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Research Article

Construction of Perceptual Classroom Based on Internet of Things Technology

Tongtong Yu

School of Business and Trade, Nanjing Vocational University of Industry Technology, Nanjing 210023, Jiangsu, China

Correspondence should be addressed to Tongtong Yu; hn487@wfd.edu.ug

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At present, in the traditional classroom teaching process, there are still problems such as differences in students' original knowledge, low student participation, and single teaching methods. For students, the mobile phone carrying rate is high, but the learning utilization rate is low and has self-control, poor ability, and low classroom participation. To solve the above problems, the research on the construction of perception classrooms based on the Internet of Things technology is particularly important. Perceived classroom refers to the use of existing technology to closely connect students and teachers, fully mobilize students' enthusiasm, and make the classroom atmosphere. This article aims to study the construction of perceptual classrooms based on the Internet of Things technology to increase students' interest. Through the investigation of the current situation of the digital campus, relying on the Internet of Things technology, the feasibility of the perception classroom is analyzed, and the perception classroom is constructed through the design of image processing and fuzzy control rules, which provides a perfect hardware environment for the digital campus. The experimental results show that based on the Internet of Things technology, through the perception of classroom interaction and practical activities, learning is no longer a process of mechanical memory of book knowledge, but a process of students constantly discovering and exploring problems and then solving problems in the process of practice. Among 84 classroom teaching behaviors, classroom interaction accounted for 69.05% of the total classroom teaching activities. In the "computer + projection" classroom environment, the proportion of teacher-student interaction in classroom teaching activities is 40.47%. Teachers can focus on the design of teacher-student interaction according to the characteristics of students and learners, avoid long-term theoretical explanations, and intersperse interactive links such as question and answer and request answers.

1. Introduction

1.1. Background. Since the 1990s, information technology and the Internet have rapidly developed and become popular. The traditional campus is based on the network, from environment, resources, activities to digitalization, to realize network office, network management, and network services, which has an important influence on the construction of digital campus, education and teaching mode, learning, and lifestyle of teachers and students. With the development of perception technology, artificial intelligence and automation technology have promoted the formation and development of a new generation of network technology Internet of Things. This will promote the research and construction of a new generation of smart digital campuses. China is one of the pioneers of IoT technology. Localities have also increased their investment in the Internet of Things industry, and the concept of "Smart Earth" and "perceived China" has become popular. The development and deployment of smart campuses have had a positive impact on the school's informatization construction and promoted the improvement of the school's core competitiveness. Therefore, this article attempts to build a perceptual classroom based on the perceptual classroom, using the Internet of Things as the carrier to provide ubiquitous online learning, integrating new network research, transparent and efficient student management, colorful classroom culture, and a convenient and thoughtful campus.

1.2. Significance. Constructivist theory believes that individuals actively construct knowledge and acquire knowledge of the world in a certain social situation, in interaction with others and the environment. An important concept of constructivist theory is the schema. Schema refers to the way in which individuals perceive and think about the world. It can also be regarded as the framework or organizational structure of mental activities. Perceptual classroom is a teaching model based on constructivism theory. With the help of the Internet of Things, technology, we focus on real-time interaction and convenient dialogue between people and things, better improve the classroom ecology, allow students to actively participate in activities and problem exploration and self-construction in their own practice and real experience, and form a positive cognitive psychology and unique cognitive personality. According to the individual needs of students, teachers should prepare rich learning resources, diverse homework forms and different levels of problems, build appropriate teaching scaffolding, and guide different students to individualized learning.

1.3. Related Work. The construction of perceptual classrooms will jointly promote the development of Internet of Things technology in teaching and increase students' interest in classroom learning. Saban pointed out that the purpose of this study was to investigate the views of teacher candidates on the physical aspects of classroom management. Instruct 120 third-grade students from the elementary education department of the state university to visit an elementary school, and observe the physical dimensions of the classroom. Guide students to tell the actual classroom they have observed, and tell the classroom they dream of. Therefore, this research aims to discover students' understanding of actual classrooms and the construction of dream classrooms from the physical characteristics. Research findings show that most teacher candidates mentioned their dream classrooms based on actual classrooms, and only one-third of them designed classrooms based on the characteristics of their dream classrooms. However, the teacher candidates did not mention the emotional impact of physical layout and environment on individuals [1]. Brown and Hughes pointed out that the purpose of this article is to examine three middle school teachers' beliefs about how their understanding of history affects their teaching. The authors of design/methods/methods conducted qualitative multicase studies based on semistructured interviews and artifact analysis. Survey results analysis described teachers' understanding of history, involving the choice of historical viewpoints, the use of textbooks, the integration of major resources in the classroom, and the tension between teaching content and teaching techniques. The study concluded that although exposure to history may be useful for undergraduates and can help history teachers manage the complexity of the major, it is still a long-term process to fully understand history to understand historical narratives in the classroom challenge [2]. Zhou and Zhang believe that with the rapid development of information technology and mobile Internet technology, the learning methods of learners have also undergone tremendous changes. In this new era, learners face two main problems: information overload and knowledge fragmentation. In this case, university teaching is no longer limited to the traditional classroom teaching mode. Instead, integrating MOOC, SPOC, and flipped classroom models is a new trend. By combining mobile Internet technology with classroom teaching and course materials, this paper constructs a flipped English teaching classroom model to solve the disconnection between teaching software and textbooks in the teaching process, to improve language learning in terms of time. And space truly realizes border learning [3].

