

## Research Article

# Teaching Design and Practice of English Education under the Network Learning Space

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Received 30 May 2022; Revised 13 June 2022; Accepted 18 June 2022; Published 13 July 2022

Academic Editor: Lianhui Li

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With the comprehensive coverage of the Internet in China, the online learning space can basically cover the whole country, but in terms of the use of online learning space in education, it has not been fully used. The basic application mode of the school, namely, autonomous learning, flipped classroom learning, collaborative learning, exchange, and discussion learning, and personalized learning mode, based on flipped classroom learning and relying on network learning space, design the corresponding English teaching process based on network learning space, according to the teaching process, the specific design of the platform, content, organization, implementation, and evaluation. From the research results, the students in the experimental class are more active and active in class than in the control class, their work scores are generally higher than those in the control class, and their interest in English has been significantly improved. The ability has also been significantly improved. After long-term practical research, it has been shown that the performance of the experimental class students in the online learning space has also been significantly improved. Therefore, it can be shown that the English course based on the network learning space has a certain positive influence and promotion effect on the teaching effect.

## 1. Introduction

With the continuous addition of new educational concepts and technologies, how to use modern information technology to provide services for learning and teaching has become the current focus. The continuous informatization and networking of high-quality resources has gradually increased the use of online teaching resources to assist teaching in junior high school English teaching. Rooted in the characteristics of junior high school English teaching, the use of online learning space in junior high school English teaching helps classroom teaching to show the superiority of modern educational methods. During the “Thirteenth Five-Year Plan” period, efforts will be made to promote the informatization of education, use modern information technology to complete the sharing of high-quality resources, focus on the breadth and depth of the application of online learning space, and gradually complete the concept of having a space for life and unique space for life. By 2022, the

system will fully popularize the online learning space, integrate the use of information technology to solve practical puzzles in education and teaching, and complete the teaching application, management, and governance supported by the space, making it the norm. It will continuously promote teachers' use of online learning spaces, workshops, training communities, and other tools, use online resources, integrate offline discussions, complete the creation of “technological innovation classrooms,” improve the use of information technology to analyze learning conditions, improve teaching, design, guidance on learning methods, and evaluation of academic performance and other diverse abilities and qualities, resolve difficulties in education and teaching, meet children's individual development needs, and help the school to carry out teaching innovation. From the perspective of teaching application, the deep integration of online learning space and English subject teaching has changed the traditional teaching mode. The use of online learning space in school education and home-school

coeducation helps to train talents' information literacy and promote educational information. To move forward, it is essential to strengthen and improve basic education informatization in junior high school English teaching and optimize its process. Therefore, with the support of online learning space, teachers and students have the opportunity to have a personalized online environment. Applying the online learning space to the real English subject teaching not only shows the idea of combining information technology with the subject but also becomes one of the important guides for applied research in the future [1–8]. This study takes English as the subject background. Through the analysis of the online learning space and the exploration of the online learning platform, it comprehensively considers how to integrate the diversified functions of the online learning space with the English teaching of junior high school and selects the appropriate teaching content. The junior high school English teaching based on the main functions of the online learning space is designed and implemented in the classroom. After that, interviews are conducted with students and teachers, and the results of the application are compared and analyzed according to the students' pre- and posttest scores in the experimental class in order to optimize the application of the online learning space in junior high school English teaching and provide support for its follow-up implementation in H Middle School, so that it can truly exert its advantages, effectively improve the quality of English education and teaching, and further promote the sharing of high-quality resources.

