Research Article

A Study on Competence of Teaching or Scientific Projects Research for Primary and Secondary School Teachers Based on Blockchain Technology

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1.Introduction

To solve the problems of lack of peer-to-peer trust and high cost constraints in traditional transaction systems, Nakamoto created a digital currency based on blockchain technology that can be directly traded without a third party institution, that is, Bitcoin. Blockchain is essentially a distributed database where data information is jointly maintained by all participating nodes with the same rights and obligations, and individual nodes cannot manipulate the data. With the characteristics of decentralization, transparency, openness, autonomy, information manipulation, and anonymity, blockchain technology can better solve the problems of information asymmetry, high transaction costs,
and lack of trust among strangers in the process of sharing economy.

Teacher research competency development is a hot research topic in the field of education. The Competence of Teaching or Scientific Projects model is the sum of the competency characteristics required for the specific role of a teacher, and it is a set of characteristics developed in response to teacher teaching or scientific project performance and task requirements. Other studies on the psychological qualities of good and ideal teachers have also examined the relationship between teacher professional qualities and success from different perspectives using a variety of methods. While they have focused on individual teacher characteristics that influence teachers' work, there has been less and limited research on Competence of Teaching or Scientific Projects behaviors, and the work done is far less than that done on children's characteristics. Nationally, the issue of Competence of Teaching or Scientific Projects has attracted attention.

1.1. Research Status. Regarding the research on consensus mechanism of blockchain technology, Lázaro-Cantabrana et al. [1] sorted out the academic research on consensus mechanism and compared the consensus mechanism of blockchain with the consensus mechanism of traditional technology. According to Casillas Martín et al. [2], in the study of the combined application of blockchain and equity trading platform, the interests of investors can be more effectively maintained through smart contracts and consensus mechanisms.

While the Internet brings convenience to life, there are also hidden dangers such as leakage of users' personal information. Wu [3] argued that blockchain technology can guarantee in the protection of users' identity information. The application of blockchain's decentralized, tamper-proof, consensus mechanism, smart contracts, and other technologies seems to be a perfect solution; however, it is not. Xia and Xu [4] then pointed out the drawbacks of the POW algorithm and the uncertain potential security boundaries, among other issues. At present, the research on the application value of blockchain technology is more at the theoretical level and lacks more quantitative or empirical analysis studies, but these theories provide the application direction for blockchain technology and also lay the foundation for further research to follow, which requires various disciplines including computer field, economic field, and social research field to jointly seek breakthroughs in the application of blockchain technology.

Research on Competence of Teaching or Scientific Projects models can be traced back to the competency-based teacher education (CBTE) and humanistic teacher education (HBTE) movements of the 20th century and the competency movement sparked by McClelland’s 1973 article, “Measuring Competence, Not Intelligence.” These influences have led to the emergence of two types of Competence of Teaching or Scientific Projects models: “skill” (or knowledge) based and “quality” (or person) based. The former emphasizes skills and behavioral performance, as in the UK National Vocational Qualifications model, while the latter focuses on the personal “qualities” of creativity, problem-solving skills, and good judgment, as in the UK National Center for Educational Assessment model and the Hay Corporation’s High Performance Teacher model submitted to the US Department of Education and Employment. [5] These models, with their heavy emphasis on the instrumental and functional nature of competencies, have resulted in a breakdown of competencies into multiple skills and microskills. By contrast, the competency framework designed for teacher induction development by the National Council on Teaching and Learning (NPQTL) in Australia in 1996 is an eclectic model. It decomposes teaching competencies into five areas: using and developing professional knowledge and values, communicating and interacting with students and others to work together, planning and managing the teaching process, monitoring and assessing student progress and learning outcomes, and reflectively assessing and planning for continuous progress, emphasizing the holistic and universal nature of the model, and containing competency characteristics that are independent of and interrelated with each other, but between high and general competencies. No distinction is made.

1.2. Contents and Methods. Science and technology is the first productive force, and the transformation of scientific and technological achievements is an important driving force to connect science and technology with the economy to form and create productivity. Nowadays, a new round of scientific and technological revolution and industrial reform is emerging, and as one of the key technologies of the new round of scientific and technological revolution and industrial transformation, the role of blockchain should not be underestimated, and the popularity of its application is of great significance to promote China’s economic and social development.

