Hindawi
Wireless Communications and Mobile Computing
Volume 2022, Article ID 7239191, 10 pages
https://doi.org/10.1155/2022/7239191

Research Article

Evaluation Method of English Learning Engagement Based on Wireless Communication Network and Big Data

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Received 23 February 2022; Revised 14 March 2022; Accepted 22 March 2022; Published 6 April 2022

Academic Editor: Zhiguo Qu

The existing English learning engagement assessment methods still have some deficiencies, which cannot predict students' interest in English learning, and the teaching effect is not good enough, resulting in the improvement of students' performance which is not obvious. Therefore, an English learning engagement assessment method based on wireless communication network and big data is proposed. Firstly, build a mobile wireless communication network model, analyze the metaphor processing and evaluation methods adopted by English learners according to big data, and realize the acquisition and interpretation of metaphor meaning through three steps: the establishment of metaphor knowledge base, the analysis and description of metaphor language, and the classification and recognition of metaphor; build an evaluation framework based on wireless communication network and big data, propose a Java application platform for English learning engagement evaluation, and realize the English learning engagement evaluation method. The experimental research shows that the evaluation method has good stability, short evaluation time, and high efficiency and has practical application effect.

1. Introduction

The research on the influence of English learning engagement on learning achievement is one of the important research topics in the field of higher education quality evaluation [1]. Stimulating students' learning enthusiasm and improving students' learning value are an important breakthrough in improving the quality of higher education [2, 3]. According to the confirmatory information of exploratory factor analysis and confirmatory factor analysis, the evaluation model of higher vocational students' learning engagement includes seven dimensions: advance investment, task-based investment, feedback investment, expansion investment, avoidance investment, reverse investment, and nonmoral investment. The first four dimensions are called "positive input," and the last three dimensions are called "negative input" [4, 5]. Among them, the active learning involvement behaviors mainly include the following [6, 7]: preview the content of teaching materials, refer to relevant materials, online learning courseware, discuss problems in advance, bring learning materials into the classroom, listen carefully, take notes, complete after-school homework, feed back information to teachers, put forward opinions, talk with teachers, telephone communication with teachers, online communication with teachers, discussion with students, feed back the learning content, put forward new ideas, and think differently [8]. Research related to students' English learning engagement and academic achievement evaluation has gradually sprung up and become the trend of higher education quality evaluation.

Many scholars have also recognized the important influence and role of students' English learning engagement on academic performance and carried out relevant studies. In reference [9], compared with traditional lecture forms, nontraditional immersive seminars enhance learning by promoting greater physical and psychological participation. The purpose of this study is to determine the impact of immersive seminars on learning compared with traditional lecture forms. Twenty-six healthy participants were randomly assigned to groups in the form of an immersive workshop or a traditional lecture and presented material related to positive psychology and human values/beliefs over the course of two days. Over two days, physical activity was collected using the bioharness, along with saliva cortisol and

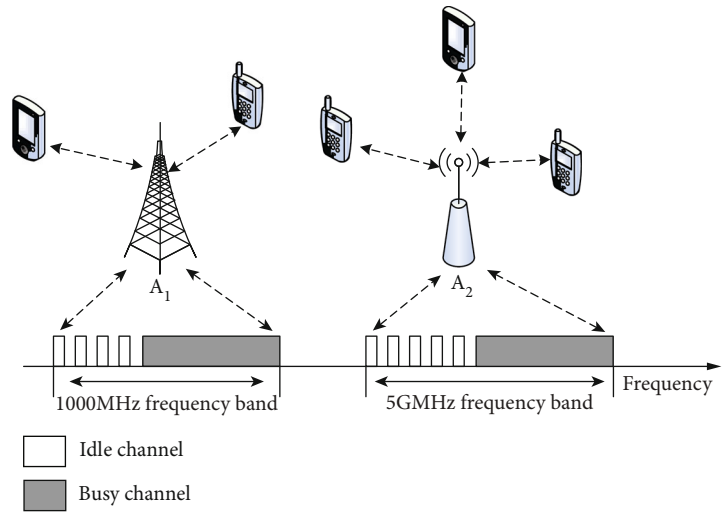

Figure 1: High-speed mobile wireless communication network model.

Table 1: Statistical results of metaphorical compound understanding evaluation times.