## 2. Related Works

There are foreign studies on the existence of online learning space to analyze. Regarding the current research situation abroad, in 2005, the design scheme of learning space and its technical configuration mentioned by American scholar Brown is very representative. Brown agrees that, compared with traditional learners, new learners pay more attention to interactivity and participation in experience. He encourages the design of corresponding learning modes and learning spaces based on the characteristics of learners themselves, and the design of the learning space and the configuration of technology should be considered according to the characteristics of new learners. After summarizing the relevant research on new learners, Brown proposed that they have characteristics such as “group activity tendency, goal and achievement orientation, multitask orientation, and high dependence on the network.” Taking these characteristics as a reference, they provide a variety of corresponding learning. In 2010NETP (National Educational Technology Program), the United States mentioned the learning model assisted by technology support and the learners who use it. Having the construction paradigm existing in the personalized online learning space, which provides the information management, communication, and knowledge construction tools that learners need and integrates every learning participant into the space to form an online learning community, the University of Minnesota created an active classroom for the first time; in 2008, the British Joint Information Systems

Committee issued the “21st Century Learning Space Design Guidelines” and said: “In order to meet the needs of two different teaching methods, teacher-centered and student-centered, building a technology-rich learning environment is an important research trend in learning space, and learning space must also be the focus of future research.” In 2008, this framework focuses on how the virtual learning space supported by information technology plays a special role in teaching method reform and improving teaching efficiency. The first idea was proposed by the Norwegian University of Science and Technology; based on the problem-based learning model, Cindy divides the learning space into two types: problem space and related concept space. However, the above literature on learning spaces focuses on physical space design. The research on online learning space in foreign countries is gradually growing on the online learning platform, and the foreign online learning platform has become a universal and mature learning resource; especially in the United States, most schools have installed official learning websites, these websites can cover the whole school, and students and teachers within the school can learn through the network platform anytime, anywhere. [9–17].

## 3. Related Theories and Technical Methods

*3.1. Vue.js Framework.* Vue.js technology framework is a very convenient and powerful framework for front-end web design and development, and its essence is the JavaScript MVVM library. Vue.js is a lightweight front-end framework, Vue. The performance of js is very high, with fast data rendering speed. In addition, Vue.js technical framework provides many simple instructions and APIs for users to learn the front-end framework and can also efficiently build a relatively complete front-end page. Vue uses a simpler template for data rendering, which is closer to the native code mode. The development mode is also relatively simple and convenient, and it also provides tools for rapid development of projects, which is conducive to the analysis and analysis of later development personnel. Code maintenance and updates: the ViewModel of Vue is responsible for the two-way data binding and data monitoring of the database and the real DOM. The real DOM monitors the data at the ViewModel layer and transmits it to the database, and the data of the database monitors the monitored data in the view. The model layer performs two-way binding of data, passes it to the virtual DOM, and then obtains the real DOM to form a closed loop of DOM rendering [18]. The rendering process is shown in Figure 1.

In addition, the two-way data binding of Vue.js also plays an important role in the development of our project platform. Generally speaking, the data binding process of Vue.js is that the user enters data in the view interface. The view layer can bind data to both the view model layer and the model layer. After binding, the data is paired at the model layer. Data is bound to each other. This feature of Vue.js makes it easier for developers to run and maintain the system later, making the management of data state changes very simple and convenient [19]. The two-way data binding process is shown in Figure 2.

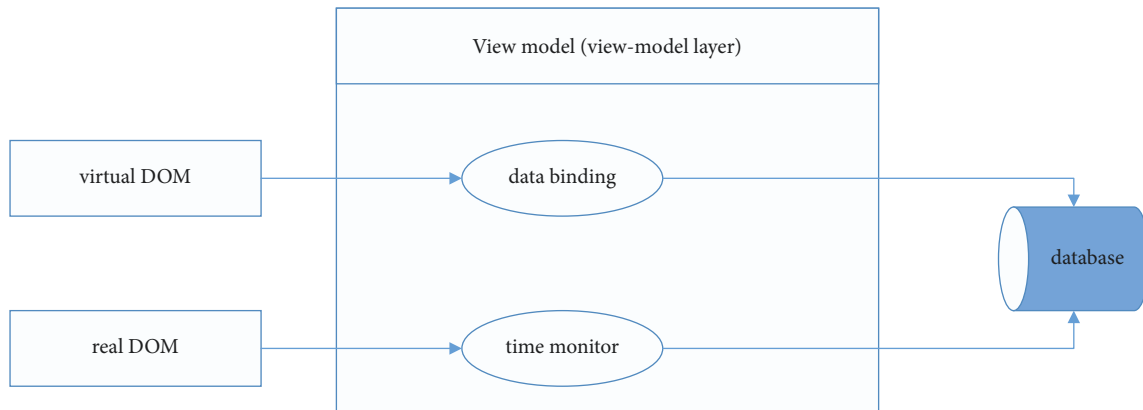


FIGURE 1: Rendering process.

