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Intelligent English Education and Teaching Evaluation System Based on Internet of Things System

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Abstract: *At this stage, the development of IoT technology is very good. Technology-based developments allow for more possibilities in education and instructional assessment, which is especially true for English evaluation. Although the whole people are now learning English, assessment of teaching quality and differences between teachers is difficult to do by professionals, which makes the development and application of intelligent English education and teaching evaluation system urgent. This paper designed an English education and teaching evaluation system and designs a comparative experiment to analyze and find that the use of this intelligent English education and teaching evaluation system not only improves the satisfaction of teachers and students for education and teaching evaluation, but also improves the scientificity and authenticity of the evaluation results, objectivity and validity. Compared to conventional education and teaching evaluation systems, the intelligent English education and teaching evaluation system also has good system performance advantages, strong reliability, low cost, and low energy consumption. To sum up, the intelligent English education and teaching evaluation system based on the IoT system can effectively improve the evaluation efficiency of students' English learning. It has been proven that the application of computational intelligence in the intelligent English education and teaching evaluation system is beneficial to English teaching and learning, and can be applied to education in the future to promote the long-term development of education.*

Keywords: *Internet of Things, Smart Teaching, Smart Evaluation System, English Education*

1. Introduction

With the advancement of scientific technology, the new era has put forward higher expectations for English education and teaching and its evaluation. Today's English education and pedagogy is no more the traditional way of students' learning, teachers' teaching, and then filling out questionnaires at random. Instead, it pays more attention to the process education of students, which is related to the whole process of education. Simple offline teaching and learning can no longer meet the needs of modern education, and teaching and evaluation based on IoT technology are gradually gaining popularity. At this stage, the scale of education continues to expand, the number of students continues to increase, and the heavy workload brings enormous pressure to teachers. This harsh condition seriously affects the effectiveness of educational and pedagogical evaluation. In addition, with the development of the IoTs, the IoTs has many applications in the education industry. Based on this, in the face of such a huge number of students and the amount of information, the adoption of the IoT in English education and teaching evaluation is particularly important. Therefore, there is a need to address the application of IoT to English language education and teaching evaluation.

At present, the research on the evaluation of English education and teaching is relatively common. Yu Y proposed an innovative model of college English teaching based on network learning resources and MOOC improvement [1]. Su H discussed the application of pattern grammar and local grammar in English teaching, and carried out the evaluation of related content [2]. Lu C presented a teaching quality assessment method based on RBF neural networking optimized by genetic algorithm. The results showed that the method can effectively evaluate the teaching quality of English interpreting with relatively high accuracy and real-time performance [3]. Tavoosy Y evaluated the fifth grade intensive English language teaching plan according to teachers' opinions, and used descriptive and content analysis methods for data analysis. The results showed that most teachers have a positive attitude towards the fifth grade English

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intensive course and its curriculum [4]. The aims of Nurmayanti N' study was to assess students' proficiency with Quillbolt to compose error-free original scientific papers in English. It is a quantitative study. One particular type of data was used for analysis in this study, and that was responses to questionnaires [5].

At this stage, the research on IoT is also becoming mature. Razzaque M A outlined a set of requirements for IoT middleware and conducts a comprehensive review of existing middleware solutions for these requirements [6]. Perera C examined more than a hundred IoT smart solutions on the market, developed by start-ups, SMEs, large corporations, academic research institutes such as universities, and private and public research institutes. And he studied them carefully to identify the technologies, functions and applications used to provide guidance and a conceptual framework for future research on the IoTs [7]. Xue J W addressed the computationally complex problem of compressed sensing algorithms. He used the multi-objective optimization particle swarm optimization algorithm to improve the search term of the gradient projection sparse reconstruction algorithm, which can effectively improve the reconstruction accuracy of the algorithm [8]. Stojkoska B defined the main features of the overall framework of the smart home from a literature review. A general description, discussion, and future challenges of IoT-based solutions based on a holistic framework for smart home management models [9]. Hahm O analyzed the specific requirements that an operating system should meet to run on low-end IoT devices and investigates applicable operating systems. Focus is on candidates that may become equivalents for such devices, namely the most suitable open source operating systems for low-end IoT devices [10]. To sum up, the IoTs technology is developing vigorously and is being reused in a wide range of fields. Many scholars are also solving the problems in the evolvement process of the IoT.

In order to solve the existing problems of English education and teaching, this paper studies the application of the IoT system in English teaching. It designed an intelligent English education and teaching evaluation system based on the IoTs system, and compared the satisfaction of students and teachers using the intelligent English education and teaching evaluation system. The evaluation results of both the teachers and students' use of the traditional education and teaching evaluation system and the intelligent English education and teaching evaluation system are to be analyzed. Finally, the two kinds of education and teaching evaluation systems are systematically analyzed.

