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Research Article

Measurement, Evaluation, and Model Construction of Mathematical Literacy Based on IoT and PISA

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"Mathematics Curriculum Standard for Ordinary Senior High School" points out that mathematical modelling literacy is the literacy of abstracting real problems mathematically, expressing problems with mathematical language, and building models with mathematical methods to solve problems. It assesses the amount to which students who are about to finish compulsory schooling have the knowledge and aptitude to deal with future life issues, based on the notion of lifelong learning. The usage of a local integrated development environment requires a number of complex processes, including installation and setup, as well as the procurement of necessary hardware. In reality, in order to nurture students, the core literacy of mathematics is to completely execute quality education, further identify the training and development direction of talents, and infiltrate the core literacy material into junior high school mathematics classroom instruction. For such a large-scale international education measurement project, the research and development of test questions is very important. Therefore, detailed technical consideration has been carried out and test volumes have been designed that are relatively suitable for different countries. The test questions are closely related to life, while there are few questions related to real situational problems in the test, which are mathematically processed first. Due to the international background of evaluation, it is a great challenge for researchers to realize the localization of evaluation on the basis of adapting to the domestic situation. At the same time, there is no scientific and perfect mathematical modelling literacy evaluation system in China's basic education research. How can middle school front-line teachers better evaluate students' mathematical modelling literacy? As a result, it is critical to develop a scientific and quantitative mathematical literacy measurement model that will aid in the teaching and research of mathematical modelling by middle school front-line teachers, as well as contributing theoretically to the evaluation and research of mathematical modelling literacy in China. Therefore, based on mathematics literacy evaluation, this paper studies the hierarchy of the IoT and the measurement and evaluation model of mathematics literacy based on the IoT, as well as its enlightenment to the compilation of mathematics academic test questions in China.

1. Introduction

As we all know, mathematics is one of the most important subjects in the curriculum of primary and secondary schools, accounting for a very large proportion of the senior high school entrance examination and college entrance examination [1]. At the same time, people cannot live without mathematics in their daily life and work. PISA (Program for International Student Assessment) is an international student evaluation project of the Organization for Economic Cooperation and Development (OECD). In PISA, the field of mathematical literacy is one of the three major sectors of evaluation (science, reading, and mathematics) [2]. The educational phenomenon of studying just for exams will change. The purpose of motivating students to study is no longer to get higher scores, but the social value of mathematics and its charm, which are the scope of mathematics literacy [3]. The limitation of communication capabilities to service developers will be substantially lessened in the 5G era. The 5G network's robust communication capabilities allow for real-time docking of distant services, giving service providers a bigger development platform [4]. The Internet of Things (IoT) is not something that can be developed overnight [5]. It is a long-term evolution from a network

constructed by thousands of hosts to the Internet, which connects billions of people across the globe and eventually to the Internet of Things, which achieves the interconnectedness of commodities [6]. To finish the transfer across a large region, the IoT may employ a number of data transmission protocols. It includes criteria for diverse data transmission formats, such as speed and convenience and minimizing the number of distant data access [7]. Many customised and intelligent tools are achieved by combining the processing capabilities of computer algorithms with data collecting, analysis, and processing, as well as mathematical models developed by probability theory, pattern recognition, and applying mathematical statistical knowledge. They can analyze human thinking mode and personalized behavior so that the system can more actively and intelligently "think" for users [8]. Therefore, the new curriculum standard emphasizes the need to focus on cultivating students' mathematical core literacy, and China's college entrance examination proposition must conform to the concept of cultivating students' mathematical core literacy.

When conventional methods extract the main frequency characteristics of transmission data, the information flow of random transmission channel is extracted, which leads to a slow data transmission rate [9]. In addition, the particularity of the IoT determines that it is different from Internet security, and the IoT puts forward a higher level of security requirements [10].