The most prominent feature of Vue.js is that it has easy-to-manipulate components, and it is also the most used feature of the Vue.js framework. It can not only extend HTML but also encapsulate and reuse code to improve software development efficiency. Vue.js components come in four flavors, including global components, local components, nested components, and single components. Generally speaking, we most often use the form of global components. All global components in Vue can be used in all js instances, and the life cycle of use is relatively long. You can reuse the developed source code, develop new projects, expand the use of code, save development time, improve development efficiency, and save development costs.

**3.2. Markdown Language.** Markdown is a lightweight markup language that can easily and quickly write documents in various formats. Markdown is now a markup language commonly used by many international editors and writers. Compared with the HTML markup language, its language syntax is very simple, easy to learn, and the easiest to use. Editing various documents with markdown notation allows for very elegant and immersive recording. It pays more attention to the content, not the typography, because the editor or the platform can render the final typography of the article through markdown markup. The resulting effect is very simple and clear. On the other hand, the cost of learning markdown is not very high. As long as you understand this grammar rule, you can achieve the effect once and for all. It can also be used to write documents, which are saved in the software directory, and the file name is "README.md." In the English core literacy platform, we need to take notes or mark the chapters we read during the reading process. During the reading process, if you have any questions that you do not understand, you can leave a message to the teacher or ask questions on the forum. This process is inseparable from the language markdown. Markdown was originally primarily used for web writing. Later, after a series of development of the Internet, now markdown has been applied to more fields, and many extended grammars have also been generated. These grammars are based on the basic grammar. Functions such as tables, character lists, and fence

codes are added. Another notable feature of markdown is that it has good compatibility. You can quickly open multiple editors, allowing you to write in one place and use it in many places. It works in any scenario where you can write. This is the solution for writing. This problem has been solved perfectly [20]. Markdown workflow is shown in Figure 3.

**3.3. SQL Database.** Structured Query Language, referred to as SQL, is a language in the database world. It uses query statements to query and modify data in the database. SQL is a relational database system in database classification and has all the features of relational databases. Databases can store large amounts of data, which are processed by computers to efficiently access collections of data. Structured Query Language can nest query data. Relational databases are managed by a database management system. Two-dimensional tables called database tables are used to manage data in relational databases. A database table consists of a column of data items and a row of data and is read and written in units of records. The most common system structure of relational database management system (RDBMS) is client/server type (C/S type), as shown in Figure 4 [21].

In the structure diagram of the relational database, the server is used to process requests from other programs. The client uses the SQL query statement of the program in the database to send a request to the server. The server receives the query statement and reads the data program to the database. The database performs logical judgment processing on the data request and responds to the requested program. The server responds to the received processed data to the client, and the user can get the processed data. It can also be sent to the relational database management system through SQL statements to change and obtain data.

## 4. Teaching Design of English Courses Based on Network Learning Space

**4.1. Teaching Application Mode in Online Learning Space.** For teaching based on the network learning space, this study proposes five basic modes suitable for teaching, namely, autonomous learning mode, collaborative learning mode,

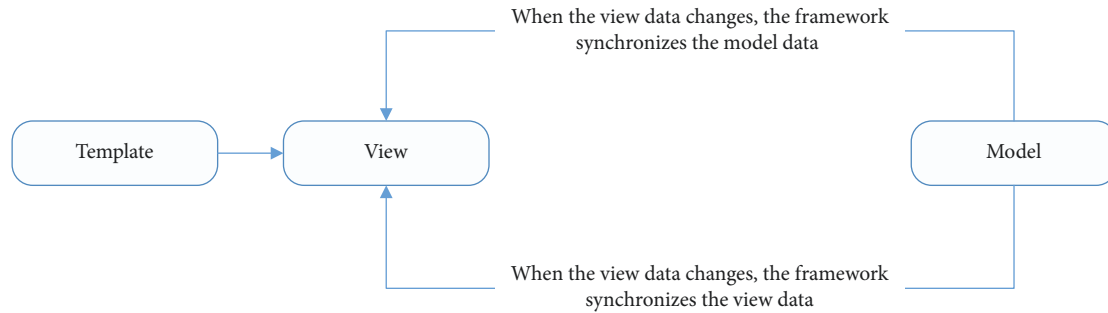


FIGURE 2: Two-way data binding.

