blockchain network realizes the peer-to-peer link of different participants. The nodes linked in the blockchain network through a consensus algorithm, when most of the nodes admit that a transaction is valid, transaction data will be submitted to the blockchain (public ledger) for permanent storage. Through the blockchain client API, individual nodes (learners) can access the data stored in the blockchain network. In order to ensure the security of the data, the data stored in the blockchain is encrypted by the private key of the individual learner.

The platform has two functions, one is the interconnection with external teaching resource platforms (online teaching resource platform, etc.), and the other is the data exchange between different academic institutions.

### **4.2. Application Scenarios of the Platform in Chinese International Teaching**

#### **4.2.1. Record Certification**

The needs for the development of language skills and the cultivation of personal abilities are complexity which other types of education do not have. When schools, organizations or enterprises appraisal a student's Chinese level, apart from quantitative indicators such as HSK scores, some practical experiences such as short-term Chinese training programs, online courses, academic conferences, Chinese cultural activities, etc., can constitute an important reference. For example, the program named "Princeton in Beijing" is held at Beijing Normal University annually for overseas Chinese learners. The two months Chinese learning experience can be converted into Princeton University credits. However, when the dimension of the evaluation system is broadened, especially when it involves the multi-identification of different educational and cultural institutions, it is more difficult to evaluate the language, cross-cultural competence and comprehensive quality of learners. Smaller organizations even may not have sufficient capacity to identify the true value of credentials or experiences.

In the blockchain, just an actor can not place trusts in the system, but in the whole system, a kind of "system trust doctrine". Through the technical characteristics of blockchain, such as open traceability and non-tampering, it can make accurate records of language level, academic experience, study tours and Chinese cultural activities. Improving the credibility of process assessment in an open education environment. By embedding intelligent contracts to complete diploma, we can permanently preserve and retrieve all kinds of certificates at any time, reduce the risk of loss or forgery by students, schools and enterprises. It also can identify the certification in less time and costs by more convenient way. Moreover, on account of the

premise of mutual trust between educational institutions in the system, it does not require high computing power or third-party organization to ensure whether an agreement is valid, because the node itself can provide proof of rights.

#### **4.2.2. Intelligent Matching**

Any integration of technology and education should return to focus on the learners themselves, and the application of blockchain in education embodies the "learner-centered" mode. The combination of artificial intelligence, digital twin, AR/VR/MR will contribute to the formation of "blockchain + education" technology ecology and promote the development of online immersion Chinese teaching. At the recent developer conference, GOOGLE announced remote three-dimensional technology "Project Starline", which can display three-dimensional images on the screen. It makes the distant teachers seem to be around the students. In addition, to strengthen the effective connection between Chinese and professional content, training local teachers of "Chinese + vocational skills", blockchain technology could provide corresponding high-quality resources. Some Chinese learners need to acquire professional language, such as economics, medicine, law, sports and so on, so they should rely on HSK language points and take online teaching materials. In the process of language learning, blockchain technology can generate word cloud maps by personalized factors such as educational experience, cognitive style, learning attitude and cultural background. On the one hand, it is helpful for educators to analyze the visualized cloud maps. On the other hand, it is also convenient to matching appropriate MOOC, online courses and academic resources for students in new 5G education ecosystem, promoting the interconnection of information and education, and making learning spaces more interactive.

#### **4.2.3. Using of Virtual Currency**

Learning platforms in some countries have linked blockchain virtual tokens to student. This decentralized learning platform with incentive mechanism is beneficial for eliminating barriers and promoting educational equity in certain extent. Virtual currency circulation relies on the intelligent contract technology of blockchain, which can completely automatic operation. It has become a technical guarantee to stimulate the enthusiasm of users to participate. We envisage that the Chinese international education platform will focus on encouraging learners to earn fees by learning or using the target language, the more they learn, the more money they get, creating an academic gig economy. First of all, the forum section of the system can share knowledge content that produced by students. High-quality producers are compensated by virtual currency, so as to improve users' motivation to use the platform and output superior content. Secondly, the platform has social section that introduces an automatic scoring mechanism and links up with the learning management system, so that students can communicate and discuss according to the language points or text they learn. The system sets up that users can get virtual currency rewards after completing the tasks, replying comments or sharing resources, in this case, it can realize the effective combination of synchronous interaction online and asynchronous interaction after class. In this way, language learning and acquisition can complement each other. It is remarkable that the platform also sets up a game background with Chinese cultural elements. Learners can experience Chinese culture in immersive games simulated by digital twin technology, use Chinese to communicate with players in the game, and obtain virtual coins by participating in the game. This platform would be interactive and social. It also allows learners to experience target language environment online. Language learners can use their virtual currency to purchase teaching resources and daily necessities, or even buy food in restaurants.

#### **4.2.4. Digital Copyright Protection**

The distributed ledger supported by blockchain is permanent, traceable and untouchable, which can innovate digital copyright management, realize copyright protection and reader



information confidential. Proof of Work (POW) used by Bitcoin network and Proof of Stake (POS) used by Ethereum are two common consensus algorithm mechanisms with high credibility and easy operation. In the creation of teaching resources for Chinese education, the creator attaches his or her information on courseware, test questions, papers or videos and stores them in the block with a time stamp. On the block, the node can keep a continuous trading data covering the whole process, so as to obtain the sequence of transactions. The creation, upload and download of any teaching resources can be queried at any time, and the historical version would be recorded, so that learners can fully grasp of a theme. Compared with the traditional teaching resources platform, creators need to add watermarks or signatures to their works to ensure copyright. However, that method is easy to be changed and has poor security. Now, in the view of decentralized copyright protection mechanism, when users search these electronic file packages, they can read the content of the statement. When users quote or reprint resources, the system will automatically embed copyright information to protect the intellectual property rights of resource authors. In the meanwhile, providing users with high-quality and original educational resources, and promote the development of co-creation and sharing mode. Using this mechanism will help to build a sustainable platform, encourage all nodes to actively participate in the construction of the Chinese international education platform. On the other hand, Blockchain technology can also alleviate the phenomenon of "hitchhiking" during group learning and form an open appraisal system of Chinese language teaching.