Therefore, mathematical literacy assessment and model based on Internet of Things is an extension and development of traditional mathematical assessment and evaluation. The security hidden danger of the Internet will pose corresponding challenges to the security of the IoT [11]. The perception layer of the IoT is mainly used for data acquisition and object communication, and it transmits information wirelessly, which is easy to be illegally monitored and stolen [12]. Firstly, the mathematical statistical model is used to quantitatively describe the relationship between the data feature vector and the data attribute value, and the resource data with similar feature vectors are summarized into the same classification plane. The similar resource data in the packet transmission plane is analyzed, and the information contained in the similar resource data is analyzed. On this basis, the data classification packet transmission channel is located [13]. Secondly, the channel adaptive equalization allocation of multidevice optical communication under the IoT is carried out by spatial equalization scheduling method, and the orthogonal matching signal tracking model of multidevice optical communication is established [14]. The decision feedback equalizer is used for the balanced allocation of multidevice optical communication channels in the IoT, and the multimultiplexing communication resource block balanced allocation method is used for the optimal allocation of optical communication resources. The number of endpoint pathways determines the performance of multidevice optical communication information transmission in the IoT, and the anti-interference of communication is increased by integrating the intersymbol interference suppression approach. Finally, the workload and packet probability density are combined to create a data transmission efficiency model [15]. A comparison experiment was set up using the data packet size of IoT resources and data from network cluster head nodes as test conditions.

The mathematical modelling literacy measurement, assessment, and model will assist Chinese middle school front-line educators in understanding mathematical modelling literacy, as well as the components of mathematical modelling literacy and how to evaluate mathematical modelling literacy. Constructing a mathematical modelling literacy assessment index system may assist front-line instructors in guiding students' mathematical modelling.

2. Related Work

Literature [16] clearly defines mathematical literacy and holds that mathematical literacy is a kind of personal ability, which enables students to determine and understand the role of mathematics in society, obtain a well-based mathematical judgment, and effectively use mathematics. Literature [17] pointed out that the purpose of mathematical literacy measurement and evaluation is to abstract the actual problems in real life, establish a mathematical model, solve the model, verify the rationality, and use the answers provided by the mathematical model to explain the real problems. The corpus given is used to extract the feature vector from the positive sample document and the subject description as the model of the user's first wants in literature [18]. It interacts with the test set to assess the size connection between the document in the test set and the elucidation condition of a subject based on the initial threshold of each topic acquired in the interaction of the training set. Literature [19] pointed out that solving practical problems with mathematical methods requires finding out their internal laws from the complex relations of reality, then expressing them with numbers, charts, symbols, and formulas, and then obtaining quantitative results for people to analyze, make decisions, predict, or control through mathematical and computer processing. The process of simplifying practical problems into mathematical problems and solving them is the measurement and evaluation of mathematical literacy. Literature [20] explains that the scope of mathematics literacy mainly includes four aspects: mathematics skills, mathematics concepts, mathematics curriculum factors, and mathematics situations. At the same time, it analyzes the evaluation structure of mathematics literacy from the perspective of ability. Literature [21] provides several usage methods of representing lexical knowledge, combining manual interaction and automatic learning, and combining content-based recommendation algorithm with collaborative filtering algorithm. Literature [22] comprehensively analyzed the background, test framework, and test results of the mathematics literacy test and put forward the enlightenment of test to Chinese mathematics education. Document [23] proposed a data transmission efficiency modelling method based on big data fusion, which restores the dynamic data of railway communication network through the transmission efficiency sampling matrix. However, the fused multisource communication signal is missing, and the transmission rate of the selected data format is slow. Based

on the mathematical literacy, literature [24] constructs an analysis framework for evaluating mathematical problem situations from the micro- and macroperspectives. Taking Singapore O-level test questions and Shanghai high school entrance examination mathematical test questions as examples, it compares and analyzes the problem situation types, characteristic levels, and distribution proportion of the test questions and draws some important conclusions. Document [25] adopts a data transmission efficiency modelling method of monitoring network measuring points. After filtering the measuring point signals in the monitoring network, the data transmission process of measuring points is simulated. However, the data transmission time of measuring points is not fixed, and the data format transmission rate is not ideal. Literature [26] focuses on the analysis of the meaning and value of mathematics literacy and believes that mathematics literacy is the ability of individuals to determine and understand mathematics, make informed mathematical judgment, and engage in mathematical activities. In addition, he also puts forward some enlightenment from the aspects of mathematics classroom, evaluation, student subject, and learning style.