1.4. Main Content. This article proposes to create a perceptual classroom, creating a resonance classroom of knowledge, life, and emotion. Students are the main body and the real protagonists on the stage. They are also the builders and creators of knowledge. Combining things with people based on the Internet of Things technology, the classroom is not boring, but becomes lively and interesting. This article introduced the methods of perception classroom energy saving and emission reduction, realizing classroom energy saving, and realizing and establishing the perception classroom through the construction experiment of "perception classroom." The teachers here are more to guide the students to explore and create together. The teaching process is a process of collision of ideas. This process must reflect respect for student life. There is no standard answer here. Students can speak up, think independently, explore together, and actively use existing equipment to realize their ideas.

2. Perceive Classroom Energy Saving and Emission Reduction Methods

2.1. Research Methods

2.1.1. Survey Method. Select representative schools and students, conduct questionnaire surveys and interviews on the status quo of teacher-student interaction in classroom teaching, analyze existing problems, and seek a realistic basis for this research.

2.1.2. Observation Method. In a natural situation, personally go deep into the classroom teaching, directly use your own eyes, ears, and other senses to perceive the authenticity of teacher-student interaction, and provide first-hand information for the research of this topic. For the collected data, qualitative and quantitative research methods are used to analyze the interaction between teachers and students in the classroom.

2.1.3. Experimental Method. The classroom teaching design based on teacher-student interaction is applied to classroom teaching practice, and the homogeneous contrast experiment method is used to compare and analyze the experimental results and draw the scientific conclusion of teacher-student interaction.

2.2. Key Technologies of the Internet of Things. With the rapid development of the Internet of computers and the continuous improvement of technology, through the use of radio frequency identification technology [4], sensor technology, nanotechnology, intelligent embedded technology, and other technologies, the Internet of Things will be able to realize the integration of all things in the world. In this world, the connection between things can be realized through RFID tags, as long as they use wireless sensor network technology to collect the main information of the goods to the central information center, identify them, and complete the communication. Finally, it is shared and exchanged around the world through the use of the Internet.

Radio frequency identification technology (RFID) is a major communication technology. The main step uses radio signals to directly identify and interpret the locked target, and does not require mechanical or optical linking of the identified system with the target in the process of recognition and interpretation. At present, the use of RFID technology should be very mature and complete, and the cost of the technology is extremely low. However, there are also shortcomings. In the data collection technology, RFID technology [5] is not enough, and it can only identify the type and characteristic attributes of the items. This technology is collected in the Internet of Things.

In information technology, sensor technology, computer technology, and communication technology are the most important main technologies, and they play a major role in information technology. Sensing technology is using various types of sensors to sense, to obtain corresponding information in nature, classify and process it, and finally obtain key information. The quantity and quality of information obtained from nature are mainly determined by the quality and type of the sensor. In the process of information processing, it needs to go through many procedures, the main steps of which are preprocessing, postprocessing, extraction of its main features, and selection of main information. For the identification of information, as long as the information is classified, it will be very convenient to use in the future. Wireless sensing technology plays an essential role in the perception of information in the Internet of Things.

The application principle of wireless sensors is to connect the functions of some scattered space nodes [6] (application sensors) to each other and then play the role of collecting network information, so that the information can be transmitted to each other and the content of the information can be transferred. A series of processing is forming useful information for humans. The WSN that traverses the entire network connects computing, communication, and sensor technologies, which promotes the development of the Internet of Things network. Cloud computing is a networked application program that divides a large-scale computing processing system into small pieces and then hands them to multiple servers to solve each subroutine together. After the solution is solved, they are assembled to form a whole for users.

Embedded technology is a technology that uses a computer to process information and then uses it in an application system. It is a system that integrates computers, apps, and operating systems. It is an intelligent network of embedded systems that realizes perception capabilities. In many cases, embedded systems will exist, and the development of the Internet of Things is also created on the basis of embedded systems. It is also said that the emergence of the Internet of Things symbolizes the rapid development of embedded systems.

Therefore, the Internet of Things will cause a technological revolution in the future. If the development of wireless sensors with nanotechnology can achieve significant development, then the Internet of Things will also develop rapidly.

2.3. Classroom Lighting Control Strategy. To achieve the goal of energy saving and emission reduction, a new lighting control strategy is proposed. When students enter the classroom, they turn on part of the lights in the classroom to provide light sources. The surveillance camera starts to take photos and analyzes the location of the students through image processing. The light controller turns on the lights around the students and turns off other lights. The lighting controller monitors the intensity of the lights around the students in real time and adjusts the brightness of the lights through PWM to keep the best light intensity around the students and provide a good learning environment for the students.

2.3.1. Image Processing. The first step to realize the intelligent control of classroom lighting is to analyze the position of students in the classroom, analyze the position of students in the classroom through the photos taken by the monitoring camera, and capture a monitoring picture every minute. In the figure, the contour of the human body is extracted by the steps of foreground image extraction and binarization to obtain the coordinates of the midpoint of the human body [7].