1.2.1. Contents. (1). Blockchain Technology Helps Solve the Information Asymmetry of Technology Transfer and Transformation. By realizing decentralization, visualization, and transparency, blockchain helps to enhance the information supply in the whole process, and the relevant subjects can easily obtain the real information of the whole process of transferring and transforming scientific and technological achievements. According to the relevant needs, it can realize real-time monitoring, dynamic analysis, and effective correction; stabilize the expectations of all parties in the process of transferring and transforming scientific and technological achievements; minimize or eliminate uncertainties in the process; and enhance the confidence of all subjects; at the same time, through the implementation of synchronization and information sharing, it can reduce the friction in communication and coordination; enhance the efficiency of information inquiry, sharing, and processing; and greatly reduce the inefficiency of cross-industry and cross-regional subjects. It also reduces the cost of communication and coordination, management and supervision, and mechanism evaluation.
Blockchain Technology Helps Enhance the Transfer of Scientific and Technological Achievements and Knowledge Diffusion. A technological innovation has no economic effect if it is not implemented and popularized. Blockchain is a permanent, public, tamper-proof, globally distributed database. The decentralized mechanism of blockchain technology not only collects scattered users and information to form a common distributed information transaction and conversion center but also solves the risk problems of legality of information sharing, ownership determination of scientific and technological achievements, and nonauthorized responsibility of scientific and technological achievements distribution. Based on the decentralized and universal participation mechanism formed by blockchain, a unified platform for knowledge exchange and dissemination is formed. Each user becomes a node with its own public key and private key, and jointly participates in the verification and recording of information related to scientific and technological achievements, and acquires and transfers the ownership and value of scientific and technological achievements through the consensus mechanism to improve the effectiveness, efficiency, and implementation efficiency of transfer and transformation.

1.2.2. Methods

(1) Competency qualities

(1) Thinking: vision or innovation, deep analysis to solve problems or decisiveness to drive change or change adaptation, certainty and persistence, expertise.

(2) Work: planning and organization, drive to achieve results or results achievement, quality-centered or continuous improvement or policy, steps and processes, safety orientation, audience orientation or audience service, integrity, and stress tolerance.

(3) Interpersonal: teamwork, influence and persuasion, managing others or team leadership, coaching and developing others, motivating others, organizational perception or relationship management negotiation or midsurge management, interpersonal communication skills, written communication skills, presentation skills, meeting leadership, and respect for diversity.

(2) Competency model

(1) Competency iceberg model. As shown in Figure 1, the iceberg only reveals the top, and most of it is hidden in the sea water. The “above water part” is the external presentation of personal qualities, which is easy to understand and assess, and easier to change and develop through training, including basic knowledge and skills. The “part below the surface” is the internal part of the individual, difficult to observe and assess, not easy to be changed by external influences, but is indeed a key factor affecting personal behavior and performance, including role orientation, values, self-perception, personal traits, and motivation [6].

(2) The onion competency model. American scholar Richard Boyatz (1981) proposed the onion competency model on the premise of an in-depth and extensive study of McClelland’s quality theory, and it can be said that the onion competency model is further evolved from the iceberg competency model, as shown in Figure 2.

2. Model Building

2.1. Model Construction Method

2.1.1. BEI. The BEI method, also known as Behavioral Event Interviewing (BEI), allows interviewees to answer a set of questions and, by analyzing the content of the interviewees’ answers, initially determines the competency characteristics exhibited by the interviewees. By comparing two different performers of a certain job role, that is, high performers and mediocre performers, the competency characteristics of the two are determined, and the competency model appropriate for the job role is determined. The BEI method should be used to construct a competency model for teachers, which includes the following steps: first, to refine the criteria for identifying high-performing teachers and average performing teachers, which should be subdivided by primary and secondary schools according to their own development strategies and work objectives, and then formulated; second, to select a certain sample of effective standards according to the criteria in Step 1, which should include high-performing teachers and average performing teachers; third, on the basis of the sample, we extracted data related to the competency of primary and secondary school teachers; fourth, we used certain analysis methods to analyze the above data to construct a relevant model; and fifth, we validated the model.

2.1.2. Hierarchical Analysis. Hierarchical analysis, also known as AHP, was proposed by Professor Saaty, an American operations researcher. This mathematical method
not only can realize the transformation from qualitative to quantitative but also this method is simple, flexible and has a very wide range of applications. [7] The core of the hierarchical analysis method is a systematic system of evaluation indicators, which is divided into different levels from top to bottom according to the complexity of the problem, such as the overall objective, subobjectives and evaluation criteria. Each level is a target level, a solution level, and a criterion level. Each level is assigned different weights according to its importance in the evaluation process, and finally, the scores are calculated according to the weights, and the best choice is selected in the order of the scores from the highest to the lowest.