3. The Hierarchy of IoT and the Implementation Process of Model

3.1. Hierarchical Structure of IoT. The main difference between the IoT and the Internet lies in the construction of a global computer network. The IoT is the application of Internet and mobile communication network resources to transmit business information. It is the integration of automation control technology and information application technology and the extension of Internet and mobile communication network applications [27]. The main function of EPCIS in the IoT is to provide interfaces for storing and managing captured information. The key to the establishment of EPCIS is to build an EPCIS server with PML language. EPCIS server interface is shown in the following Figure 1.

The ability of optical information transmission and information output may be increased by using the approach of optical sensor fusion and tracking for information collecting [28]. The input and output characteristics of data flows are analyzed, and the types of data transmission feature vectors are divided according to the priority of each data flow in Internet of Things resources. It constructs the information enhancement model of multidevice optical communication data transmission under the IoT and improves the anti-interference ability of multidevice optical communication data under the IoT through information enhancement in the multidevice optical communication environment of the IoT. Developers may package apps in development mode using nonminimized resources, and the debugging information in these resources can assist developers in locating the code issue [29]. The idea of variety should be followed while designing IoT architecture, which means designing multiple kinds of IoT architecture based on different types of services and nodes. Second, the space-time concept must accommodate the IoT's time, space, and energy requirements. Users will bundle apps in production mode with the fewest resources possible to achieve better performance. [30].

Mathematical modelling of multidevice optical communication under the IoT is based on the design of multidevice optical communication channels under the IoT, and adaptive scheduling of multidevice optical communication channels under the IoT is carried out by using wireless ad hoc network method. The data stream classification problem is transformed into the optimal classification plane to solve the problem. Assuming that nonlinear transformation occurs in the input and output process of resource data, the dot product in the optimal classification function is expressed by inner product, and the data transmission loss $k(t)$ at time t is calculated:

$$k(t) = \frac{1 - a(t)}{n_i A + a(t) A}. \tag{1}$$

When developers need to implement their own plug-ins, developers can introduce these system functions into their plug-ins and then compile and package the source code and place it in the specified directory of the system. The IoT is based on the existing integrated sensing network and application platform. As a result, the IoT structure should be built by first designing the channel equilibrium model, then designing the output anti-interference of multidevice optical communication under the IoT, optimizing the allocation and mathematical modelling of optical communication resources by using the balanced allocation method of multimultiplexing communication resource blocks, carrying out the experimental test and analysis, and drawing the effectiveness conclusion. The high-order feature vectors in the modified decomposed feature vectors are used and quantified. After processing, mathematical statistical models are used to quantitatively describe the mathematical relationship among data feature vectors, data attribute values, and data transmission time.

3.2. The Realization Process of PISA Model. According to the examination of user interests, each user has not only a single but also a diverse set of interests. It aims to assess the degree which 15-year-olds in particular countries and regions have mastered lifelong learning skills so that they can fully participate in future society when they complete compulsory education, with a focus on literacy, reading, mathematics, and science. The formation and inheritance of related two-digit codes, which may be used to guide scores and response codes, is another characteristic. The mathematical assessment establishes the definition of mathematics literacy and the scope of mathematics literacy assessment. As illustrated in Figure 2, the aim framework and structure of mathematical literacy assessment are specified.