The idea of binarization is to find a threshold and compare the gray value of the image with it. If it is greater than the threshold, it is 1, and if it is less, it is 0. The Bernsen binarization algorithm that we used in this design is a local threshold algorithm that can solve the problem of uneven illumination of the image. The central idea is to calculate the threshold $T\ (x,\ y)$ of the pixel $(x,\ y)$ in the area of $(2w + 1) * (2w + 1)$ centered on the pixel $(x,\ y)$, and the expression is as follows:

$$T(x, y) = 0.5 \times \left[\max_{-w \le k, l \le w} f(x+k, y+l) + \min_{-w \le k \le w} f(x+k, y+l) \right]. \quad (1)$$

After that, $f\ (x,\ y)$ is binarized, and the relationship between its gray value and $T\ (x,\ y)$ is compared. If it is greater, then the current value is 1;

otherwise, it is 0, and the binarized image is $B(x, y)$ as follows:

$$B(x, y) = \begin{cases} 0 & f(x, y) < T(x, y) \\ 1 & f(x, y) \geq T(x, y). \end{cases} \quad (2)$$

For general images, there is usually a certain amount of noise. To reduce the problem of missing image details after binarization, the paper improved the traditional Bernsen algorithm, adding Gaussian filtering before binarization to remove excess noise. The model of the Gaussian filter is as follows:

$$G(x, y) = \frac{1}{2\prod \sigma^2 e^{-\frac{x^2+y^2}{2\sigma^2}}}. \quad (3)$$

Let $f(x, y)$ be the gray value at the point (x, y), take the point (x, y) as the center, and select a region S with a size of $(2w+1) * (2w+1)$. $f(x, y)$ is the gray value after Gaussian filtering at the point (x, y), which is the smoothing scale, k and l are the position parameters, and $B(x, y)$ is the result of binarization. The improved Bernsen binarization algorithm can be written as the following expression.

The $f(x, y)$ threshold $T_1(x, y)$ of the unfiltered wave is expressed as

$$T_1(x,y) = 0.5 \times \left[\max_{-w \leq k, l \leq w} f(x+k, y+l) + \min_{-w \leq k, l \leq w} f(x+k, y+l) \right]. \quad (4)$$

The gray value $f(x, y)$ after filtering at point (x, y) is

$$f(x, y) = \frac{1}{(2w+1)^2} \sum_{i,j \leq s} f(x, y) e^{-\frac{x^2+y^2}{2\sigma^2}}. \quad (5)$$

The threshold $T_2(x, y)$ of f (x, y) after filtering is

$$T_1(x,y) = 0.5 \times \left[\max_{-w \leq k, l \leq w} f(x+k, y+l) + \min_{-w \leq k, l \leq w} f(x+k, y+l) \right]. \quad (6)$$

Set parameter $a \in (0, 1)$, to binarize $f(x, y)$ point by point

$$f(x, y) = \begin{cases} 0 & f(x, y) < (1-a) T_1(x, y) + a T_2(x, y) \\ 1 & f(x, y) \geq (1-a) T_1(x, y) + a T_2(x, y) \end{cases}, \quad (7)$$

where a is the adjustment coefficient. The degree of Gaussian filtering [8] can be changed by adjusting the size of a. When $a = 0$, the system does not add Gaussian filtering. The value of a is not as large as possible. If it is too large, the image will be partially distorted, as shown in Figure 1.

2.3.2. Fuzzy Control Algorithm. The indoor light intensity y of the system is different from the target light intensity $y1$, and e is obtained; that is, $e = y - y1$, the error rate of change is $de = e_{i+1} - e_i$, e_{de} and u are fuzzified, and the language variables are E, DE, and U, respectively. The state stipulates that the light intensity in the classroom is between 300 and 500 lux, and the system determines that e does not exceed 80 lux; that is, the domain of science is [80, 80], the domain of E is $X = \{-4, -3, \ldots, 0, \ldots, 3, 4\}$, the quantization factor of e is $ke = 4/80 = 0.05$, and the language variable E is {*NB*, *NS*, *O*, *PS*, *PB*}, so that the membership function of the error e can be determined. Establish the assignment table of E, as shown in Table 1.

The light intensities measured by the sensors in the classroom are all accurate values, which can be calculated by converting them into the membership function of the fuzzy set. For example, if the detected light intensity in the classroom is $y = 415$ Lux, and the target light intensity is $y1 = 450$ Lux, then $e = -35$ can be calculated. After transformation $[e'] = -2$, you can see -2 level from the table. The upper membership degree is only 1.0, and the maximum value is 1.0. According to the ZAD method, it can be expressed as

$$NS = \frac{0.5}{-3} + \frac{1.0}{-2} + \frac{0.5}{-1}. \quad (8)$$

The fuzzy set NS is the fuzzy result of the exact error e. The fuzzification principle of error rate de is the same as e. Select the domain $Y = \{-4, -3, \ldots, 0, \ldots, 3, 4\}$ of DE, the transformation factor $K_{de} = 1$ from de to DE, and the language variables of DE are {*NB*, *NS*, *O*, *PS*, *PB*}, according to the membership function to establish the assignment table of the language variable DE shown in Table 2.