2.1.3. Gray Decision Model. The gray decision model is not as widely applied as the previous two methods, but it still plays a non-negligible role in the construction of Competence of Teaching or Scientific Projects model. In the gray system theory, different things and factors have different degrees of correlation with each other, and their correlation degree and size are expressed by the correlation degree. The correlation coefficient can be obtained by some quantitative methods, and the analysis of the correlation coefficient can be used to judge and predict the development of physical objects. The multilevel correlation depends not only on the correlation coefficient but also on the correlation weight coefficient, which can be multiplied to obtain the correlation degree of the evaluation scheme.

2.2. Scientific Research Analysis. About scientific research analysis, Table 1 shows the scientific research analysis.

2.3. Contract Object

2.3.1. Smart Contract Object of User Information Management Module. The main smart contract object involved in the user information management module is mainly User, which is located in the sol file. The smart contract User handles a series of operations such as user registration, user login, and identity audit, where Table 2 shows the attribute fields and their descriptions.

2.3.2. Smart Contract Objects for the Results Information Management Module. The main smart contract object of the Results Information Management module is PatentInfo, in the file PatentInfo.sol. The PatentInfo contract handles operations such as results’ modification, results’ addition, results’ query, and results’ review. The main attribute fields and their descriptions are shown in Table 3.

3. Model Experiment

3.1. Sample Selection. An expert panel is composed of researchers and principals of primary and secondary schools determined the three criteria that teachers selected for the excellent group must meet at the same time: provincial or national outstanding teachers, special teachers, outstanding educators, model teachers, advanced workers in the education system, teaching experts, and backbone teachers; teachers in service with excellent teaching performance assessment in the past five years; and teachers in schools with more than 50 teachers in the past five years. Teachers in the general group were randomly selected from the schools where the outstanding teachers were located, or other primary and secondary schools that met the criteria of Article 3. Twelve excellent teachers were selected according to the sampling criteria to form the excellent performance group and 12 average teachers to form the general performance group. The study was a single-blind design, and subjects did not know their group beforehand.

Using Hay’s basic competency dictionary as a model, one interview text was coded independently by four researchers and then discussed to achieve consistency in coding and to supplement the dictionary. Once the coding was consistent, the remaining texts were coded separately and a first draft of the Competence of Teaching or Scientific Projects Coding Dictionary (“Dictionary”) was developed. The Dictionary included Challenge and Support, Self-Confidence, Creating Trust, Respect for Others, Analytical Thinking, Conceptual Thinking, Motivation to Advance, Sense of Effectiveness, Information Seeking, Initiative, Flexibility, Advocacy for Responsibility, Innovation, Relationship Building, Managing Students, Passion for Learning, Impact and Influence, Developing Others, Teamwork, and Collaboration. A total of 28 competency traits were identified, including understanding others, honesty and integrity, self-control, professional knowledge and skills, attention to student and faculty needs, self-assessment, emotional awareness, resilience, and career preferences. Each characteristic consists of a name, code, definition, rating, rating designation, and behavior description. A rating indicates the intensity or complexity of a behavior [8]. The distinction between levels is based on the minimum perceptible difference (JND) in psychophysics. The behavioral indicators (indicators) of different levels are clearly differentiated and are mainly representative typical behavioral performances of teachers’
work, listed in the column of behavioral descriptions, which serve as the basic reference point for the assessment of teachers’ competency characteristics. The whole dictionary is the core basis for text coding.