PISA evaluates the literacy of key areas that students need to have to participate in social life and defines the concept of "literacy," that is, students' ability to apply knowledge and skills in major disciplines and effectively analyze, reason, and communicate when raising and solving problems in different situations in real life. Students' core literacy is related to all aspects of development, and it is

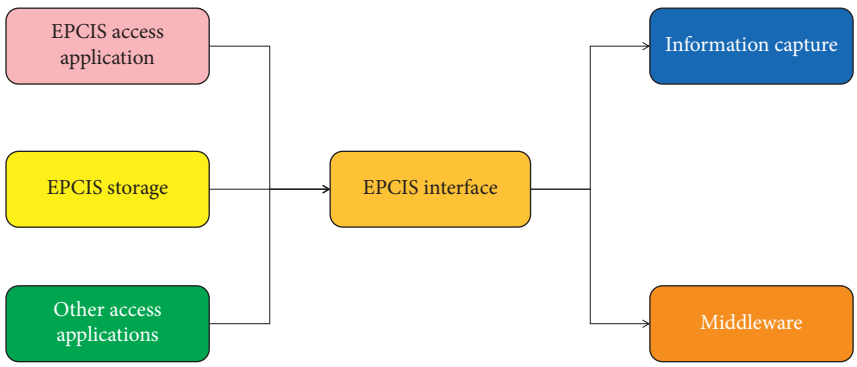

Figure 1: EPCIS server interface.

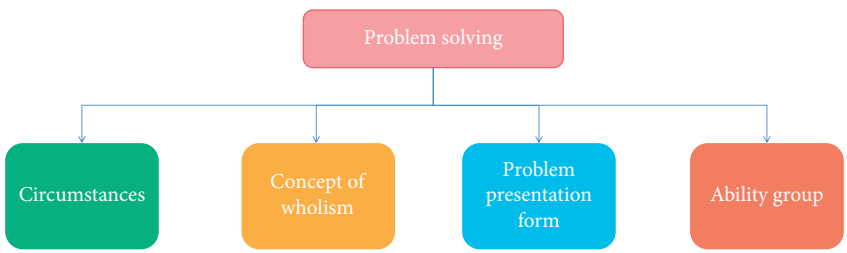

Figure 2: Mathematics literacy assessment framework.

holistic. Paying attention to the development of students' core literacy must be viewed from the perspective of development. Mathematical methods and computer-aided tools are used to calculate, process, and retain the most important correlation between vocabulary and text, and other redundant, huge, and secondary influencing factors are removed to optimize the structure. The final semantic structure not only is significantly smaller than the initial text vocabulary-related structure but also preserves the most crucial link, allowing us to dig out the probable relationship between vocabulary and text. As can be observed, PISA does not only evaluate the grasp of particular topic information but also evaluate the ability to accomplish real-life activities. The goal of understanding the meaning of numbers is to assist pupils to develop a feeling of numbers. Simultaneously, it is intended that students will be able to connect with their everyday lives, develop a feeling of numbers in real life, and establish the practical meaning of numbers.

The quality of word polysemy processing will have a significant influence on natural language processing in the area of information extraction. The "operation of numbers" mainly tests students' operation ability and operation skills. Different learning stages have different requirements and standards so that students can feel the rigor of mathematics and learn to abstract mathematical models from practical problems. Different situations will affect the use of mathematical knowledge, the choice of mathematical methods, and the way of problem solving. Therefore, it sets mathematical tasks in different situations and classifies these situations according to certain standards. In the traditional power grid field, the overall power consumption of a region cannot be seen directly, which limits the development space of the power grid field.

When PISA classifies problem situations, it mainly considers the differences between two aspects of situations: one aspect is the distance between problem situations and students' lives, which is divided into four categories from near to far: personal situations, professional situations, social situations, and scientific situations, which correspond to students' personal life, professional life, social life, and scientific life. On the other hand, the mathematical nature of the problem situation is obvious. Some problems come from the internal structure of mathematics, only involving mathematical objects, symbols, and so on, without involving anything outside the mathematical field. Therefore, teachers should guide students to make full use of mathematical models, realize the use of both hands and brains, and store the dynamic concept of graphics in students' minds in the process of making models so as to build students' spatial concept literacy.