Metaphor comprehension assessment	Lower grade group total times (success times)	Senior group total times (success times)
Common sense	25 (11)	28 (20)
Repeat	25 (11)	10 (9)
Analogy	6 (6)	3 (2)
Ask oneself	17 (9)	6 (4)
Syntax	2 (1)	1 (1)
Context	135 (79)	120 (103)
Collocation	12 (7)	15 (11)
Translate	81 (45)	80 (61)
Metaphor	10 (6)	12 (7)
Imagery	30 (17)	13 (8)
Total	334 (184)	281 (217)

measures of perceived well-being. Test scores related to course materials are used to assess learning. On average, time spent above 65% of maximum heart rate, energy expenditure, total limits, and mechanical and physiological load increased significantly in the immersive workshop group compared to the traditional teaching format. In addition, immersive workshops had significantly higher cortisol levels and perceived measures of mood, attention, energy, and well-being compared to the traditional teaching format. Participants in the immersive workshop significantly improved their recall of the course material 30 days after class compared to the traditional classroom group. In reference [10], acting out general chemistry concepts in social media videos contributes to student-centered learning and public engagement. This article describes the educational and public engagement results of the "ChemClout Challenge" campaign implemented in a general chemistry course at UC Riverside. Students work in groups to make videos themed around chemistry, post them on social media platforms, and then vote for their favorite. Most students chose to make videos that personify general chemical concepts, with physics representing principles such as ideal gas law relationships and electrolyte solubility. It is reported that students like the anthropomorphic videos the most. In the first month after the social media platform TikTok was launched, such videos racked up more than 1 million views worldwide. Studies have shown that student-created social media videos that personify chemistry are efficient vehicles for student-centered learning and public engagement with chemistry concepts. In the case of COVID-19, this activity could be particularly useful for educators because it is compatible with distance learning.

Although the above research has made some progress, it is not suitable for the evaluation of English learning input, and the current situation of college English learners' learning input and learning output is not optimistic. Therefore, this paper proposes an English learning engagement evaluation method based on wireless communication network and big data.

2. Evaluation of English Learning Engagement under Wireless Communication Network and Big Data

2.1. Wireless Communication Network and Big Data

2.1.1. Mobile Wireless Communication Network Model. Before studying the wireless communication network and big data, set up the evaluation indicators of English learning engagement under the wireless communication network and big data [11], including four indicators: evaluation classification rate, evaluation use accuracy, evaluation use frequency, and evaluation contribution. Among them, the analysis of evaluation and classification indicators mainly adopts the induction method. Based on the converted English learning interest points, the evaluation used by the subjects is deduced for classification, and the evaluation list is generated according to the evaluation type. Evaluation using

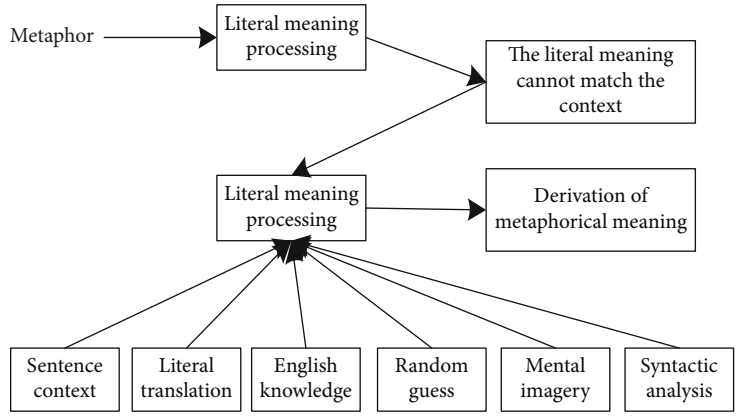

Figure 2: Analysis model of English learners' metaphor understanding.

indicators are divided into answer selection accuracy and measuring accuracy using the accuracy of two kinds; the former can be calculated directly through the English learning interest and actual metaphor between the results of standard [12, 13], and the use of the evaluation accuracy is closely related to the correct answer choice; the index calculation formula is as follows:

$$P_G = \frac{c_1}{C_1}. \tag{1}$$

In formula (1), c_1 and C_1, respectively, represent the times of correct use of metaphor assessment and the times of total use of metaphor assessment. For each test sentence, the tester may use more than one evaluation. In the actual indicator statistics process, all evaluations need to be included in the statistics. The calculation formula of usage frequency is as follows:

$$P_G{}' = \frac{c_1{}'}{C_1{}'}. \tag{2}$$

In formula (2), $c_1{}'$ and $C_1{}'$, respectively, represent the use times and total use times of metaphor understanding evaluation. Assessment cooccurrence refers to the situation that the tester uses more than one kind of metaphorical understanding assessment. It is assumed that the high mobile wireless communication network includes A spectrum holders and B secondary users, The spectrum holder a_i holds i free channels, including $i = 1, 2, 3, \cdots, n$. A' represents the set composed of spectrum holders, and B' represents the set composed of secondary users. It is assumed that the channels held by each spectrum holder are not different; that is, the bandwidth, center frequency; and adjustment mode are the same [14].