Scientific and technological achievements are often information-intensive with large information flow, which may lead to information asymmetry problems in the process of transferring and transforming scientific and technological achievements. At the same time, the limited ability of each stakeholder to analyze and understand the environment leads to risks such as blindness of market demand and uncertainty of performance industrialization. It should be noted that there is a distinction between scientific and technological achievements.

| Position level: Teacher | Direct supervisor: Academic affairs administration |
|--------------------------|---------------------------------------------------|
| **Job title: Primary and Secondary School Teachers of Various Subjects** |
| **Descriptions** |
| (I). Knowledge structure |
| 1. Professional subject knowledge |
| (1) mastering the basic theories and basic knowledge necessary and sufficient for the specialty. |
| (2) have a broad vision, a sense of constantly updating knowledge and chasing academic frontiers; scientific and dialectical thinking and research methods; master certain disciplinary knowledge, expansion, and research skills. |
| 2. Conditional knowledge |
| (1) knowing the laws of education; learning modern educational concepts, teaching methods, and teaching strategies. |
| (2) know the general characteristics of the physical and mental development of adolescents, the general rules of personality and character formation and how to educate students according to these characteristics and rules. |
| (3) to be able to adopt proven strategies for flexible and effective regulation of education and teaching. |
| 3. Practical knowledge |
| (1) knowledge of developing and implementing teaching, education, unit and lesson plans, and classroom rules. |
| (2) knowledge of instructional techniques to present lessons in a way that captures students’ attention. |
| (3) knowledge of how to focus on student growth; design classroom exercises and task-based homework of appropriate difficulty and ease. |
| (II). Competency structure |
| 1. Education professional and technical ability |
| (1) teaching design, (2) teaching media, (3) classroom teaching, (4) teaching research, (5) classroom management, organization, and guidance of extracurricular activities |
| 2. Education and teaching organization and management ability |
| (1) good at planning and arranging. |
| (2) thoughtful arrangement and inspection. |
| (3) formation of a complete order and system. |
| 3. Educational foundation ability |
| (1) having a high sense of responsibility, good moral cultivation, and intellectual level |
| (2) good observation, familiarity with the situation, and quick and decisive judgment. |
| (3) having a strong ability to write Chinese characters and express language and writing. |
| **Requirements** |
| 1. Teaching or scientific projects’ research quality (humanities and scientific quality) |
| (1) adhering to science, believing in truth, and supporting the educational policies of the party and the state. |
| (2) being able to teach people the way; teaching them knowledge; teaching them wisdom; teaching them development. |
| (3) mastering the principles of education, understanding the laws of youth development, treating students with an open attitude; understanding students with a scientific attitude; looking at students with respect, educating students with professionalism; loving students with a friendly attitude. |
| 2. Personality quality (ideological and moral quality) |
| (1) "to be a teacher,” “to set an example,” “to follow good examples,” “to teach others,” and “to "practice what you preach” |
| (2) maintain an optimistic state of mind, a positive and uplifting mental state, and a constant drive to pursue a career |
| (3) have a broader knowledge, good cultural cultivation, and good interpersonal public relations. |
| 3. Modern teaching or scientific projects’ research quality |
| (1) flexible use of modern information technology, the ability to query, evaluate, transmit, effectively use, and create information with various forms. |
| (2) have the ability quality of processing and transforming course learning content into digital learning resources according to the subject content and teaching characteristics. |
| 4. Physical and mental qualities |
| (1) have a healthy physique. |
| (2) have strong psychological adjustment ability and good psychological quality. |
| (3) have a team spirit of cooperation with others and a positive and innovative spirit. |
technological achievements and the environment, as well as doubts about the market acceptance and expected returns. The research results of domestic and foreign countries can be synthesized to conclude that the key competencies of primary and secondary school teachers are not only reflected in professional skills but also the personality and values of teachers as a deeper level should be reflected in the competency model. The model algorithm is divided into three parts: cloud center layer, edge layer, and field layer, as shown in Figure 3.

Table 2: Smart contract User attribute field table.