2. Introduction to Intelligent English Education and Teaching Evaluation System

(1) The composition of the education and teaching evaluation system

The education and teaching evaluation system generally consists of five modules [11]. The five modules are: teaching grading module, lesson plan module, instructional video module data acquisition module, and attendance module. Specifically as shown in Figure 1:

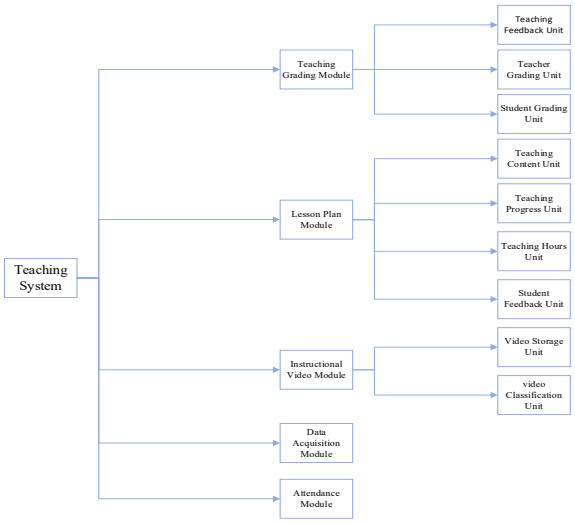

Figure 1: Composition of Education and Teaching Evaluation System

Design of teaching grading module: The teaching grading module mainly includes teaching feedback unit, teacher grading unit and student grading unit. Teaching grading includes mutual evaluation and self-evaluation between teachers and students. Mutual evaluation means that teachers evaluate students, and students also evaluate teachers. Self-evaluation is the evaluation of teachers and students on

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themselves.

Design of teaching plan module: The teaching plan module mainly includes teaching progress unit, teaching content unit, teaching class hour unit, and student feedback unit. The design of the teaching plan module is mainly to remind teachers to keep in mind the various steps of teaching and to pay attention to the feedback of students.

Design of instructional video module: The teaching video module mainly includes video storage unit and video classification unit.

(2) Problems in the current evaluation system of education and teaching

At this stage, the education and teaching evaluation systems on the market are not targeted for English evaluation [12]. Because of the complexity and uncontrollability of English teaching, a simple teaching evaluation system cannot guarantee that students truly master English. In addition, because of the large number of students to be taken care of, it is impossible to guarantee that all aspects of the students will be taken care of, and a large number of students cannot study personally. The intelligent English education and teaching evaluation system involved in this research can solve these problems very well.

(3) Composition of Intelligent English Education and Teaching Evaluation System

In the actual operation process, the intelligent English education and teaching evaluation system consists of several main parts, such as electronic whiteboard, computer, IoTs, teacher-side equipment, student-side equipment, and education cloud platform [13].

In the wireless transmission of the wireless communication module, step 1 is: Assume that the campus network has L cells in total, each cell has 3 sectors, each sector has a base station. And each cell has N users: Assuming that the number of antenna array columns of the wireless base station is Nt, the number of array elements on each column of antennas is Nv, and the number of antennas at the receiving end is Nr, the dimension of the channel matrix H obtained by the user is $N\mathrm{r}\times(N\mathrm{t}\times N\mathrm{v})$. In the i-th region, the signal received by user k is expressed as:

$$\mathrm{y_k} = H_{3D\mathrm{k}}{}^{(\mathrm{i})} w^{(i)} x_k + \sum_{\mathrm{l}=1, l\neq i}^{3L} H_{3Dk}{}^{(l)} w^{(1)} \mathrm{x_l} + \mathrm{n_k} \tag{1}$$

In Formula (1): H3Dk is the three-dimensional channel matrix between the base station and user k in the i-th cell sector;

$H3Dk^{(l)}w^{(l)}$ (l≠i) is the three-dimensional channel matrix between the base station and user k in other cell sectors;

$w^{(l)}$ (1=1, 2, ..., 3L) is the precoding matrix between the first base station and its serving user;

x1 (l=1, 2, ..., 3L) is the signal sent by the first base station, and n_k is noise.