Finally, determine the domain of the output variable u, divide the LED light from the brightest to the extinguished into 100, evenly, select the domain of U, $Z = \{-4, -3, \ldots, 0, \ldots, 3, 4\}$, the transformation factor from u to U is $K_u = 1$, and the language value of U is {*NB*, *NS*, *O*, *PS*, *PB*}. According to the membership function, the assignment table of the language variable DE shown in Table 3 is established.

2.3.3. Design of Fuzzy Control Rules. The design of fuzzy control rule [9] depends on experience. On the basis of fuzzy set theory and operation experience, the control quantity of equipment operation is obtained by reasoning. The fuzzy control rule base is induced and established by if-then statement. This design adopts a fuzzy controller with dual input and single output. The expression of the sentence is as follows:

If there are E and DE, then there will be U.

For example, if $E = PB$ and $DE = PB$, then $U = NB$; this sentence indicates that if the light intensity in the classroom is much larger than the target light intensity, and the brightening trend is great, the control light dimming should be taken to the maximum state at this time. In the design, E and DE both have 7 language values, and the control state U should have 25 situations. These 25 situations are summarized into a control rule table, as shown in Table 4.

Figure 1: Binarized image when $a = 0.2$.

Table 1: Language variable E control table.

$E\ u(x)\ X$	−4	−3	−2	−1	0	1	2	3	4
NB	1.0	0.5	0	0	0	0	0	0	0
NS	0	0.5	1.0	1.0	0	0	0	0	0
O	0	0	0	0	1.0	0.5	0	0	0
PS	0	0	0	0	0	0.5	1.0	0.5	0
PB	0	0	0	0	0	0	0	0.5	1.0

Table 2: Language variable DE control table.

$DE\ u(x)\ Y$	−4	−3	−2	−1	0	1	2	3	4
NB	1.0	0.5	0	0	0	0	0	0	0
NS	0	0.5	1.0	0.5	0	0	0	0	0
O	0	0	0	0.5	1.0	0.5	0	0	0
PS	0	0	0	0	0	0.5	1.0	0.5	0
PB	0	0	0	0	0	0	0	0.5	1.0

Table 3: Language variable U control table.

$Uu\ (x)\ Z$	−4	−3	−2	−1	0	1	2	3	4
NB	1.0	0.5	0	0	0	0	0	0	0
NS	0	0.5	1.0	0.5	0	0	0	0	0
O	0	0	0	0.5	1.0	0.5	0	0	0
PS	0	0	0	0	0	0.5	1.0	0.5	0
PB	0	0	0	0	0	0	0	0.5	1.0

Table 4: Fuzzy control status table.

E U DE	NB	NS	O	PS	PB
NB	PB	PB	PB	PB	PB
NS	PB	PS	PS	O	NS
O	PB	PS	O	NS	NB
PS	PS	O	NS	NS	NB
PB	NB	NB	NB	NB	NB

The 25 fuzzy sentences are described by connecting them through the "or" relationship. The fuzzy relationship R ($i = 1, 2, \ldots, 25$) of each fuzzy conditional sentence is calculated as follows:

$$\widetilde{R}_i = \left(E_i \times DE_i\right) \times U_i. \tag{9}$$

After calculating each fuzzy relationship R ($i = 1, 2, \ldots, 25$), we start to calculate the total fuzzy relationship of the entire control system:

$$\widetilde{R} = R_1 \vee R_2 \vee \ldots R_{25} = \bigcup_{i=1}^{25} R_i. \tag{10}$$

According to the fuzzy subsets E_i and D_{Ej} on the input language variable universe, calculate the fuzzy subset U_{ij} on the output language variable universe:

$$U_{ij} = \left(E_i \times DE_j\right) \circ \widetilde{R}. \tag{11}$$

2.3.4. Precision. According to the previous introduction, the fuzzy set of the output has been obtained. If the fuzzy number is executed, defuzzification needs to be performed, and it is converted into a precise quantity and applied to the actuator. This process is also called precision. The commonly used center of gravity method is used to achieve precision. The center of gravity method takes the center of gravity of the area enclosed by the fuzzy membership function curve and the abscissa as the output value of fuzzy inference. For a discrete domain with n output quantization series [10], there are

$$v_0 = \frac{\sum_{k=1}^{n} v_k \mu_v\left(v_k\right)}{\sum_{k=1}^{n} \mu_v\left(v_k\right)}. \tag{12}$$

If the calculation result is not an integer, the result is rounded. The control output obtained by precision is a quantization level, and then multiply it with the quantization factor mentioned in the previous article; that is, $u = k_u * V_0$, and the executable control quantity u of the system can be obtained.

As shown in Table 5, the fuzzy control table is a two-dimensional array. When writing a single-chip microcomputer program, you must first declare a two-dimensional array [9]. When the single-chip microcomputer is running, the error collected will be e and the error rate of change de is multiplied by its quantization factors k_e and K_{de} to obtain their respective domain representation elements x and y, and then query from the two-dimensional array fuzz [9] to find the corresponding control variable u, and then multiply. With its scale factor k_u, the actual control amount can be obtained, and the brightness of the light can be adjusted.