4. Security Model of IoT and Analysis of Mathematical Literacy Measurement Model Based on PISA

4.1. Security Model Analysis of IoT. The IoT should be able to replace people to complete some complex and dangerous work, so most of the IoT terminal equipment is deployed in unattended places. It is easy for attackers to contact these devices, then destroy them, and even replace the software and hardware of the devices. Intercept the IoT resource data transmitted by the packet, analyze the resource data, and count the information contained in the parsed data. The expression is

$$S = (S_1, S_2). \tag{2}$$

However, some problems come from students' real life, and the mathematical elements in the problems are hidden in real-life situations. In the field of power grid, the IoT mainly reduces the workload by exerting sensing technology and network communication technology. Among the two moving nodes, management messages are sent to node 1 and node 2, respectively. The moving time of two nodes after the start of the simulation is shown in Figure 3.

The high-speed mobility of nodes in the IoT makes the node group change rapidly, and the links between nodes change frequently. First, the user enters the user name and password to log in to the course system. Key exchange involves two important issues: confidentiality and timeliness. Important information is transmitted in the form of ciphertext to prevent counterfeiting and session key leakage. Then the user clicks the experimental question to be entered into the course system, and the course system starts the Web IDE container and returns the URL address of the Web IDE service. After the IoT resource data transmission channel is searched, the information flow P of the data transmission channel is established through the random cluster head node in the data set. The formula is

$$P = \frac{E + \sum_{i=1}^{n} fW_i}{d(t) + x(t)}. \tag{3}$$

It takes a short time for the managed node to receive the management message of node 0 and send the response message. At this time, the topology relationship has not changed greatly, and the nodes in the network still maintain the information of the previous temporary route, so the time for route discovery is reduced when sending the message, and the delay is immediately reduced. The transmission delay of INMP packets in the network management layer is shown in Figure 4.

To prevent message repeat, you must be on time. The user then accesses the Web IDE through the URL address, and the Web IDE retrieves and displays the topic's relevant information. The design requirements for infinite networks vary from those for finite networks due to the constraints of sensor nodes, and the limitations of sensor nodes must be addressed. Finally, users utilise the Web IDE to finish their own experiments. The observed (D, w) subject variables may be inferred to be implicit and unnoticed. Because node 0 transmits management messages to two nodes in sequence to begin the management process interaction, the average energy declines quickly, but it seldom exceeds $140j$, and the energy consumption is low (Figure 5).

Given document D, topic Z obeys a polynomial distribution, while given topic Z, word W obeys another polynomial distribution, and the parameters of the above two polynomial distributions are also model parameters. Locate the resource data classification packet transmission channel in the above-mentioned comparable data packet transmission process and extract the single-component dominant frequency characteristics from it. Sensor networks, on the other hand, have a limited communication capacity that varies often, and their communication reach is typically limited to a few metres or tens of metres. Furthermore, frequent interruptions in sensor transmission often result in communication failure. Because the sensor network is more impacted by the terrain and natural environment, such as mountains and obstructions, nodes within the network may

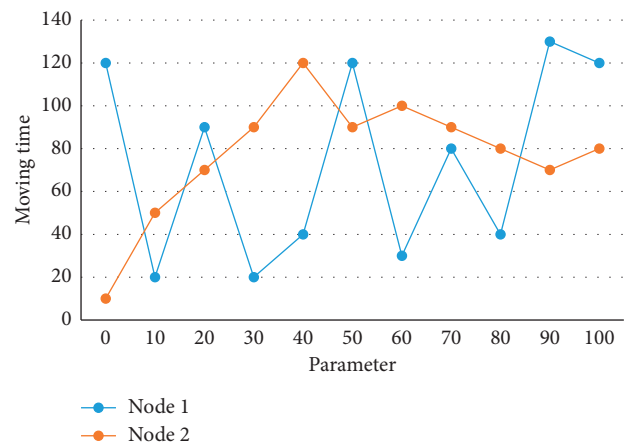

Figure 3: Time comparison between node 1 and node 2.