## 5. Reflection and Prospect

The development of blockchain is gradually entering 3.0 stage. In comparison with traditional Chinese teaching methods, blockchain technology has great potential. In the next few years, on the basis of "Internet + education" and "artificial intelligence + education", it is necessary to delve into the new application scenarios of "blockchain + Chinese International Education", establish mutual recognition of credits in open education. Because of the stronger uniqueness and complexity in the field of education, there are still some problems to be solved. It mainly focuses on the following aspects:

### 5.1. Improve the Relevant Policies and Norms of "Blockchain + Chinese International Education"

At present, governments, educational administrative, enterprises and universities have realized the great potential of blockchain in education. At the same time, the relevant policy and guidance are not standardized and perfect to certain extent, so, it has become an urgent need to formulate criterion and regulations of blockchain technology in the field of language education. The International Standards Organization IEEE has developed the "Blockchain Vertical Industry Standard" (P2418, ISO), which has three working groups and three research groups (Use Cases, Governance and Interoperability). In the future, in the exchange of different cultures, educational centers and Chinese universities can set blockchain education alliances. Educators and blockchain experts cooperate together to study the hot issues of blockchain technology in the field of education, and jointly produce application rules to ensure its universality and scientificity. In this way, it is not only beneficial to spread Chinese culture, but also helps enhance the application effect.

### 5.2. Strengthen Information Integration and Promote Mutual Recognition of Records

With the development of blockchain, 5G and intelligent technology, language learning is no longer confined to the classroom and region, and various modes such as extracurricular research, mobile learning and ubiquitous learning make online and offline learning blended. However, the immature technology makes it impossible to share information or migrate

learning data between different Chinese teaching applications. Sometimes we have to use more than one platforms to finish a course. This not only hamper the opening of educational, but also causes the waste of resources. How to transplant the experience and achievements from offline learning activities (such as language competitions, cultural activities, visiting internships, etc.) to online and use blockchain technology form a complete report is a problem that must be solved. The University of Nicosia is the first school use blockchain technology to manage student certificates on MOOC platform. The Knowledge Media Institute at the Open University has developed a combination named "micro-credentials" which provide learning certificates for some MOOC courses. Some else platforms promise that the results of online learning can be recognized offline. These measures have greatly enhanced the motivation of students to learn. Therefore, at this stage, we should use technology to eliminate information island and contrive to concentrate the resources. On the other hand, through collecting online and offline data, we can understand the cognitive and learning rules of Chinese learners. Using technology to optimize education and teaching, to meet diverse needs of different learners, and ultimately play an important role in Chinese international teaching and cultural exchanges.

### **5.3. Establishing a New Ecological Science and Technology Ethics of Education, Putting Learners as the Main Body**

In the construction of new ecosystem of intelligent education, new problems are constantly emerging. Information explosion, privacy security and algorithmic discrimination, if technology lacks constraints, it will be abused and bring new challenges to social governance. Therefore, it has become the focus of global attention to establish educational science and technology ethics. When education enters the era of intellectualization, they can obtain diversified high-quality resources at any time and anywhere to complete the interaction between reality and virtuality. Learners are likely to be immersed in virtual interaction even lose interest in the real relationship and face-to-face teaching process. So that the role of teachers will be replaced by information technology. In addition, users should be the main body of information selection. But in fact, a small number of technical and professional elites decide what kind of resources or news people can see. It is very likely that when people faced with numerous dazzling information on Internet, these people will become slaves of information, losing their ability of rational judgment.

In this regard, we need to know that data science should integrate intelligent technology in a human-computer collaborative way, technology can not replace the teacher. Language education should attach importance with the two-way interaction, and ultimately technology is a means of teaching. Through the combination of blockchain technology and cloud file technology, machine is mainly responsible for repetitive, monotonous and routine work. Teachers are responsible for the work of creation, emotion and inspiration. As for construction learning resources in the future, ordinary users are not only enjoyers, but also builders. Through the efforts of all parties and mutual cooperation, we will achieve "student-centered" and promote the development of Chinese international education.

## **6. Conclusion**

Blockchain is considered as the most promising technological revolution after steam engine, electricity, information and Internet technology. It is a strategy in the future for most of countries. Through blockchain technology, Chinese learners can fully grasp their own learning data, and do not need to spend extra time to manage their own educational records. At the same time, it can also ensure the privacy of data. Educational institutions can create an educational big data sharing environment and provide more secure and personalized learning support for learners through deep-seated and portrait analysis. At present, the coverage rate of Chinese international education informalization has reached a certain scale, but there is still great

potential for the combination of blockchain technology with information technology such as big data and artificial intelligence. Chinese language teaching researchers should keep up with the times and arm their minds with new scientific trend. Language teaching is centered on "people", technology can not replace teachers, and just technology can not fully embody the beauty of language and culture, but they can complement each other. We hope by learning experience of blockchain in the field of education could help Chinese language and culture disseminate worldwide.

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