Table 5: Fuzzy control table.

e u de	−4	−3	−2	−1	0	1	2	3	4
−4	4	3	3	3	3	3	0	0	0
−3	3	3	3	2	2	2	0	0	0
−2	3	3	2	2	1	1	0	−1	−2
−1	2	2	2	1	1	0	−1	−2	−2
0	2	2	1	1	0	−1	−2	−2	−3
1	2	1	0	−1	−1	−2	−2	−3	−3
2	2	1	0	−1	−1	−2	−2	−3	−3
3	0	0	0	−2	−2	−2	−3	−3	−3
4	0	0	0	−3	−3	−3	−3	−3	−4

3. "Perception Classroom" Construction Experiment

Through questionnaire surveys and interviews, we have learned about the current situation of the classroom. Teachers rarely use information technology in the classroom, and many equipment is idle and cannot really play its role. Because many teachers are experienced, they have difficulties in accepting new ideas and new technologies. However, the role of information technology in education is unquestionable and cannot be ignored. Therefore, under the support of the existing information technology environment and existing platforms, we must jointly create our own "perceived classroom," inject new vitality into teaching, maximize the use of equipment, optimize classroom teaching effects, and optimize students' learning experience.

The teaching goal of the perceptual classrooms is that teachers organize teaching reasonably, and information technology really plays a role. Teachers choose different teaching strategies according to the different teaching contents of different students, use their own words and deeds to influence students' words and deeds, and help students develop good thinking habits.

Students can enjoy the learning process and use related equipment to learn and create independently. They can study independently and think independently. It can also be created by teamwork. Finally, the profound resonance of knowledge, social life, and the lives of teachers and students is reached.

3.1. Provide Hardware Environment. The hardware environment is the foundation of a modern classroom and a necessary condition for a good class. The author's ideal classroom is not for a certain class, but for the general needs of junior high school mathematics.

3.1.1. Sound Recording and Broadcasting System. As shown in Figure 2, it is a standard classroom for information education. Area A in the front is the classroom, and Area B in the back is the listening room. The advantage of separating the classroom from the listening room is that the attendees can listen to the lesson at any time without interrupting the classroom. Because the front and rear are separated by mirror glass, the attendees can clearly see the picture in the classroom during the class, but the people in the classroom

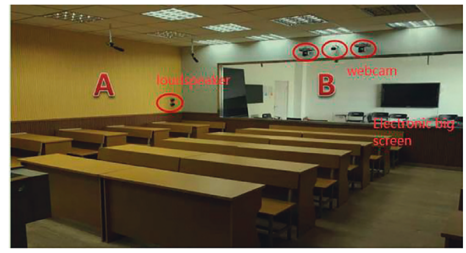

Figure 2: Classroom with recording and broadcasting system.

Figure 3: Recording system host.

cannot see the lesson in this way; even if the classroom is full of leaders and classrooms, it will not bring any psychological pressure to the classroom and students, and the audience will hear a normal class that represents the real situation of the teacher. The circle marked [11] in the classroom of Area A is the automatic tracking camera throughout the whole process. In the classroom, no matter if the teacher and the student have a large floating movement, such as the teacher's gesture, the student raises their hand and speaks, and the camera can track it. At this time, the expression of the speaker can also be clearly presented and recorded. The TV on the side wall of Area B is used to present the teacher's courseware, and the wall on the back is a hanging all-in-one machine, which is convenient for the lecturers and instructors to comment on the lectures. There is also a device in area B as shown in Figure 3, the host of the recording and broadcasting system. Its function is to complete the recording and postproduction of classroom videos. In the past, to facilitate after-class research and realize classroom reobservation, at least two sets should be installed on the classroom shelf. The above video recorder and two professionals are used to track the operation, and the required pictures must be organized according to the audio track later. With such equipment, we can also realize the live and broadcast of classroom videos [12], so that experts and scholars from other places can participate in the lectures. These authors believe that they are also part of the integration of information technology and courses.

3.1.2. 3D Printer. With the development of technology, 3D printing in the classroom is no longer out of reach. The teacher concluded that the integration of 3D printing and mathematics has the following advantages: 3D printing technology realizes the concept that mathematics comes to life, allowing students to see the real object of spatial imagination; with the help of modeling software such as the 3D one, it can restore students who lack a sense of space. A real picture helps to learn the knowledge of three-dimensional graphics, through the printer to verify whether your modeling ideas are correct.

3.1.3. Pad. Pad entered the classroom and set off a wave of times. Recalling that in the mathematics classes, the teachers left students with analytical tasks for proof questions. Students quickly wrote different proof processes on their own scratch paper, just for who can be the first. After finishing the writing, let the teacher present it to the class through the physical booth. Now, how can we save paper and pen through the pad [13] and write directly in the homework mode. After finishing the one-click submission, it can be presented on the big screen. When the results are presented on the big screen at the same time, students can start a discussion and vote for the simplest process with pad.

Another function of the pad is to realize the instant feedback of objective questions. In the practice class, teachers can send practice question banks to students. The question types can be multiple-choice questions and fill-in-the-blank questions. Students can choose the difficulty level of the question according to their actual situation. Each question will have instant feedback after the students answer, and all questions will have a total score. The teacher has a real-time monitoring function for students' answers. As shown in Figure 3, you can know what percentage of students has chosen different levels. Judge and understand the completion of teachers' teaching objectives by researching and analyzing students' responses to questions. At this time, the pad realizes teaching students in accordance with their aptitude and realizes that teachers can check the quantity and quality of students' homework at any time, and can quickly solve the problems in the homework in the classroom.