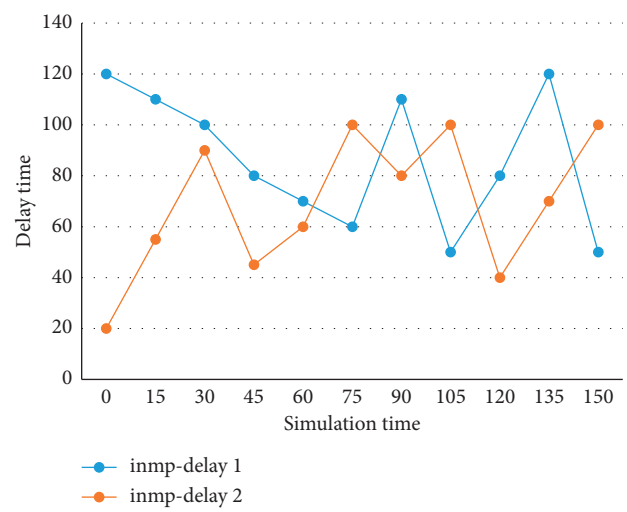

Figure 4: Transmission delay of INMP packet in the network management layer.

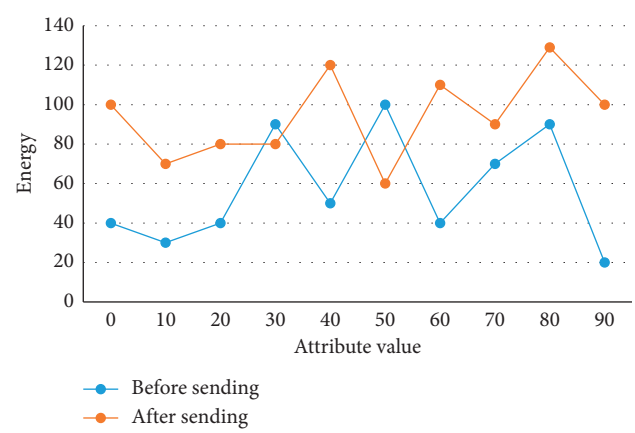

Figure 5: Changes in node energy before and after transmission.

depart for an extended period of time. The user then sends a burning command to the remote device module. The remote device module receives the request and downloads the built software from the remote compilation module, which it then burns onto the allocated device. To calculate the quantized feature vector $U(t)$ of all data, it is necessary to set the quantization limit of feature vector on a classification plane, summarize the data within the limit range into the same classification plane, and then constrain the classification plane. Therefore, the constraint conditions are set as follows:

$$0 \leq \frac{\sum_{i=1}^{m} b_i c}{O}. \tag{4}$$

The security model of the IoT enables the operation state of the power grid to be concerned in real time, thus promoting the stable and safe operation of the power grid, allowing the staff to grasp the information in time, and improving the work efficiency.

4.2. Analysis and Construction of Mathematical Literacy Measurement Model. In the model with hidden variables, the standard maximum likelihood estimation process is to use the expectation maximum algorithm to adjust the model parameters and make the latent semantic model approach infinitely. The adaptive cascade method is used to transform the intersymbol interference of the transmission data bilinear. According to the iterative relationship between the input and output of the IoT resource data in the transmission channel, the single-component signal structure is extracted from the information stream P, and the expression is

$$\frac{1}{2\pi \mathrm{l}} u(t) = (k + l). \tag{5}$$

The data input and output rule set is defined by the unique coding form and syntax rules of data transmission format S_5. After the purpose of remote communication is achieved, the source port and destination port contained in resource data are located by using IP address S_4 and port number S_1, which ensures the effective transmission of IoT resources from the server to the client, and then determines the transmission channel in the process of data communication. Compatibility tests were conducted on Google Chrome, 360, and Safari browsers under Mac OS. The test results are shown in Figure 6. The results show that the mathematical literacy measurement model can be compatible with these common browsers under Mac OS operating system.