Figure 1 depicts a high-speed mobile wireless communication network model including two spectrum holders.

In Figure 1, A_1 and A_2 represent spectrum holders, in which the spectrum holder A_1 has four spare channels in the 1000 MHz frequency band and the spectrum holder A_2 has five spare channels in the 5gmhz frequency band; the high-speed mobile wireless communication network model provides a reference for big data analysis.

2.1.2. Big Data Analysis. Combined with the quantitative results of the evaluation indicators corresponding to English learning interest points obtained from the data analysis test, the current application status of English learners' metaphor understanding evaluation is obtained through data analysis. The statistical results of the number of metaphor compound word understanding evaluation are shown in Table 1.

By substituting the statistical results of metaphorical compound word understanding evaluation times in Table 1 into formula (1) and formula (2), we can get the quantitative calculation results of English learners' metaphorical understanding evaluation indicators.

2.2. Evaluation and Analysis of Metaphor Processing Adopted by English Learners. Combined with the results of data analysis, the metaphor processing evaluation adopted by English learners can be roughly divided into five types, including sentence context, literal translation, Chinese knowledge, psychological image, and syntactic analysis [15, 16]. Through the statistics of the number of times of using metaphor comprehension evaluation and the calculation of relevant indicators, it can be found that the subjects' comprehension evaluation is ranked according to the frequency of use, followed by sentence context, literal translation, English knowledge, Chinese knowledge, casual guess, psychological image, and syntactic analysis. This shows that current English learners mainly rely on language knowledge and background knowledge to understand metaphor.

2.3. Construct English Learners' Metaphor Understanding Model. Combined with the evaluation of English learners' metaphor understanding, this paper discusses the existing metaphor processing methods and constructs an English learners' metaphor understanding model. In the traditional cognitive research on the evaluation of English learners' metaphor understanding, the understanding and processing of metaphor have always been a meaningful research topic. The study of English learners' metaphor understanding can not only promote our understanding of the understanding mechanism of metaphor itself but also help us understand the language understanding mechanism more clearly and better reveal the brain processing process of bilinguals. At the same time, it can also help us reveal the cognitive

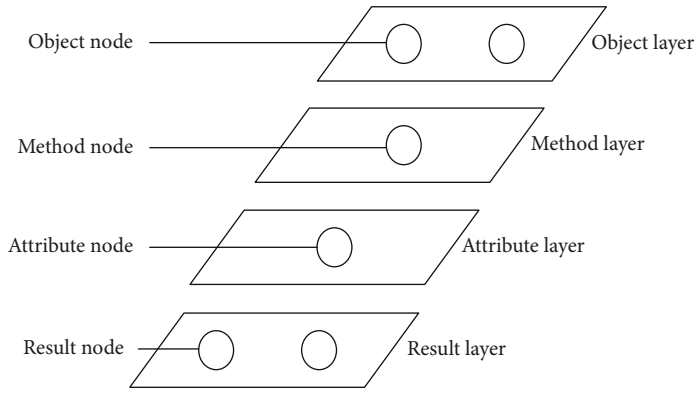

Figure 3: Hierarchical structure of English sentences.