Step 2: After user k receives the signal y_k, it first performs channel estimation on $H_{3Dk}{}^{(i)}$ to obtain a channel matrix of size $N\mathrm{r}\times(N\mathrm{t}\times N\mathrm{v})$. Assuming that the sub-channel matrix between the jth transmitting antenna and the receiving antenna at the base station is $H_{jk}^{(i)}$, and the size of the sub-channel matrix $H_{jk}^{(i)}$ is $N\mathrm{r}\times N\mathrm{v}$, the three-dimensional channel matrix H is rewritten as:

$$H_{3Dk}{}^{(\mathrm{i})} = \left[H_{1\mathrm{k}}^{(\mathrm{i})},\ H_{2\mathrm{k}}^{(\mathrm{i})},\ H_{3\mathrm{k}}^{(\mathrm{i})},\ldots,H_{N_t k}^{(i)}\right] \tag{2}$$

The DFT codebook is used for feedback in the vertical direction of the three-dimensional channel matrix, and the feedback form is:

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$$Codebook = \frac{1}{\sqrt{N\mathrm{v}}}\begin{bmatrix} 1 & 1 & \cdots & 1 \\ 1 & e^{-i2\pi 1\frac{1}{N}} & \cdots & e^{-i2\pi 1\frac{N-1}{N}} \\ 1 & e^{-i2\pi 2\frac{1}{N}} & \cdots & e^{-i2\pi 2\frac{N-1}{N}} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & e^{-i2\pi (N\mathrm{v}-1)} & \cdots & e^{-i2\pi (N\mathrm{v}-1)\frac{N-1}{N}} \end{bmatrix} \tag{3}$$

According to the DFT codebook, the optimal codeword selection is performed for each sub-channel matrix $H_{jk}^{(i)}$. A certain column v_j in the DFT codebook is selected as the best codeword. When the codeword selection is completed for all subchannel matrices, a precoding matrix W_v of size $N\mathrm{r}\times(N\mathrm{t}\times N\mathrm{v})$ is obtained:

$$W_V = \begin{bmatrix} \mathrm{v}_1 & 0 & \cdots & 0 \\ 0 & \mathrm{v}_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \mathrm{v}_{N\mathrm{t}} \end{bmatrix} \tag{4}$$

For each user k, the three-dimensional channel matrix $H_{3Dk}^{(l)}$ between it and the base station becomes an equivalent two-dimensional channel matrix H_{equal} after vertical precoding. Among them, $H_{\text{equal}} = H_{3D\mathrm{k}}^{(\mathrm{i})} \times 3W_V$, H_{equal} is regarded as an equivalent horizontal channel, and the size of the equivalent horizontal channel H_{equal} is Nr×Nt.

Step 3: The receiving end transmits the index feedback corresponding to the precoding matrix W_v in the vertical direction and the equivalent two-dimensional channel matrix H_{equal} to the base station. According to the index feedback, the base station selects the precoding matrix from the DFT codebook stored offline, so as to obtain the equivalent horizontal channel of each user it serves. Then perform SLNR-based coordinated multipoint transmission, and select the horizontal direction precoding vector W_{h}^{CoMP} based on the maximizing SLNR algorithm:

$$W_{CoMP}^{3D} = W_{\mathrm{v}} \times W_{\mathrm{h}}^{CoMP} \tag{5}$$

The wireless base station performs precoding processing on the transmitted signal according to the obtained downlink cooperative multi-point precoding matrix W_{h}^{CoMP}, forms a three-dimensional beam, and transmits the processed signal to the receiving end. After receiving the signal, the receiving end returns to step 2. If the signal transmission is completed, the communication is completed.

(4) Functions of Intelligent English Education and Teaching Evaluation System

The functions of the intelligent English education and teaching evaluation system are mainly realized through the tablet computer and the education cloud resource platform [14-15]. To this end, it will be described from two aspects:

(5) Functions of education cloud resource platform

The education cloud resource platform is the data center of teaching activities [16]. Teachers can make educational content such as teaching courseware, outlines, and videos in advance and upload them to the cloud platform, so that students can view the learning content on their own. Students can also feed back their opinions and ideas to the teacher in time, so that the teacher can adjust the teaching content according to the opinions of the students [17]. Educational and pedagogical assessments are designed to investigate the status of prior teaching and learning, during and after class, and issue questionnaires immediately to evaluate all aspects of teaching. Teachers can also evaluate students after class based on their learning completion and class attendance status. In addition, the system also designed a summary evaluation after the course, teachers and students can make self-evaluation according to their actual situation.

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3. Image Processing Based on IoT System

Computational intelligence methods use stochastic heuristics to find optimal solutions in the global problem space, which can find the global optimal solution or an acceptable solution in a reasonable amount of time. The optimization problem does not require a rigorous mathematical derivation and has good global searchability and global scalability as well as robustness of the solution. In this paper, we apply the theory of computational intelligence to construct an intelligent English education and teaching evaluation system based on the IoTs system and apply it to image processing.