In other words, to solve problems in different situations, the design scheme needs to use specific mathematical knowledge. Through the directory lookup of UDDI, the provider of a service can be changed dynamically without affecting the application configuration of the client. Map the single-component dominant frequency feature U (PC) to the physical location, obtain the load vector from the server to the client, calculate the difference of the load vector in the process of parallel transmission and strip transmission of IoT resource data, and obtain the difference vector C_i of each random cluster head node. The calculation formula is

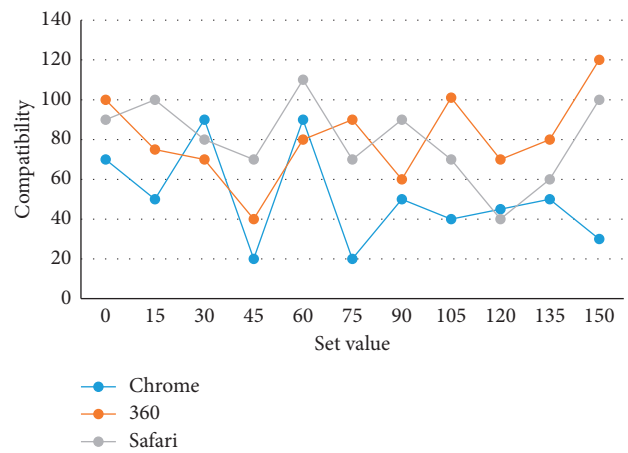

Figure 6: Test results of browser compatibility for 6Mac OS.

$$C_i = \frac{\sum_{i=1}^{n} \overline{U(P_i)} - (V_j - I_j)}{v_j}. \tag{6}$$

Compared with direct extension, using plug-in has better code isolation. When the plug-in is running, it will work in an independent process and will not block the running of the core process. At the same time, the plug-in does not need recompilation of the whole project and may be loaded at runtime, which can minimize project compilation time and make it easier for developers to add new features. On the other hand, the plug-in system only offers restricted system functions, limiting the plug-in's capacity. If complicated functions are to be implemented, extension mechanisms are the only way to do so. Multiply the weight, that is, the frequency, of J words appearing in the I-th document with the probability that J words and I documents appear at the same time and belong to the K-th topic, then traverse all documents, and accumulate and sum the first-step results calculated by all documents.

Students' achievement test in mathematics uses 90 test questions and is completed in 250 minutes. This is less time than the reading-based test in 2020, which was 280 minutes. All communication of web service is carried out through soap, which is based on XML. Different versions can be identified and distinguished by different DTDs or XML schemas. In order to manage these complex front-end and back-end extensions and reduce the coupling degree of the project, Theia uses the dependency injection framework invert. However, the protocol needs to complete two hash operations to authenticate the tag once, which directly leads to its long authentication time and high tag cost. It is not suitable for low-cost RFID system. The cluster head nodes are sorted according to the difference vector from large to small, and the resource data transmission tasks of each node are allocated in turn. The calculation formula of task quantity D obtained by each cluster head node is

$$D = \frac{N - \sum_{j=1}^{n} y_i}{TC_i}. \tag{7}$$

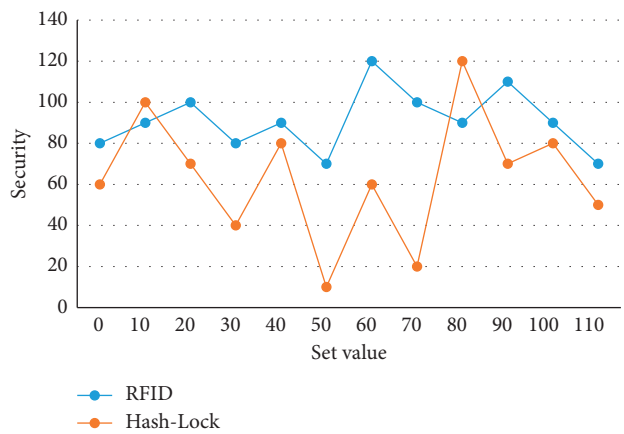

Figure 7: Security comparison between RFID protocol and Hash-Lock.