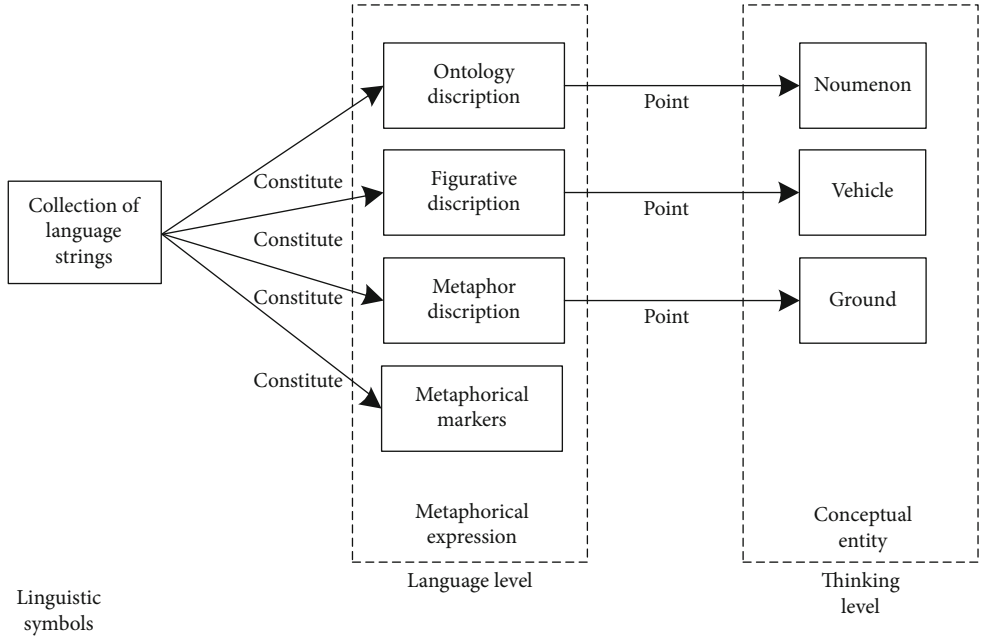

Figure 4: Relationship between two levels of metaphor calculation.

activities and cultural interaction of learners in the process of English learning and promote students' English thinking and cultivate metaphorical ability and conceptual fluency, so as to improve the efficiency of English teaching. The metaphor understanding model believes that learners' understanding of metaphor can be roughly divided into three steps: first understanding the literal meaning, then combining the context, and finally obtaining the metaphorical meaning [17]. The metaphor understanding model constructed this time emphasizes the role of literal meaning and context to ensure English learners' understanding ability of metaphor [18–20]. Conceptual metaphor has the characteristics of systematicness, saliency, asymmetry, and national culture. From the perspective of the understanding mechanism of metaphor and the psychological and neural mechanism of metaphor processing, the metaphor understanding model of English learners is obtained, as shown in Figure 2.

According to Figure 2, metaphor is a language phenomenon, so the role of metaphor in the development of English learners' metaphor understanding and analysis model is inevitable. Because people's cognition, language, society, and other factors work together on the formation and development of metaphor, this is the social reason for English as a communication tool.

2.3.1. Establishing Metaphor Knowledge Base. Due to its cognitive nature, the understanding mode of metaphor is inseparable from the metaphorical knowledge base. It involves the comparison of ontology concept and metaphor concept, so the premise of metaphor understanding model is to have the ability of concept description and reasoning [21, 22]. Therefore, speech knowledge base needs to provide a large number of metaphor ontology and carrier relational knowledge data as support. Establish the corresponding spatial structure of knowledge base, input the sample data of English metaphor, extract the characteristics of the input data, and calculate the RFR value [23, 24]. On the basis of the calculation results of the RFR value, the features with

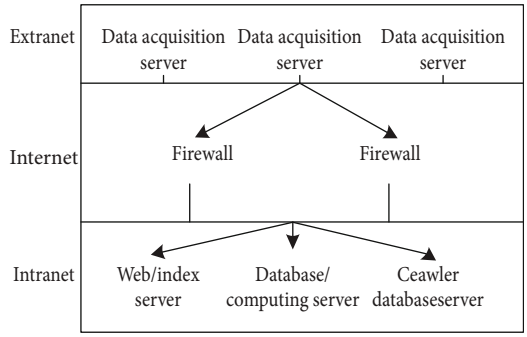

Figure 5: System architecture based on Internet data.

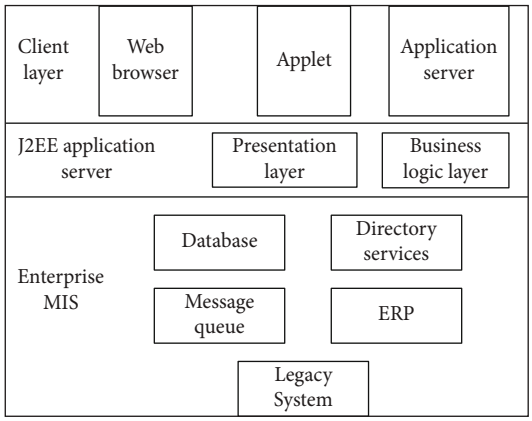

Figure 6: Design of Java application platform for English learning engagement assessment.

high RFR value are sorted, and the structural form output of metaphorical features is selected. In the metaphorical knowledge base, appropriate feature input is selected as the final result. With the continuous growth of metaphorical knowledge in English, the metaphorical data in the knowledge base is also increasing and updating [25].