At the same time, pad can realize the sharing and mutual evaluation of subjective questions [14]. What people care most about is the evaluation of others. This is especially true for students in junior high school. In view of the psychological characteristics of their age group, a student's point of view is in class, and it was proposed that other students gave an agreeable point of view. This student naturally accepted it. How to give an opposing point of view might be rebutted out of the face and without thinking. If this form is moved to pad, the student will express his own opinion. Opinions are established in a forum. The authors will not have much emotional fluctuations when receiving different opinions. They think this is a very private discussion. The opinions that the students give me are for their own good, so they will think and accept humbly and modify them objectively. Improve your point of view.

3.1.4. Combination of Blackboard and Whiteboard. No matter how good the whiteboard is, the author believes that it cannot replace the role of the blackboard in a class. The blackboard writing is a high-level summary of the key and difficult content of a lesson. Students can always pay attention to the content on the blackboard and recognize their own mathematics. The structure of knowledge has an impact, and a new cognitive model is constructed through various forms of content on the whiteboard [15, 16] as shown in Figure 4.

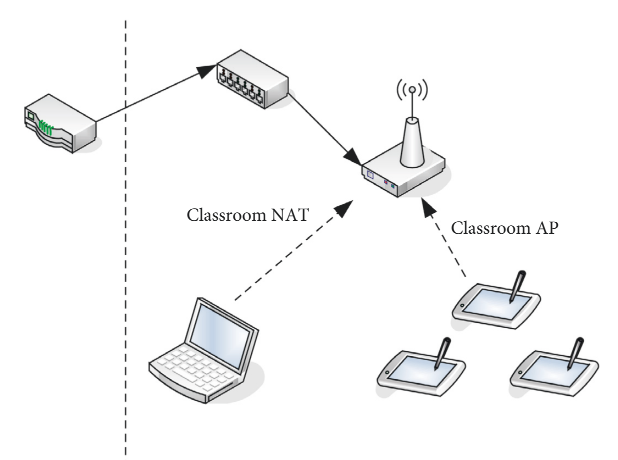

Figure 4: Hi-teach classroom internal network.

3.2. "Teacher-Class" Interactive Activity Design Based on Interactive Whiteboard. The interactive whiteboard combines the advantages of "blackboard" + "computer projection." The whiteboard screen is both a "whiteboard" and a computer screen. The teacher breaks away from the shackles of the computer console [17], walks into the middle of the students from the high platform, and looks. It is also not necessary to alternate back and forth between the computer screen and the student, which is more in line with the teacher's habit of talking and writing while walking. It not only plays the role of teachers in guiding and assisting learning, but also highlights the dominant position of students, and the interaction between teachers and students is more equal and naturally accessible. Use interactive whiteboards to create a reasonable teaching situation, naturally carry out teachers' classroom interactive activities, and create a relaxed teaching environment. Display multimedia materials such as pictures, music, and animation related to the main body of teaching content, present them intuitively and easily, strengthen the connection between students' original knowledge and new knowledge, and enhance students' confidence in participating in learning. For the teaching content that students cannot see and operate, using the characteristics of multimedia to reproduce and simulate, students can more truly feel the shape of things and the process of development and change, which makes up for the deficiency of traditional teaching in the presentation of teaching content.

It can be intuitively observed from Figure 5 that in teacher *Z*'s classroom teaching, teacher-class interaction and teacher-person interaction are the main types of classrooms. In classroom teaching, teachers spend most of their time in classroom narration and teacher-student questions. By recording the number of teacher-class interactions and the

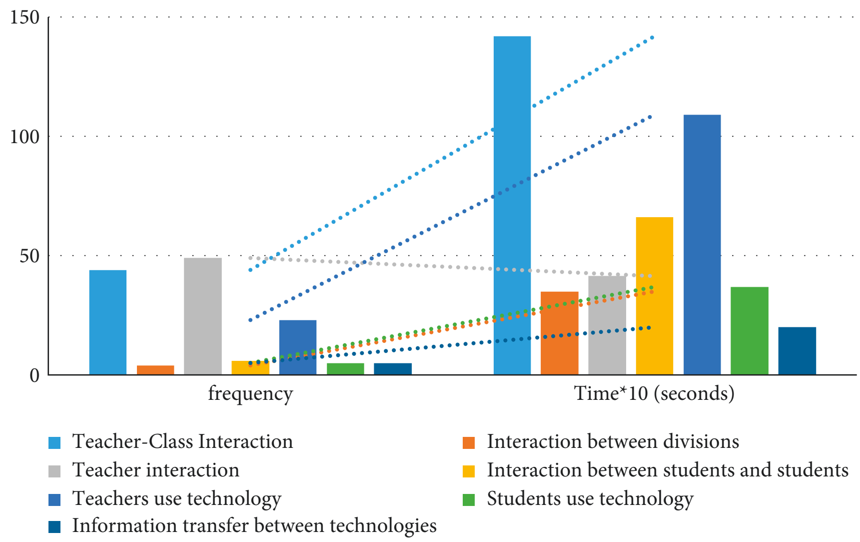

Figure 5: Analysis of observation results.

number of teacher-teacher interactions, the frequency of teacher interaction is very high, but the proportion of teacher-teacher interaction time makes the teacher-class interaction average. It can be seen from the data that the teacher has a high frequency of interaction with student, the time is short, and the classroom rhythm is fast. Combined with video observations, it is found that questions and answers in teacher-person interaction are the most important way of interaction, and teachers and students have almost no time to think. The time for questioning and answering does not exceed a minute or even a few seconds, which reflects the problems existing in teachers and students in classroom teaching.