(1) Binarization of images

During the image processing, Bernsen binarization algorithm is used. The central idea is to calculate the threshold value T(x, y) of the pixel point (x, y) in the area of $(2w+1)\times(2w+1)$ with the pixel point (x, y) as the center. The expression is as follows:

$$T(x,\ y)=0.5\times\left[\max_{-w\le k,\ l\le w} f(x+k,y+l)+\min_{-w\le k,l\le w} f(x+k,y+l)\right] \tag{6}$$

After that, f(x, y) is binarized, and the relationship between the gray value and T(x, y) is compared. If it is greater than the current value，it is 1, otherwise it is 0, and the binarized image B(x, y) is obtained.

$$B(x,\ y)=\begin{cases}0 & f(x,y)<T(x,y)\\ 1 & f(x,y)\ge T(x,y)\end{cases} \tag{7}$$

For general images, there is usually a certain amount of noise. In order to reduce the problem of missing image details after binarization, this paper systematically improves the traditional Bernse algorithm. Gaussian filtering is added before binarization to remove excess noise [18]. The model of the Gaussian filter is as follows:

$$G(x,\ y)=\frac{1}{2\pi\ \sigma^2}e^{-\frac{x^2+y^2}{2\sigma^2}} \tag{8}$$

(2) Foreground extraction

The research object of this paper is people, so it is necessary to extract the foreground of the person from the image to remove the background interference in the scene, and then extract the feature value of the person [19]. This system uses background subtraction to extract the foreground of people, the steps are as follows:

1) Calculate the absolute difference D(x,y) between the current image f(x,y) and the background image b(x,y):

$$D(x,y)=|f(x,y)-b(x,y)| \tag{9}$$

2) Binarize D(x, y), and R(x, y) can be obtained according to the previous analysis:

$$R(x,y)=\begin{cases}0 & D(x,y)<(1-\alpha)T_1(x,y)+\alpha\ T_2(x,y)\\ 1 & D(x,y)\ge(1-\alpha)T_1(x,y)+\alpha\ T_2(x,y)\end{cases} \tag{10}$$

(3) Canny edge detection

Let f(x,y) be a binary image, according to the definition of the canny algorithm, let the center edge point be G_n, and its two-dimensional Gaussian function is:

$$G(x,\ y)=\frac{1}{2\pi\ \delta^2}e^{-\frac{x^2+y^2}{2\delta^2}} \tag{11}$$

4. Experimental Design

This paper is mainly a procedural evaluation of English education and teaching combined with the

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intelligent English education and teaching evaluation system. Teachers and students are equally important in the evaluation process [20]. Therefore, whether the evaluation results are feasible and effective, we must understand the views of the two. For this reason, this research experiment is designed. This experiment conducts investigations from two dimensions of students and teachers, and designs the successive satisfaction surveys of students using the intelligent English education and teaching evaluation system, the comparison experiment of students using different teaching evaluation systems in terms of evaluation results, the comparison experiment of teachers using different education and teaching evaluation systems in terms of evaluation results, and the systematic analysis experiment of the two education and teaching evaluation systems from the perspective of professionals.

5. Experimental Results

(1) Satisfaction survey of students using the Intelligent English Education and Teaching Evaluation System

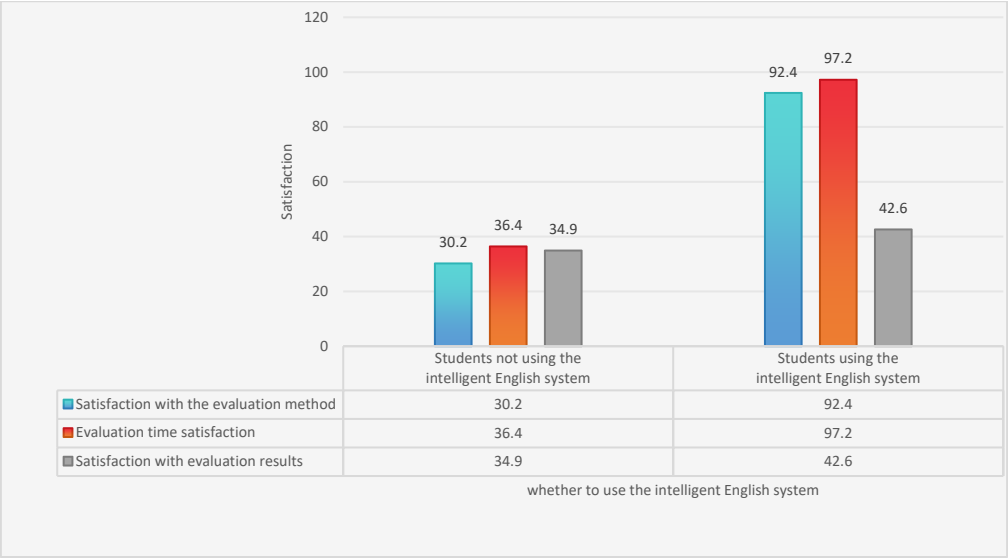

Figure 2: Satisfaction survey of students using the Intelligent English education and teaching evaluation system

The experiment selects the same group of students, compares and analyzes the satisfaction of the group of students using the Intelligent English Education and Teaching Evaluation System, and draws a feasible conclusion. The experiment is conducted from three dimensions of evaluation method, evaluation time, and evaluation result satisfaction. The survey results are shown in Figure 2. In terms of the evaluation time satisfaction survey, the evaluation time satisfaction increased by 60.8%, indicating that the intelligent English education and teaching evaluation system has improved student assessment time satisfaction, but student satisfactory evaluation results only increased by 7.7%, and the evaluation results need to be further improved.