2.3.2. Analysis and Description of Metaphorical Language. In the process of language processing, English learners first need to formally describe the language. Sentence components can be formalized into a four-tier structure diagram, as shown in Figure 3.

In Figure 3, the object node in the object layer represents the subject and object in linguistics; the method node in the method layer represents the adverbial, predicate, object, and complement in linguistics; the attribute node in the attribute layer is the subject in linguistics; and the result node in the result layer is the attribute in linguistics [26]. In order to describe the semantic relationship between each node, the directed connection arcs in semantics are defined as call arc, common sense arc, same-sex arc, and metaphor arc [27, 28]. By dividing the sentence into component nodes and using the arc between nodes to represent the semantic relationship between the components of the sentence, we can construct the semantic structure of a sentence and realize the formal description of English metaphorical language [29, 30]. In the actual metaphor calculation process, the calculation relationship between the two levels can be obtained by combining the sentence structure, as shown in Figure 4.

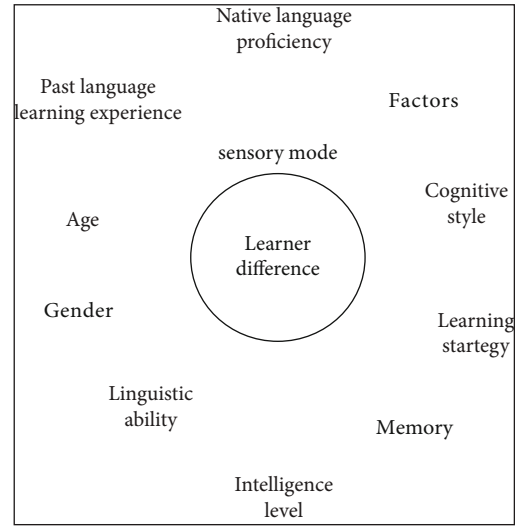

Figure 7: Learner differences.

As can be seen from Figure 4, because the understanding process requires a feature giving mechanism, metaphor provides candidate features to give ontology. In metaphor, ontology and metaphor play different roles, but they provide equally important information for the understanding of metaphor. Ontology is used to provide given dimensions, and the final interpretation depends on the interaction between ontology dimensions and metaphorical features. Finally, the realization of metaphorical meaning acquisition mainly includes constructing the attribute set of target concept, constructing the important cognitive feature set of metaphorical source concept, constructing the contextual feature set of metaphor, and realizing the contextual feature set of important cognitive feature set and attribute set.

2.3.3. Classification and Recognition of Metaphor. Based on the formal processing of metaphorical language, the metaphorical types of sentences are determined through the quantitative matching of metaphorical word similarity and semantic anomalies [31, 32]. Assuming that the two words are D_1 and D_2, if n concepts in D_1 are marked as d_{1n} and M concepts in D_2 are marked as d_{2m}, the similarity between D_1 and D_2 can be calculated by the following formula:

$$X_s(D_1, D_2) = \max_{i=1\cdots n, j=1\cdots m} \left(x_s\left(d_{1i}, d_{2j}\right)\right). \quad (3)$$

Similarly, the anomaly degree of D_1 and D_2 can be calculated by the following formula:

$$Y_c(W_1, W_2) = \frac{1}{\max\left[X_s(D_1, D_2), H_o(D_1, D_2)\right]}. \quad (4)$$

In formula (4), $H_o(D_1, D_2)$ represents the correlation calculation function of D_1 and D_2 and represents the possibility of the hyponyms of D_1 and D_2 [33, 34]. Combined with the calculation results of similarity and anomaly, the

Table 2: Statistics of relevant information of experimental English learning resources.

Name	Data/number
User	3000
Word	25432
Grammar	52153
Phrase	162890

corresponding metaphor classification and recognition results can be determined by matching with the corresponding metaphor types.