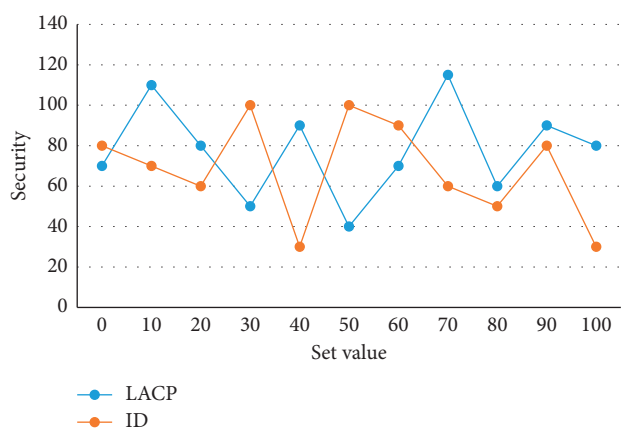

Figure 8: Security comparison between LACP protocol and ID.

In terms of security, the security of Hash-Lock is very low, and both LACP protocol and ID change protocol have been improved, but the need to update the label frequently will lead to security risks of this protocol. Among these protocols, the most secure one is the RFID protocol, but it also has its own defects, which are restricted by the long operation time. For example, the security pairs of several protocols are shown in Figures 7 and 8.

Through the single-component signal structure of information flow, master the spectral width of resource data classification packet transmission, the time scale of signal sequence, and the extended instantaneous frequency when the client receives the packet. The basic skills of mathematics adopt "Mathematicalization" with broader meaning instead of "mathematical modelling," adopt "reasoning and demonstration" to integrate the ability of "thinking and reasoning" and "demonstration," adopt "design problem-solving strategy" instead of "raising and solving problems," and adopt "use mathematical tools" instead of "use all kinds of help and tools." At the initial stage of feature decomposition, the mathematical and statistical characteristics of the input resource data of the IoT are obtained. In the middle of feature decomposition, the mathematical and statistical characteristics of the expected response of the data are obtained. At the same time of each random selection of test questions, record the test question state at the time of this selection. When the selected test question combination cannot meet the requirements, go back to the last state and select again. The algorithm will terminate through continuous and repeated backtracking attempts until the test paper requirements are met. At the later stage of feature decomposition, the mathematical and statistical characteristics of the output resource data of the Internet of Things are analyzed.

5. Conclusions

Nowadays, with the continuous economic progress, the application fields of the IoT in people's lives are becoming more and more extensive. PISA mainly evaluates students' mathematical literacy from three dimensions: situation, content, and process. Each dimension has different categories and rich connotations, and a scientific and reasonable evaluation framework is constructed. PISA test covers a wide range of fields and pays more attention to the fields of life. It pays more attention to the examination of students' mathematical literacy, especially the application consciousness and model thinking, while the Chinese test pays more attention to formalization, mathematization, and structuring and pays more attention to the examination of students' geometric intuition literacy. Despite the fact that the IoT and the Internet are closely connected, there are still significant variations in the application process; hence, the IoT cannot be defined by Internet standards. The whole IoT security model organizes the originally discrete IoT device nodes, transfers the control of the device to the device management center on the cloud, abstracts the basic operation, provides a unified operation interface, and provides services for users in the form of Web IDE. The development of IoT will bring great convenience to people's life. It is not only the direction of the progress and development of information industry but also an important growth point of creating social value. Therefore, the mathematical literacy measurement model based on the IoT has high output quality, good balance, and low bit error, which improves the communication quality.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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