| Name            | Type              | Description                                                                 |
|-----------------|-------------------|-----------------------------------------------------------------------------|
| Details         | struct{          | User attributes structure body, including name, work number, contact phone, belonging to the primary and secondary school, belonging to the major, identity type, login password, whether willing to register, whether through the audit and other data |
| Id              | uint              | User registration number (automatically generated by the system)             |
| Data            | Mapping           | Correspondence between the user account address and the attribute structure  |
| nameXadd        | (address=>Details) |                                                                             |
| userNumXadd     | Mapping           | Correspondence between user work number and user account address            |
| emailXadd       | (string=>address) |                                                                             |
| phoneNumberXadd | Mapping           | Correspondence between user contact number and user account address         |
| uniXuser        | Mapping           | Correspondence between schools and user work numbers                        |
| string name     |                   |                                                                             |
| string userNumber |                 |                                                                             |
| string e-mail   |                   |                                                                             |
| bytes32 password |                   |                                                                             |
| uint phoneNumber |                   |                                                                             |
| string adrUni   |                   |                                                                             |
| uint major      |                   |                                                                             |
| uint regid      |                   |                                                                             |
| bool registered |                   |                                                                             |
| bool passed     |                   |                                                                             |
| Type types      |                   |                                                                             |
| Id              | uint              |                                                                             |
| Data            | Mapping           |                                                                             |
| nameXadd        | (address=>Details) |                                                                             |
| userNumXadd     | Mapping           |                                                                             |
| emailXadd       | (string=>address) |                                                                             |
| phoneNumberXadd | Mapping           |                                                                             |
| uniXuser        | Mapping           |                                                                             |
| string name     |                   |                                                                             |
| string userNumber |                 |                                                                             |
| string e-mail   |                   |                                                                             |
| bytes32 password |                   |                                                                             |
| uint phoneNumber |                   |                                                                             |
| string adrUni   |                   |                                                                             |
| uint major      |                   |                                                                             |
| uint regid      |                   |                                                                             |
| bool registered |                   |                                                                             |
| bool passed     |                   |                                                                             |
| Type types      |                   |                                                                             |

Table 3: List of smart contract PatentInfo attribute fields.

| Name            | Type              | Description                                                                 |
|-----------------|-------------------|-----------------------------------------------------------------------------|
| Details         | struct{          | Results’ information attribute structure, mainly including IPFS storage path of related data, patent examination status, and other data |
| patentDetails   | Mapping           | Correspondence between patent numbers and their details                     |
| patentXuser     | Mapping           | Correspondence between the person responsible for the result and the patent number |
| patentsXmaj     | Mapping           | Correspondence between professional divisions and patent numbers            |
| string no_patent |                   |                                                                             |
| string name_patent |               |                                                                             |
| address adr_principal |      |                                                                             |
| string date_validPatent |     |                                                                             |
| string dateto_valid |               |                                                                             |
| string dateto_fee |                  |                                                                             |
| address uni_patent |                 |                                                                             |
| string dataAdr_patent |             |                                                                             |
| bool approCol_patent |             |                                                                             |
| patentType pat_types |             |                                                                             |
| majorType maj_types |               |                                                                             |
| uint transformations |              |                                                                             |
| uint time_add |                   |                                                                             |
| uint time_modified |              |                                                                             |
| Id              | uint              |                                                                             |
| Data            | Mapping           |                                                                             |
| patentDetails   | (string=>Details) |                                                                             |
| patentXuser     | Mapping           |                                                                             |
| patentsXmaj     | Mapping           |                                                                             |
| string no_patent |                   |                                                                             |
| string name_patent |               |                                                                             |
| address adr_principal |          |                                                                             |
| string date_validPatent |     |                                                                             |
| string dateto_valid |               |                                                                             |
| string dateto_fee |                  |                                                                             |
| address uni_patent |                 |                                                                             |
| string dataAdr_patent |             |                                                                             |
| bool approCol_patent |             |                                                                             |
| patentType pat_types |             |                                                                             |
| majorType maj_types |               |                                                                             |
| uint transformations |              |                                                                             |
| uint time_add |                   |                                                                             |
| uint time_modified |              |                                                                             |
| Type types      |                   |                                                                             |

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The overall diagnostic process of this model is as follows:

(1) The field layer is responsible for collecting the data of the device, preprocessing the data, completing the missing data by using the DTW algorithm introduced, and then transmitting the completed data to the edge layer.

(2) The edge layer is responsible for the feature extraction of the uploaded time series data processed by the field layer, and the DNM model algorithm is used for data analysis to realize the primary classification, and then, the detected diagnosis results are transmitted to the cloud central layer.

(3) The cloud center layer is responsible for classifying the diagnosis results uploaded by the edge layer and the correlation between the data.

3.2. Field Layer for Data Preprocessing. The device collects relevant data in the field, preprocesses the collected data every T period, and uploads it to the edge layer.

If the collection frequency is f, the total number of data collected in T period is $n = T \times f$.

The information that the field layer receives from the device is shown in Table 4.

In general, the data collected will be lost, and the preprocessing process is to complement the lost data. The time series data are similar to each other, so it can use these time series to complement each between the data.

DTW algorithm is used to carry out point matching between sequences, and data completion is carried out after the matching is completed [9].