2.3.4. Acquisition and Interpretation of Metaphorical Meaning. Because the understanding process needs a mechanism of feature giving, metaphor provides candidate features to give ontology. "Metaphorical" sentences are understood according to their representation. In metaphor, ontology and metaphor play different roles, but they provide equally important information for the understanding of metaphor. Ontology is used to provide given dimensions, while metaphor is used to provide features. The final interpretation depends on the interaction between ontological dimensions and metaphorical features [35]. Finally, the realization of metaphorical meaning acquisition mainly includes constructing the attribute set of target concept, constructing the important cognitive feature set of metaphorical source concept, constructing the contextual feature set of metaphor, and realizing the contextual feature set of important cognitive feature set and attribute set. Through the mapping of metaphorical semantics, we can finally understand and explain metaphorical sentences.

3. Implement the Evaluation Method of English Learning Engagement

3.1. Evaluation Architecture Based on Wireless Communication Network and Big Data. According to the current needs of English resource sharing, an evaluation framework based on wireless communication network and big data is developed, mainly focusing on wireless communication network and big data collection, which brings huge information sharing resources for English learning [36, 37]. The evaluation framework based on wireless communication network and big data is shown in Figure 5.

According to the system architecture based on Internet data in Figure 5, a Java application platform for language learning engagement evaluation is designed.

3.2. Java Application Platform for English Learning Engagement Assessment. Java language is widely used in the system platform, which is mainly divided into four parts, which will make the system software too cumbersome. Therefore, the Java EE multilayer distributed application platform is adopted to combine the two parts of the web layer and the business layer, combine the background database or legacy system into one layer, and finally form three parts, as shown in Figure 6.

In Figure 6, in the (1) client layer, components are mainly applied to browsers; in (2) J2EE application server, the web layer is a component operating in the server; the business layer is a component that operates in a Java EE server; and in (3) enterprise MIS, software system is applied in the EIS server.

Based on the design of Java application platform for English learning engagement assessment, this paper studies the differences between learners. Different students have great differences in personality and cognitive style, which is also an important reason why students have different results in learning English. The differences among learners are shown in Figure 7.

As can be seen from Figure 7, in English curriculum arrangement, teachers should carry out targeted teaching work according to the differences of each student, instead of following a single mode. The use of multimedia network, according to the differences of each student, provides suitable learning materials for it to create favorable learning conditions. In learner-centered learning, let students actively participate in teaching. Through the multimedia network teaching environment, they can choose their own learning path and learning progress according to their own situation and improve their confidence in learning English, to achieve a good learning goal.

Through the above contents, the wireless communication network and big data are applied to the English learning engagement evaluation, in order to achieve good teaching results and improve students' English learning level, so as to complete the research on the English learning engagement evaluation method based on wireless communication network and big data.

4. Experiment and Analysis

In order to verify the overall effectiveness of the English learning engagement evaluation method based on wireless communication network and big data, the evaluation performance needs to be tested. Some English learning resources are randomly selected as experimental objects. These works already have the user's annotation information of English learning resources. The relevant information of the experimental data is shown in Table 2.

According to the statistics of relevant information of English learning resources in the experiment in Table 2, the performance of the research method is evaluated by simulation experiment. It is assumed that the arrival probability of high-speed mobile wireless communication network users and authorized users obeys the Poisson distribution. In the simulation scenario, there are two idle dynamic spectrum resources, one is the open ISM spectrum resources, and the other is the cellular network communication spectrum resources. The attribute indexes of different spectrum resources are described in Table 3, in which the delay is related to the bandwidth and spectrum evaluation cycle.

According to the attribute indicators of free spectrum resources in Table 3, there are three kinds of services in the evaluation process: voice, video, and file English learning. Voice learning input service has the highest

Table 3: Attribute indicators of free spectrum resources.

Spectrum	Spectrum type	Bandwidth (Kbps)	Delay (ms)	Jitter (ms)	Packet loss rate (%)
Free spectrum 1	Open ISM band	3500	120~470	12	<6
Free spectrum 2	Open ISM band	4500	110~470	23	<6
Free spectrum 3	Open band ISM	4000	100~470	18	<6
Free spectrum 4	Cellular network communication frequency band	1500	35~50	4	<1
Free spectrum 5	Cellular network communication frequency band	100	33~50	4	<1
Free spectrum 6	Cellular network communication frequency band	800	41~50	4	<1