(2) Satisfaction survey of teachers using the Intelligent English Education and Teaching Evaluation System

The subjects of this experiment are 50 teachers. The experiment selects the same group of teachers, and compares and analyzes the satisfaction of the group of teachers in using the intelligent English education and teaching evaluation system, and draws a feasible conclusion. The experiment is conducted from three dimensions: evaluation method, evaluation time, and evaluation result satisfaction. The survey results are shown in Figure 3:

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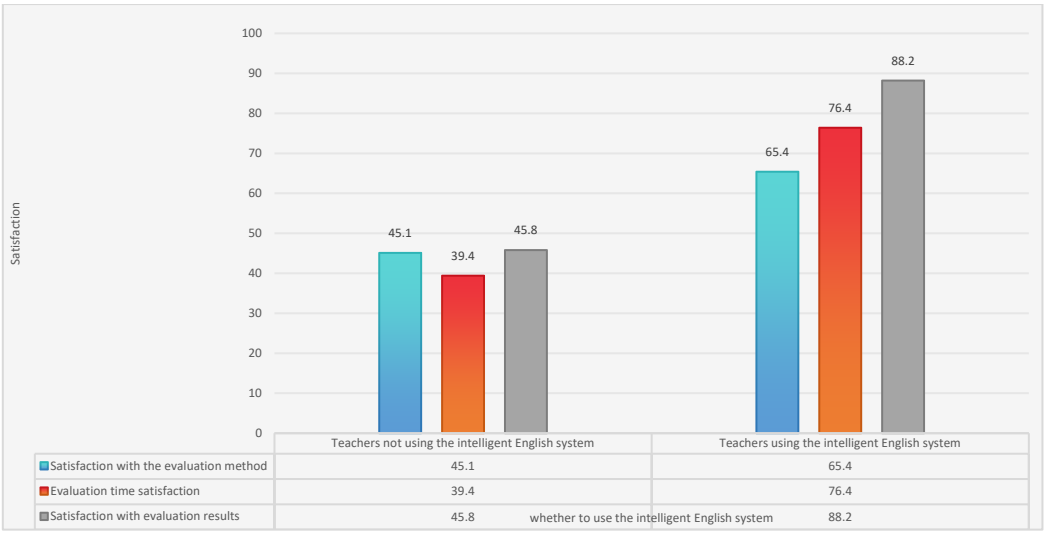

Figure 3: The satisfaction survey of teachers using the intelligent English education and teaching evaluation system

(3) Comparative experiments of students using different evaluation systems in terms of evaluation results

The subjects of this experiment were 100 students. Among them, 50 students use the traditional education and teaching evaluation system, and the other 50 students use the intelligent English education and teaching evaluation system based on the IoTs system. Comparing the differences in the scientificity, authenticity, objectivity and validity of the evaluating the results between the two, the survey results are shown in Figure 4:

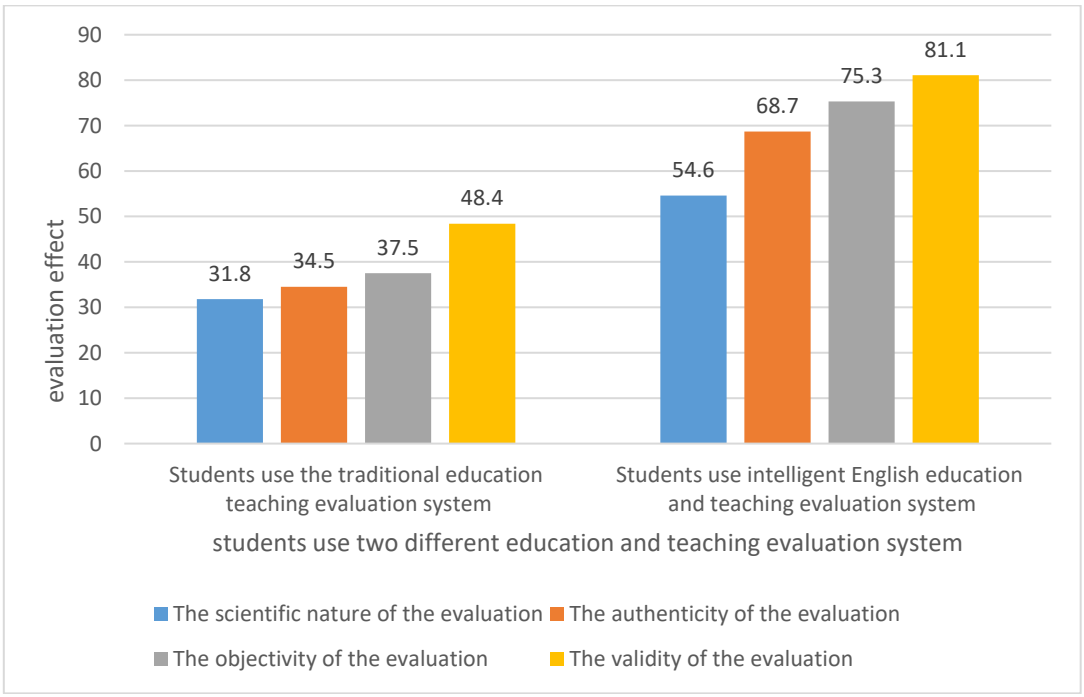

Figure 4: Comparative experiment of teachers' evaluation results using two different education and teaching evaluation systems

According to the comparative experiment of students using the traditional education and teaching evaluation system and the intelligent English education and teaching evaluation system in terms of evaluation results, it can be seen that the scientificity of the evaluation results of the intelligent English education and teaching evaluation system is 22.8% higher than that of the traditional education and teaching evaluation system. To summarize, from the students' point of view, the intelligent English education and teaching evaluation system has the best effect on improving the objectivity of the

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evaluation results.

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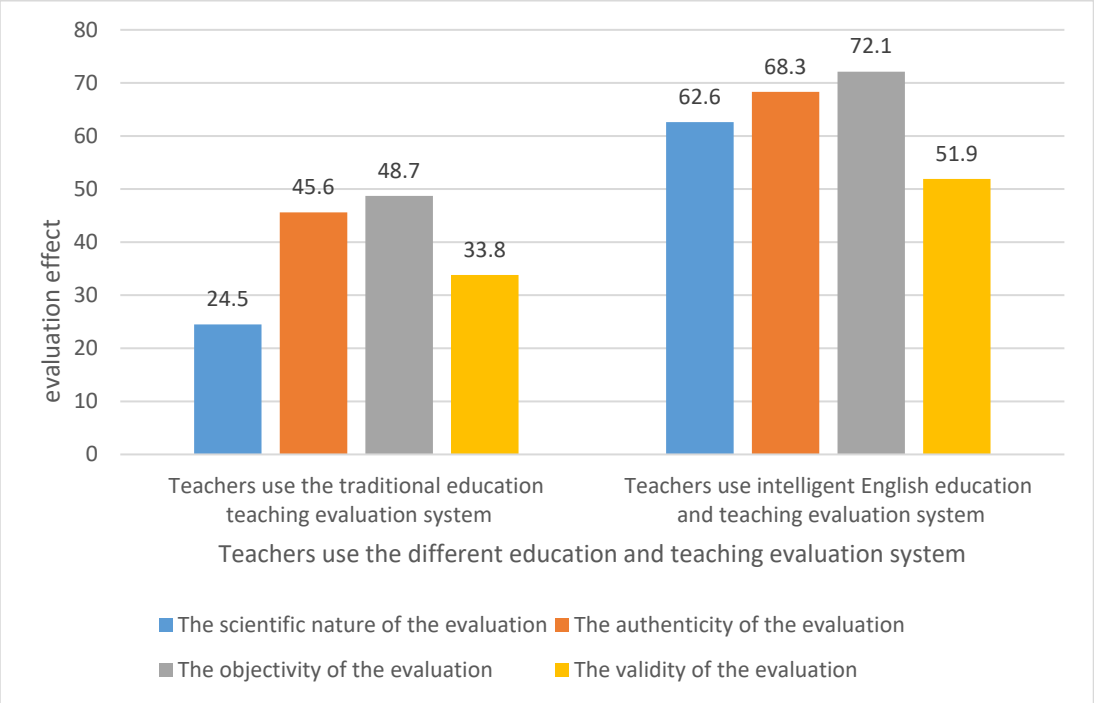

Figure 5: Comparative experiment of students' evaluation results using two different education and teaching evaluation systems

Combining Figures 4 and 5, it can be concluded that there is a big difference between students and teachers in their cognition of the evaluation results of the Intelligent English Education and Teaching Evaluation System. The reason is that teachers and students pay more attention to the scientific nature of the evaluation results when using the intelligent English education and teaching evaluation system. However, in the actual investigation process, it was found that the scientific aspects of the evaluation results did not achieve the psychological expectations of the students, so there was a large gap between the two in terms of satisfaction with the evaluation system for smart English education and teaching.