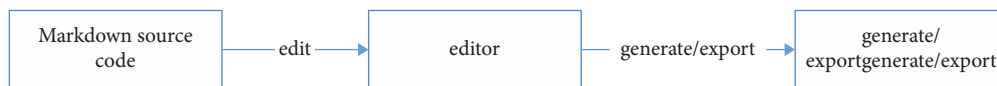


FIGURE 3: Markdown workflow.

flipped classroom, communication and discussion mode, and personalized learning mode. One of the characteristics of the online learning space is that the students' autonomous learning ability can be developed. Therefore, the autonomous learning mode under the online learning space is one of the basic modes of the online learning space. The specific process is shown in Figure 5.

Students obtain tasks through the online learning space, then determine the learning goals, then conduct independent learning, and answer questions through self-learning methods such as searching for materials, viewing resources, and online communication learning and finally through self-examination to find insufficient and continue to learn mistakes. Collaborative learning mode under the network learning space collaborative learning is also one of the characteristics of the network learning space, so the collaborative learning mode under the network learning space is of great significance. The specific process is shown in Figure 6.

Collaborative learning is also one of the teaching methods commonly used by teachers. Collaborative learning in the online learning space has injected new vitality into teachers' classrooms, enabling collaborative groups to clarify learning goals and conduct targeted learning. The teaching process mainly takes place in the classroom. The teacher explains in the classroom, and the students practice after the class. The flipped classroom is the opposite. Students obtain teaching resources for learning before class, ask and solve problems in the classroom, and conduct summary evaluation and reflection after class. It can be seen that the flipped classroom mainly includes preclass learning and classroom inquiry. The flipped classroom learning mode in the online learning space is shown in Figure 7.

Communication and discussion mode in the online learning space mostly refers to the communication and discussion between students and students, and it is an important mode of informal learning to answer questions and solve doubts through discussions between classmates. The details are shown in Figure 8.

The communication and discussion mode in the online learning space breaks the traditional boundaries of time and space. Students' communication and discussion do not only happen in the classroom. A good online learning space creates an environment for students to communicate and discuss.

**4.2. Teaching Process Based on Teaching Mode.** According to the learning mode in the network learning space proposed above, this research constructs a teaching process based on the teaching mode, as shown in Figure 10.

From Figure 9, the teaching process based on the network learning space is mainly divided into three parts: before class, during class, and after class. Based on the flipped classroom, self-learning is carried out before class, and relevant knowledge is previewed; knowledge and skills are consolidated and strengthened through exchanges and discussions after class.

#### 4.3. Teaching Design Based on Network Learning Space

**4.3.1. Platform Selection Design.** Teaching based on the network learning space requires the support of a specific teaching platform, and the teaching platform needs to include student space and teacher space. According to the research on each platform, this research chooses the "cloud class" education platform for teaching process practice. Cloud class has all the characteristics of online learning space, can share resources and communicate, can realize independent learning and collaborative learning, can track and give feedback on students' learning situation in time, and so on. It is a good online learning space.

**4.3.2. Content Design.** When choosing the teaching content of the online learning space, it is also necessary to consider the characteristics of its content:

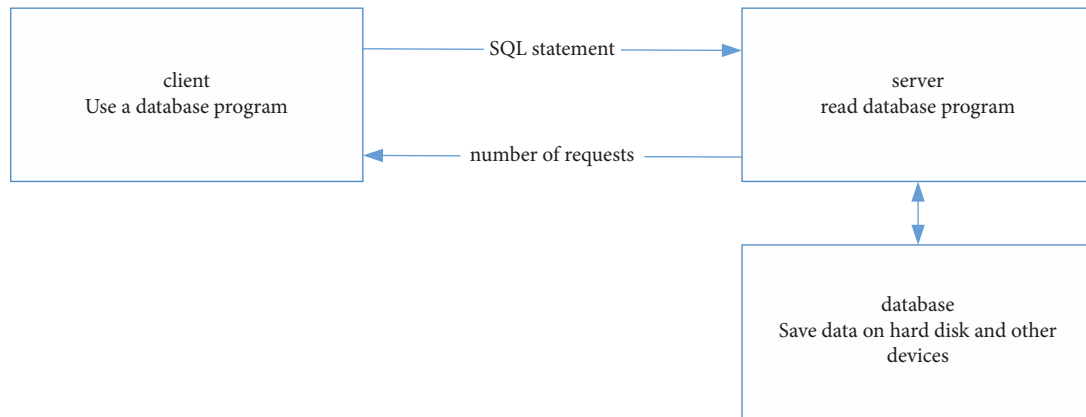


FIGURE 4: System structure of relational database.

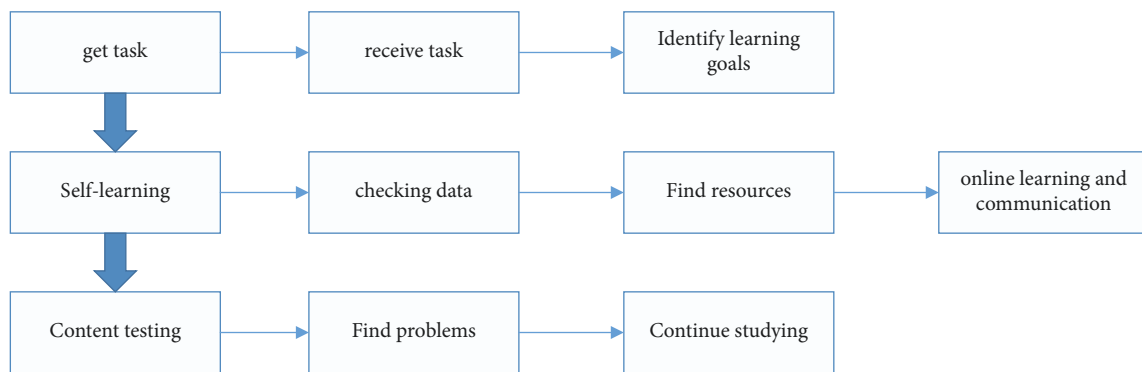


FIGURE 5: Self-directed learning mode in online learning space.

- (1) *Challenging*. Generally, it refers to the degree of difficulty of learning content in the learning process. For students, the content of learning can neither be too easy nor too difficult. Students have basically mastered the simple content, and it is difficult to have the desire to communicate and discuss the content; too difficult learning content exceeds the students' own learning cognition and ability, which will also affect the effect of students' communication and cooperation.
- (2) *Openness*. It generally means that there is no fixed answer to the content of learning, and the answer can be varied. In the process of students' learning, students get the best answer through mutual exchange and discussion and finally report according to the discussion process. Such learning content can further stimulate the enthusiasm of students to learn and communicate, obtain more different answers, and improve the learning effect.
- (3) *Exploratory*. It generally means that students can learn knowledge independently in the process of inquiry and can use it to deal with practical problems at the same time. This type of learning content focuses on mobilizing students' autonomous learning, encouraging students to express their ideas bravely,

and forming consensus answers among group members in group communication and discussion.

**4.3.3. Implementation Design.** The implementation design is a very important stage. It is mainly for teachers and students to cooperate with each other to carry out learning. In the implementation design stage, the first step, the teacher can introduce the problems of this class through some media, such as stories, audio, or video materials, to set up relevant scenarios so that students can understand the learning goals of this class through the platform. At the same time, you can also ask some questions so that students have some thinking before the class.