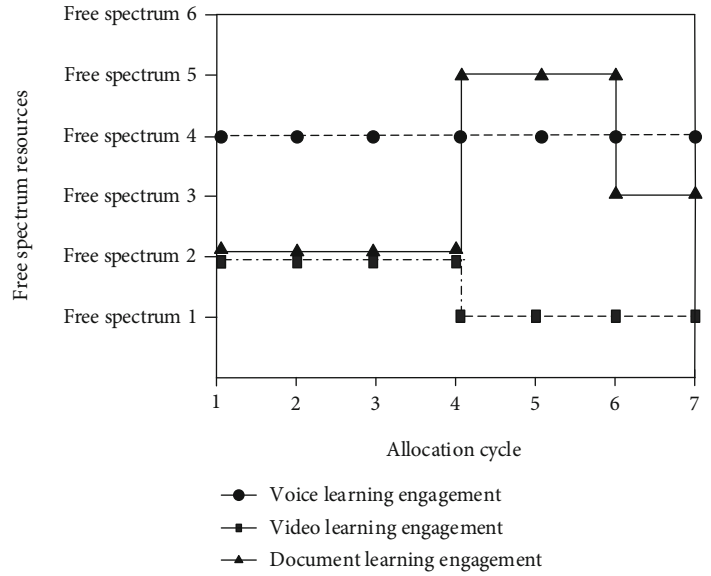

Figure 8: Spectrum allocation and switching of research method.

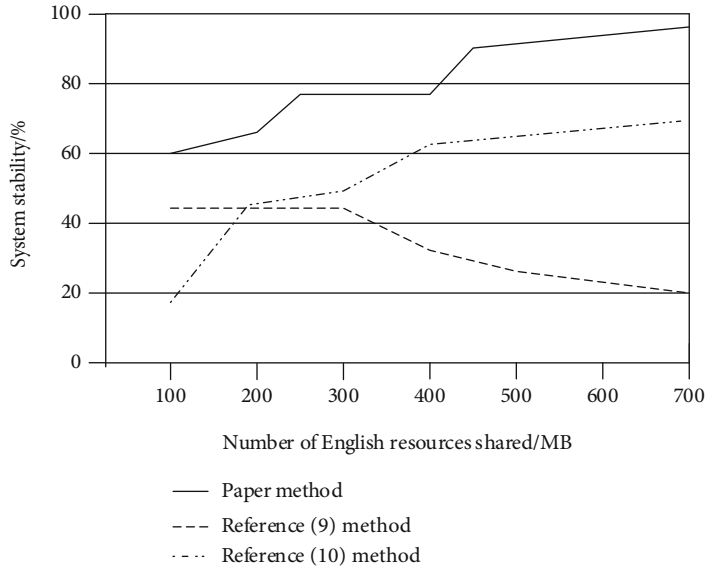

Figure 9: Stability test results evaluated by different methods.

requirements for service quality, the delay is less than 50 ms, the jitter is less than 5 ms, the packet loss rate is less than 3%, and the bandwidth occupies 10 Kbps. The requirements of video learning investment service are general. The delay shall be less than 220 ms, the jitter shall be less than 50 ms, the packet loss rate shall be less than 5%, and the bandwidth

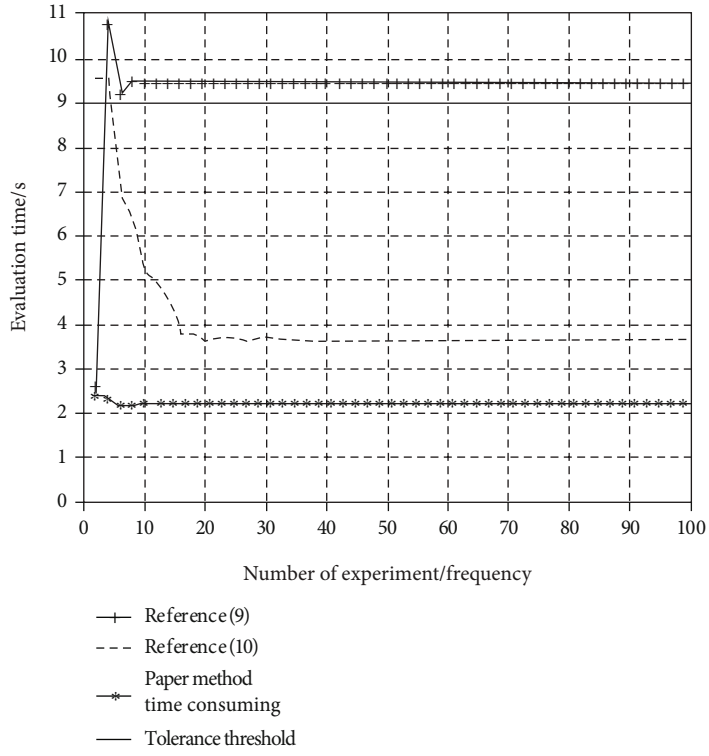

Figure 10: Comparison results of learning engagement evaluation time of different methods.

shall occupy 100 Kbps. There is no identification requirement for file learning investment business, and the maximum transmission rate supported is 130 Kbps.