(5) Systematic analysis of two education and teaching evaluation systems

After the basic analysis of the personnel who use the intelligent English education and teaching evaluation system, this experiment designed a systematic analysis of the two education and teaching evaluation systems from the perspective of professionals, and compared the pros and cons of the two systems. The survey results are shown in Figure 6.

Comparing the traditional education and teaching evaluation system and the intelligent English education and teaching evaluation system, the following conclusions can be drawn: Compared with the traditional education and teaching evaluation system, the system performance score of the intelligent English education and teaching evaluation system is improved by 19.6%, and the reliability is improved by 29.7%, costs are reduced by 25.4% and energy consumption is reduced by 32.6%. Therefore, the intelligent English education and teaching evaluation system has the advantages of strong system performance, high reliability, low cost and low energy consumption.

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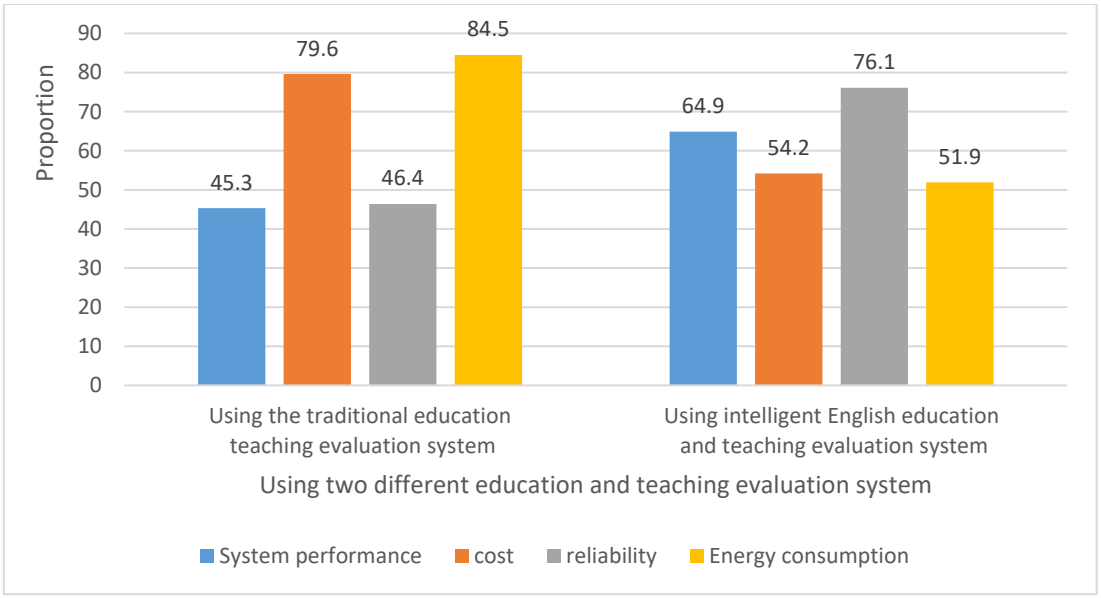

Figure 6: Analysis of two education and teaching evaluation systems

6. Discussion

(1) Advantages of Intelligent English Education and Teaching Evaluation System

The traditional teaching evaluation method is to send an evaluation form to each student. After the test, the class is bound into a booklet for leaders and teachers to inquire. The main disadvantage of this method is that the query is inconvenient and cannot be statistically analyzed, and the statistical method is single, which also consumes resources. It is difficult for class teachers and many classroom teachers to see the assessment results in a timely and convenient approach. The use of this intelligent English education and teaching evaluation system effectively ensures the evaluation efficiency and improves the teaching management level. Based on the evaluation of this intelligent English education and teaching evaluation system, the evaluators are not only teachers and students. Even parents of students or people who are not so closely related to education can evaluate their teaching process based on the teaching videos released by teachers, as a reference for the evaluation of teachers' education and teaching ability. Students can also evaluate the teaching process at any time and make targeted suggestions to teachers, in order that teachers can teach students according to their aptitude.

(2) Disadvantages of Intelligent English Education and Teaching Evaluation System

The intelligent English education and teaching evaluation system based on the IoTs system places high demands on teachers. Because the intelligence of the system requires users to operate carefully, some teachers with poor ability to accept new things need professional training. This process is a bit cumbersome and may cause teachers' irritability. Secondly, students may not understand the significance of using the intelligent English education and teaching evaluation system, and cannot cooperate with teachers to complete the relevant education and teaching evaluation work, which greatly affects the evaluation effect. Therefore, it is necessary to provide teachers and students with targeted training before launching this intelligent English education and teaching evaluation system.