If the time series collected by two devices are $X_1$ and $X_2$, we set the length of the time series as $L$, take $X_1$ sequence as a reference sequence, and complement $X_2$ sequence. The process is as follows:

Use the DTW algorithm to get the array, let

$$w_j = (h_{1,j}, h_{2,j}),$$

where $h_{1,j} \in \{1, 2, \ldots, L_1\}$ and $h_{2,j} \in \{1, 2, \ldots, L_2\}$.

If the timeseries collected by two devices are $X_{2,j-1}$ and $X_{2,i}$:

$$c_{j,1} = \frac{(X_{2,j-1} + X_{2,i})}{2}, \quad c_{j,2} = \frac{(c_{j,1} + X_{2,i})}{2}, \quad \cdots \quad c_{j,K-1} = \frac{(c_{j,K-2} + X_{2,i})}{2}.$$  

Because there are several sensors of detection equipment, the collected time series is also a lot. For the time series set $X = \{X_1, X_2, \ldots, X_m\}$, the sequence $X_{\text{max}}$ with the longest length $L$ is selected, and $X_{\text{max}}$ is taken as the reference sequence, and then, other sequences are matched and complemented one by one.

At this point, the time series with missing data has been complemented and acquired.

The pseudo code 1 for the overall process is as follows:

**Pseudo code 1**: DTW algorithm complements the time series

Input: The collected time series $X = \{X_1, X_2, \ldots, X_m\}$, $X_i = \{x_{i,1}, x_{i,2}, \ldots, x_{i,n}\}$

Output: The complemented time series $\bar{X} = \{\bar{X}_1, \bar{X}_2, \ldots, \bar{X}_m\}$

(1) The sequence $X_{\text{max}}$ with the longest length $L$ is selected, and $X_{\text{max}}$ is taken as the reference sequence.

(2) For num = 1, $\ldots$, $m$ & $X_i \neq X_{\text{max}}$, match $X_{\text{max}}$ and $X_i$ with DTW algorithm

$$W_i = \{w_{1,i}, w_{2,i}, \ldots, w_{L_i}\} \quad \text{for} \quad j = 2, \ldots, L_i$$

$$w_{j-1} = (h_{\text{max},j-1}, h_{j-1}), \quad w_j = (h_{\text{max},j}, h_j)$$

$$K = h_{\text{max},j} - h_{j-1},$$
if $K \geq 2$
\[ c_{j,k} = \frac{(x_{i,j-1} + x_{i,j})}{2} \]
for $k = 2, \ldots, K - 1$
\[ c_{j,k} = \frac{(x_{k-1} + x_{i,j})}{2} \]
end for
insert $c_{j,1}, c_{j,2}, \ldots, c_{j,K}$ into $X_{i,j}$
end if
get $\bar{X}_i$
end for

3.3. Edge Layer for Diagnosis. The edge layer receives the data set of a sensor $l$ processed by the field layer
\[ X_l = \left\{ x_{i,l} \right\}_{i=1}^n \]  
where $n = t \cdot f$ is the total number of data, $t$ is the collection time, and $f$ is the number of data collected in each period.

A sliding window with $\varphi$ sliding window size is used for feature extraction of the collected data. Because time domain signals can intuitively classify types through signal fluctuations, five time domain features such as average value, peak value, impact factor, margin factor, and waveform factor can be directly extracted to reflect waveform changes when equipment $s$ occurs [10].

The extracted feature data set is
\[ T_F = \left\{ (t_i)_{i=1}^{n_{\varphi}} \right\} \]
where $t_i$ is the $i^{th}$ characteristic data.

$T_F$ was predicted through DNM model, and the prediction result $r_i$ of data types within $T$ period was obtained.

If the data are normal, it will not be reported. If data are detected, related information and diagnosis results are uploaded to the cloud center layer for classification.

The pseudo code 2 for the overall process is as follows:

**Pseudo code 2:** DNM model diagnoses the fault

Input: Sensor data $X = \{X_i\}_{i=1}^n$; Total number of data $n$; Slide window size $\varphi$
Output: Classification result $r_i$

\[ \text{Input: Sensor data } X = \{X_i\}_{i=1}^n \; \text{Total number of data } n; \; \text{Slide window size } \varphi \; \text{Output: Classification result } r_i \]

\[ m_f = 0 \]
for $i = 0$; $i < n/\varphi + +$ do
\[ w_{(i)} = \text{sliding window}(X); \]  
\[ t_i = \text{feature extraction }(w); \]  
\[ \text{result}_{t_i} = \text{DNM}(t_f); \]
if $\text{result}_{t_i} \neq \text{normal}$ then $m_f = 1$
end if
end for
if $m_f = 1$
then display the fault data
else
return $r_i$;
end if

3.4. Cloud Central Layer for Classification. Data information of device $D_i$ uploaded by the edge layer
\[ F = \{D_i, R\}, \]  
where $R = \{r_1, \ldots, r_{N_i}\}$ is the type corresponding to data set $D_i$. The cloud center layer classifies the type according to the information contained in the data.