3.2.1. Whiteboard Interactive Function Design Example 1. The course introduction link can bring students into the problem situation by setting up questions and placing suspense, fully arouse students' curiosity, and gradually solve the problems to lead the teaching content in depth, so that we can firmly grasp the attention of all students and allow students to consciously and wholeheartedly devote themselves to the interaction to achieve the expected teaching effect or even exceed the expected teaching effect. For example, using the "screen curtain" function of the interactive whiteboard [18] to raise questions, pull the opening cloth from up, down, left, and right, and gradually carry out the teaching process to create the feeling of uncovering the mystery and improve students' attention.

3.3. "Teacher-Group" Interactive Activity Design Based on Interactive Whiteboard. Different students have a different breadth and depth of knowledge, problem-solving methods, and values. Group activities are organized under the organization of teachers. Students can diverge thinking and have unlimited creativity. They can work together to complete tasks in an active atmosphere, which is conducive to students' communication and feelings, and it is conducive to the cultivation of students' expression abilities and organizational abilities, turning a limited classroom into an infinite space for everyone to participate in [19] and think individually.

Teachers use interactive whiteboards to present group discussion questions during the teaching process. The members of the group first use their brains to think independently and speak their own ideas. After the discussion and analysis of the group members, the group members are comprehensively satisfied with the proposal. The selected group representatives present the conclusion on the whiteboard, and the whiteboard camera screenshot [20] function can save the conclusion in the form of pictures. In the teacher comment session, select screenshots of each group from the resource library, display the discussion results side by side, compare similarities and differences to find problems, and at the same time, increase the group mutual evaluation link, which is more conducive to the communication and learning between the groups. Teachers need to control the rhythm of classroom activities, and listen to and give appropriate guidance during group discussions, to ensure that each student participates in group activities and appreciates the fun and meaning of group activities. In addition to designing collaborative teaching activities within the group, mutual assistance or competition activities between groups can also be appropriately carried out to increase the classroom learning atmosphere and cultivate students' sense of responsibility, teamwork, and competition.

3.3.1. Whiteboard Interactive Function Design Example 3. In this example, the "magnifying glass" function and "texture brush" of the interactive whiteboard are mainly used. Oral English practice is one of the English classroom teaching links. Teachers use the interactive whiteboard multimedia presentation function [21] to show several sets of pictures, allowing students to understand the meaning of the pictures, set the character of the characters, design the content of the dialogue, or select relevant to the teaching

Table 6: Observation record of classroom interaction behavior in “computer + projection” environment.

	Time	Teaching process	Types of interaction	Refine	Specific interaction behavior
1	0 : 00–0 : 18	The teacher reminded the students to start the class	Teachers and students	Division class	Organization management
2	0 : 19–0 : 40	The teacher talks about the course arrangement of this section	Teacher’s individual behavior		
3	0 : 55–1 : 48	The teacher plays the video, and the students watch it	Teacher-media + living medium		Division operation media, media The body acts on life
		....			
37	20 : 17–20 : 29	The teacher explained the exercises	Teachers act alone		
38	20 : 40–20 : 52	The teacher asked the students to discuss the exercises in groups	Teachers and students	Teacher-class	Request response
39	21 : 59–24 : 13	Teachers and students + continuous questioning and discussion results, broadcast by projection Put preprepared answers	Teacher-media	Teacher	Questions and answers, the teacher operates the media
		....			
62	35 : 47–37 : 18	The teacher invites students to participate in the game and sends digital cards to each student who participates in the game	Teachers and students	Teacher-class	Request response
67	39 : 50–40 : 12	Teacher summary	Teacher alone		
68	49 : 13–40 : 35	Review key points	Teachers and students	Teacher-class	Question and answer

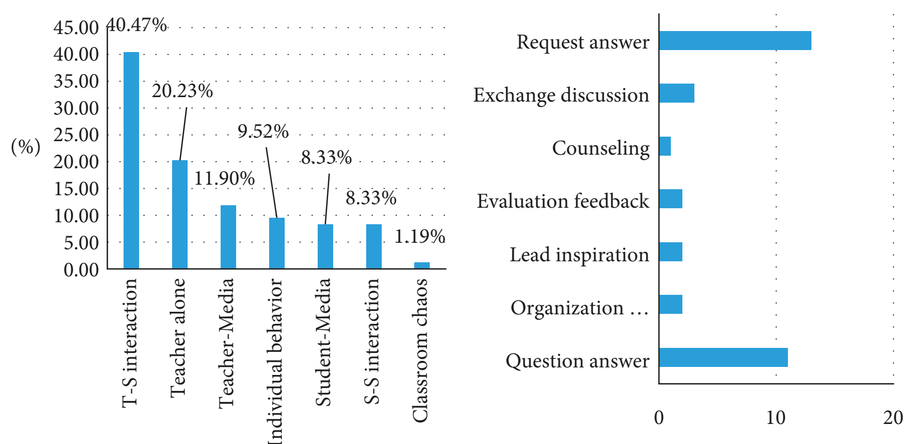

Figure 6: Classroom interactive activity allocation and specific behavior based on frequency. (a) Classroom interactive activity allocation. (b) Specific behavior based on frequency.