7. Conclusion

Compared with the traditional education and teaching evaluation system, the intelligent English education and teaching system also has the benefits of high system capacity, strong reliability, low cost, and low energy consumption. But it cannot be denied that this intelligent English education and teaching evaluation system has both advantages and disadvantages. In view of the deficiencies, it is necessary to further improve the system, propose solutions according to local conditions, and strictly implement improvement measures. In the future, with the development of the Internet of things, many technical problems will be solved, and the intelligent English education and teaching evaluation system will be widely used in English education and teaching. Computational intelligence also has a wide scope of application in the field of education, and in the future this technology can be applied to the construction

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of teaching systems, thus promoting the development of education.

References

[1] Su Y, Zhao H. Infiltration Approach of Green Environmental Protection Education in the View of Sustainable Development. Sustainability. 2023, 15 (6): 5287.
[2] Su H. Patterns, local grammar, and the design of English teaching materials. ELT Journal, 2020, 74 (1): 73-82.
[3] Lu C, He B, Zhang R. Evaluation of English interpretation teaching quality based on GA optimized RBF neural network. Journal of Intelligent and Fuzzy Systems, 2021, 40 (2): 3185-3192.
[4] Tavoosy Y. Evaluation of the intensive English language teaching programme for the fifth grade according to teachers' views. International Journal of Learning and Teaching, 2021, 13 (3): 106-124.
[5] Nurmayanti N, Suryadi S. The effectiveness of using Quillbot in improving writing for students of English Education Study Program. Jurnal Teknologi Pendidikan: Jurnal Penelitian Dan Pengembangan Pembelajaran, 2023, 8(1): 32-40.
[6] Razzaque M A, Milojevic-Jevric M, Palade A. Middleware for Internet of Things: A Survey. IEEE Internet of Things Journal, 2017, 3 (1): 70-95.
[7] Perera C, Liu C H, Jayawardena S. The Emerging Internet of Things Marketplace from an Industrial Perspective: A Survey. IEEE Transactions on Emerging Topics in Computing, 2017, 3 (4): 585-598.
[8] Xue J W, Xu X K, Zhang F. Big data dynamic compressive sensing system architecture and optimization algorithm for internet of things. Discrete and Continuous Dynamical Systems - Series S, 2017, 8 (6): 1401-1414.
[9] Stojkoska B, Trivodaliev K V. A review of Internet of Things for smart home: Challenges and solutions. Journal of Cleaner Production, 2017, 140 (3): 1454-1464.
[10] Hahm O, Baccelli E, Petersen H. Operating Systems for Low-End Devices in the Internet of Things: a Survey. IEEE Internet of Things Journal, 2017, 3 (5): 720-734.
[11] Tan P, Hsu M H. Designing a System for English Evaluation and Teaching Devices: A PZB and TAM Model Analysis. Eurasia Journal of Mathematics Science and Technology Education, 2018, 14 (6): 2107-2119.
[12] Zhang J. Research on Classroom Teaching Evaluation and Instruction System Based on GIS Mobile Terminal. Mobile Information Systems, 2021, 2021 (11): 1-11.
[13] Wu X. Research on the Reform of Ideological and Political Teaching Evaluation Method of College English Course Based on "Online and Offline" Teaching. Journal of Higher Education Research, 2022, 3 (1): 87-90.
[14] Hong, FANG. Discussion on the Performance Evaluation Index System of Basic Course Teaching Team in Colleges and Universities. Asian Agricultural Research, 2020, 12 (3): 76-78.
[15] Xu H, Zhang X. Construction and implementation of physical education teaching evaluation system based on stochastic simulation algorithm. Revista de la Facultad de Ingenieria, 2017, 32 (15): 632-636.
[16] Liu Y, Han J, Xiao L. Research on the physical education evaluation system analysis and intelligent evaluation system design. Revista de la Facultad de Ingenieria, 2017, 32 (16): 992-998.
[17] Chao Z. An improved design and mode innovation of physical education teaching evaluation based on AI system. Revista de la Facultad de Ingenieria, 2017, 32 (12): 610-616.
[18] Li W. An optimized system method design of PE teaching evaluation and related factors analysis. Boletin Tecnico/Technical Bulletin, 2017, 55 (20): 681-687.
[19] Xi Y, Dong L. Study on the intelligent evaluation system design of sports teaching. Boletin Tecnico/Technical Bulletin, 2017, 55 (4): 125-131.
[20] Xu D, Rappaport T S. Construction on teaching evaluation index system of track and field general course for physical education major in light of wireless network technology. Journal of Intelligent and Fuzzy Systems, 2019, 37 (7): 1-9.