The pseudo code 3 for the overall process is as follows:

If multiple $y$ data occur on a device within a period of time, the higher is the level of the device, that is, total period $T$.

**Pseudo code 3:** Fault type classification

Input: Fault data information $F = \{D_i, R\}$; Time segment $T$; Number of device sensors $N_i$
Output: Classification result $G$

\[ \text{While } T \text{ do} \]
for $i = 1$; $i < N_i$ do + +
\[ L_{i_1} = \sum_{i=1}^{N_i} ST(r_i)/\sum_{i=1}^{N_i} r_i; \]
CLASS$\leftarrow$collect the fault types of device $i$
\[ G_i = \text{Granding}(L_{i_1}) \]
end for
end while
return $G$

\[ L_{i} = \frac{\sum_{i=1}^{N_i} ST(r_i)}{\sum_{i=1}^{N_i} r_i}, \]  
where $ST(r_i)$ is a statistical function used to calculate the number of abnormal data in $r_i$.

The higher the value $L_{i_1}$, the more time or area the device is $y$ in a period of time. Therefore, the level $G_i$ is expressed as follows:
\[ G_i = \begin{cases} 
1, L_{i_1} \in [0.0, 0.2] \\
2, L_{i_1} \in [0.2, 0.4] \\
3, L_{i_1} \in [0.4, 0.6] \\
4, L_{i_1} \in [0.6, 0.8] \\
5, L_{i_1} \in [0.8, 1.0] 
\end{cases} \]  

4. Research Conclusion and Technical Summary

Currently, in the context of new technologies such as big data, all things are interconnected: people, people and things, and things and things. Blockchain is gradually applied to digital finance, medical services, copyright protection, commodity traceability, and other fields, which can
provide reliable data information. At present, we should seize the opportunities of blockchain technology integration, function expansion, and industry segmentation; give full play to the role of blockchain in facilitating data exchange, optimizing business processes, and reducing operation costs; and give full consideration to improving cooperation efficiency and establishing an integrity system.

4.1. Research Conclusion

(1) Elementary and secondary school teachers’ teaching or scientific projects’ research competencies were generally poor. The results of the descriptive statistics showed that primary and secondary school teachers scored relatively high on competency characteristics such as concern for students, professionalism, and interpersonal communication, while they scored relatively low on competency characteristics such as personal traits, professional preferences, relationship building, information gathering, respect for others, and understanding others. In general, the teaching or scientific projects’ research competencies of elementary and secondary school teachers showed high levels of discriminative competency traits and relatively low levels of service-oriented competency traits. In other words, primary and secondary school teachers performed better in discriminative competency characteristics such as love, respect, understanding, and nurturing of students, using various teaching methods and skills to complete teaching tasks and assignments, developing students’ thinking skills, how to get along with students and deal with students’ problems, while they performed better in personal traits such as aggressiveness, responsibility, self-confidence, flexibility, influence, enthusiasm and interest, building relationships with leaders, parents, and the public, gathering and giving feedback on teaching materials, student information, and personal teaching information, tolerance, acceptance, and respect for others, and taking the initiative to understand others in a variety of ways, among other service competencies, were underperformed [11].