flash or English movie fragments provided for students to provide students with English lines. After discussion and practice, the dialogue or dubbing will be displayed in a group.

4. Teacher-Student Interaction Activities

Classroom observation records of teaching videos in a certain “computer + projection” environment, a total of 69 records, including 84 classroom interaction behaviors, are summarized in Table 6.

As shown in Table 6, in 84 classroom teaching behaviors, classroom interactive activities accounted for 69.05% of the entire classroom teaching activities. In the classroom environment of “computer + projection,” the teacher-student interaction accounted for 40.47% of classroom teaching activities. Teachers can focus on the design of teacher-student interaction according to the characteristics of students and learners, avoiding long-term theoretical explanations, and interspersed with questions. Interactive links are answering and request response. Teachers’ individual behavior and students’ individual behavior without interaction accounted for 20.23% and 9.52% of the entire classroom activities, respectively. Teachers’ individual behaviors are mainly written on the blackboard, hands-on props, hands-on postpictures, explanation of principles, summary evaluation, etc., for students. The proportion of teachers’ explanations is relatively high. Although some textures and tools are prepared to attract students’ attention [22], the time spent on operating teaching tools is too long. The proportion of student activities is 8.33%, and the enthusiasm of student group activities is high. Perhaps, the content of the group exploration is relatively simple, and there is no longer-term student-student interaction activity, but the student-student discussion, student-student mutual evaluation, and other links are still designed. There were too many students participating in the last game, and students were required to go to the podium. There was a period of class confusion during the process of returning to their seats.

As shown in Figure 6, teachers use the media to inspire teaching content and create situations. The behavior of counseling and answering questions is a demonstration of the teacher walking among the students during the group discussion, answering questions, and so on.

As shown in Figure 6(a), the main interactive activities are mainly reflected in requests for responses and questions and answers. The frequency of occurrence is 13 and 11, respectively. To keep students' attention during the teaching process, teachers often use question and answer and request response methods. When comparing the size of the exercises of 10, the interaction of questions and answers is adopted, and the composition of exercises of 10 is also the interaction of questions and answers. The emphasis and difficulty of teaching are not prominent, the interaction method is single, and the teaching process [23] is relatively monotonous. The behavior of counseling and answering appeared once, when the teacher walked among the students during the group discussion and answered the students' questions. It can be seen that the teacher did not pay attention to the design of the interactive activities for counseling and answering.

As shown in Figure 6(b), teacher-media interaction and student-media interaction accounted for 11.9% and 8.33%, respectively. Multimedia is mainly used as a presentation tool for teaching content in the teaching process. The operation of the media by the teacher is independent of the teaching activity. Due to the poor visibility of the multimedia console, the teacher lowered his head at least twice to adjust the mouse and select links [24]. The teacher's individual behavior, such as teaching the principle and summarizing the teaching content, is accompanied by some gestures to emphasize the teaching content during the teaching process. The interaction between students and the media is almost all passive interaction; that is, the media acts on students. Students receive multimedia information by watching pictures, videos, etc. There is only one time when the teacher asks a student to come on the stage to operate the computer. Digital connection is an active interaction between students and the media.

5. Conclusions

Traditional learning is a way of passive acceptance. In contrast, research-based learning has strong initiative and practicality. Only by personally experiencing learning and gaining a wealth of experience can students truly stimulate their enthusiasm for learning, mobilize existing cognitive experiences, and promote the further construction of knowledge. The process of meaning construction is essentially a process of solving practical problems. Teachers should guide students to learn that students use problems as learning carriers and problem-centered to organize their own learning activities. Based on the Internet of Things technology, through perceptual classroom interactions and practical activities, learning is no longer a process of memorizing book knowledge mechanically, but a process in which students continuously discover and explore problems in the process of practice, and then solve problems. Perceived classrooms need to provide students with relevant emotions, but also need to generate various questions and problems in student emotions, guide students to explore problems, and actively construct relevant knowledge. Based on the cognitive theory of constructivist teaching, the classroom is no longer a preset activity, but an effective and equal dialogue between teacher and students. Perceptual classroom is formed through the behavior and interaction of participants, and it encourages teachers and students to generate lessons in interaction and dialogue. Teaching has become a common exploration activity for teachers and students in the process of meaning creation. In the classroom, teachers can timely grasp and flexibly deal with situations with generating value, making teaching full of flexibility, wisdom, and vitality. At the same time, this kind of expansion and deepening of the classroom promotes students' autonomous, individualized, and creative learning.

Data Availability

No data were used to support this study.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding the publication of this article.

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