Figure 8 describes the allocation and switching of various learning input free spectrum resources when the research method is used to evaluate the dynamic spectrum.

It can be seen from Figure 8 that the research method gives priority to dividing the speech learning investment into the free spectrum of band 4~band 6, mainly because the spectrum resources of this band meet the requirements of speech learning investment. Under the condition of meeting the time delay requirements, the input of video and file learning is preferentially divided into the free spectrum of band 1~band 3, which is mainly because the free spectrum resources of this band have high transmission bandwidth. Under the condition of improving the utilization of free spectrum resources, this method obeys the original spectrum evaluation decision, so as to prevent frequent switching between spectra. When the idle spectrum resources cannot meet the required quality of service, this method can also adaptively sense the idle information of the spectrum resources in the adjacent environment and switch to other resources to realize the evaluation of learning engagement.

The designed method, reference [9] method, and reference [10] method are used for effective testing. During the testing process, whether the running state is stable or not determines the effect of the method. Due to the need to store a large amount of English learning materials, it is necessary to test the evaluation stability of this method, reference [9] method, and reference [10] method. The test results are shown in Figure 9.

By analyzing the data in Figure 9, we can see that this method does not reduce the stability of the evaluation due to the increase of English resource sharing data. On the contrary, it will improve the stability of the evaluation itself according to the increase of the number of resources. It can be seen that the evaluation stability of this method is better than that of reference [9] and reference [10]. Compared with this method and reference [10], with the increase of resource data, the operation effect of reference [9] method gradually decreases, and the evaluation stability begins to show a downward trend. Therefore, it can be seen that the evaluation stability effect of reference [9] method is poor and the reliability is low.

The traffic of wireless communication network and big data collection is used as the background traffic. On this basis, the data in the background traffic are evaluated and compared by using manual technology. Based on the above experiments, the time-consuming situation of learning engagement evaluation by different methods is analyzed, and the time-consuming tolerance threshold is set to 9 s. The comparison results of evaluation time-consuming are shown in Figure 10.

It can be seen from the analysis of Figure 10 that the dynamic spectrum evaluation method in reference [9] takes the most time and most of the time is above the time-consuming tolerance threshold, so the practical application effect is not good. The dynamic spectrum evaluation of the method in reference [10] takes 3.7 s-9.5 s, while the time-consuming evaluation method of English learning engagement based on wireless communication network and big data is always kept below 2.4 s, which has the advantages

of short evaluation time, high efficiency, and better practical application effect.

To sum up, the English learning engagement evaluation method based on wireless communication network and big data can adaptively perceive the idle information of spectrum resources in the adjacent environment, switch to other resources, and improve the stability of its own operation according to the increase of the number of resources, and the evaluation stability is better than other methods. The required evaluation is time-consuming, efficient, and better in practical application.

5. Conclusions and Prospects

5.1. Conclusions. The conclusions are as follows:

(1) The English learning engagement assessment method based on wireless communication network and big data can adaptively perceive the idle information of spectrum resources in the adjacent environment and switch to other resources to achieve the learning engagement assessment

(2) The method in this paper evaluates the stability of its own operation according to the increase in the number of resources, which is superior to other methods

(3) The evaluation time required by the method is short, the efficiency is high, and the practical application effect is better

5.2. Prospects

(1) The research on the changes of English learning engagement assessment factors is not comprehensive enough. It needs to be further supplemented and improved in the future study and research. The research on the changes of English learning engagement assessment under different factor environments is summarized

(2) The research object is relatively single, which has a certain impact on the stability and reliability of the statistical results. The next research work can provide some thinking and reference for the research and practice of students' English learning engagement assessment under the intelligent learning environment

(3) The learning engagement of different groups of students presents different characteristics. There are significant gender differences in academic challenge, student teacher interaction, educational experience richness, and campus environment support; significant professional differences in student teacher interaction; and significant differences in the source of students before enrollment in academic challenge. More in-depth research can also be carried out in the future

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The author declared that there are no conflicts of interest regarding this work.

Acknowledgments

This work was supported by English Teaching Reform Project of Colleges and Universities in Gansu Province "learning" task chain "in ESP mixed teaching practice" (w202106).

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