(2) Female teachers in primary and secondary schools rated their teaching or scientific projects’ research competency characteristics significantly higher than male teachers. The results of the multivariate ANOVA showed that there was a significant gender difference in the teaching or scientific projects’ research competency of primary and secondary school teachers. Female teachers’ teaching or scientific projects’ research competencies were generally higher than those of male teachers, especially in the competency characteristics of concern for students, professionalism, interpersonal communication, teaching or scientific projects’ research preferences, respect for others, and understanding of others. The gender differences in teaching or scientific projects’ research competencies of primary and secondary school teachers may be related to the traditional Chinese sense of gender roles. Because teacher teaching or scientific projects’ research is stable and socially respected, many females are willing to engage in teacher teaching or scientific projects’ research, and female teachers who engage in teacher teaching or scientific projects’ research are highly satisfied with their teaching or scientific projects’ research [12]. Men, on the other hand, believe that teacher teaching or scientific projects’ research lacks a sense of achievement and challenge, and that it is difficult to realize their life values, so they lack a sense of identification with teacher teaching or scientific projects’ research. In addition, primary and secondary school teachers need a lot of patience and care, and women have an advantage over men in these aspects. Therefore, female teachers’ evaluation of their teaching or scientific projects’ research competency characteristics is significantly higher than that of males.

(3) The longer the teaching age of primary and secondary school teachers, the stronger the teaching or scientific projects’ research competency. The results of the multivariate ANOVA showed that there were significant differences in the teaching or scientific projects’ research competencies of primary and secondary school teachers with different teaching ages. With the exception of respect for others, teachers who had been teaching for more than 10 years and were in the mature stage scored significantly higher on all dimensions of teaching or scientific projects’ research competency than teachers who had been teaching for less than 10 years and were in the adaptive or/and developmental stage. In general, the teaching or scientific projects’ research competency of primary and secondary school teachers showed a trend of increasing with the age of teaching; that is, the age of teaching is an important factor affecting teachers’ teaching or scientific projects’ research competency [13]. Teachers’ competence is continuously improved with the continuation of teaching years. The longer the time spent in teaching, the more practical knowledge teachers have, the more teachers’ ability to complete various teaching tasks and deal with various teaching problems, the ability to get along with students and deal with their problems, and the ability to collect and give feedback on teaching materials, student information, and personal teaching information will all be substantially improved.

4.2. Technical Summary

(1) In terms of the stages of teachers’ professional development, mature teachers with more than 10 years of teaching experience are already at the stage of focusing on teaching contexts and the stage of focusing on students, where they focus on teaching and...
carefully study how to achieve teaching goals in teaching contexts, but also make students the center of their true attention and pay close attention to their social and emotional needs. Thus, teachers in the mature stage have developed a unique knowledge structure of the subject they teach and their unique teaching style; they have increased control over teaching activities and the teaching environment; they pay attention to students and respect them; they adopt a tolerant and sincere attitude toward them; they are able to handle the relationship with students well; they constantly seek teaching methods and approaches that are suitable for students; they are able to stimulate students' interest in learning; they have rich. They are also able to stimulate students' interest in learning and have rich experience and skills in handling teaching incidents. Therefore, personal traits such as aggressiveness, responsibility, self-confidence, flexibility, sense of efficiency and influence, enthusiasm, and interest in the classroom, school, and educational career, and competent characteristics such as understanding and respect for others are correspondingly enhanced in mature teachers.

(2) Other studies on the psychological qualities of good and ideal teachers have also examined the relationship between teacher professional qualities and success from a variety of perspectives and using a variety of methods. While they have focused on individual teacher characteristics that influence teachers' work, there has been less and limited research on Competence of Teaching or Scientific Projects behaviors, and the work done has been far less than that on children's characteristics. In this country, Competence of Teaching or Scientific Projects has attracted attention. In this study, we selected high-performing primary and secondary school teachers as a valid sample, used classical competency modeling methods, analyzed key behavioral events that occurred in teachers' past teaching work, examined performance behaviors, explored and conceptualized Competence of Teaching or Scientific Projects characteristics, and constructed a Competence of Teaching or Scientific Projects model.

(3) The integrated development of Edge Computing and Blockchain Technology makes the application scenarios of edge computing more extensive, and the intelligent services on the edge can be realized in the future. The model is divided into field layer, edge layer, and cloud center layer, and the division of each layer is scientific and reasonable, with accuracy, effectiveness, and feasibility, and can better solve the problem of low accuracy of current classification. The collected data are preprocessed by the field layer based on DTW algorithm and then uploaded to the edge layer, which helps to make the subsequent diagnosis more convenient and accurate. The edge layer carries out feature extraction of the uploaded data, and then, DNN model algorithm is used for data analysis to achieve primary classification, reduce the data processing pressure of cloud center layer, and make the data more clear and concise [14]. The classification of uploaded data at the cloud center layer makes diagnosis more real-time and intuitive.

Data Availability

The data of this paper can be obtained through the e-mail to the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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