## 5. Application and Analysis of English Course Teaching Based on Network Learning Space

**5.1. Design of the Experimental Study.** For the purpose of the experiment, this research puts forward the following hypotheses. Hypothesis 1: using the English course teaching based on the network learning space, compared with the traditional teaching method, students can better grasp the relevant course knowledge, which is conducive to improving students' learning effect and level of learning. Verification method: after the experiment is over, professional information technology teachers are invited to

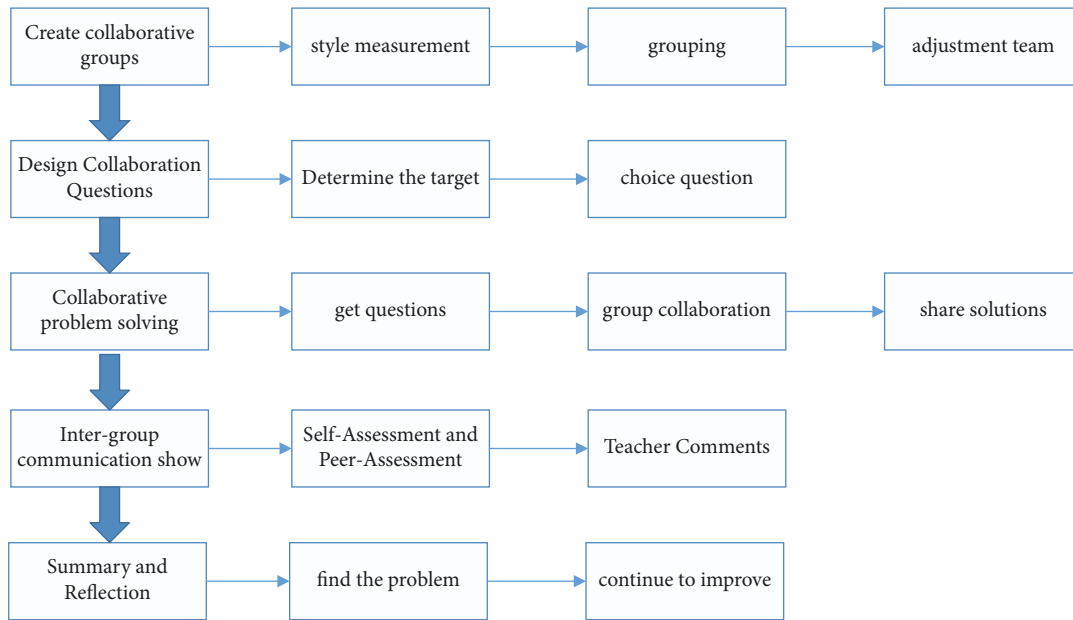


FIGURE 6: Collaborative learning mode in the online learning space.

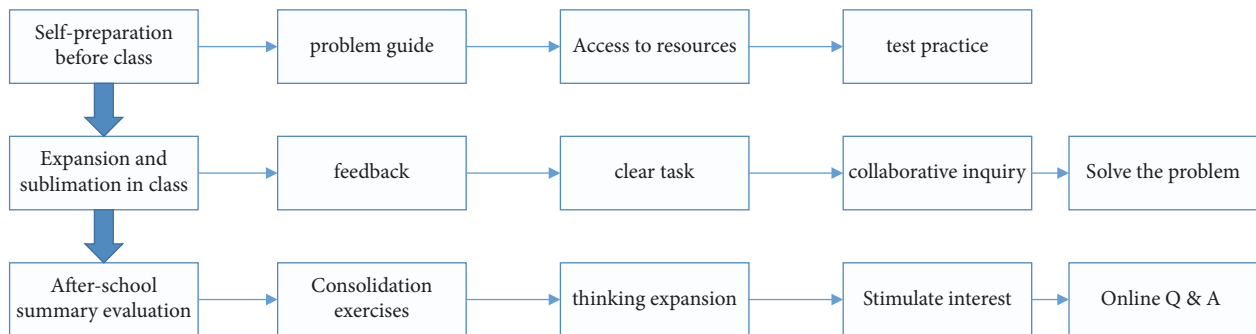


FIGURE 7: The flipped classroom learning mode in the online learning space.

make a score based on the classroom performance and the comparison of the works of the experimental class and the control class. Hypothesis 1 holds if the quality of the experimental class is better than that of the control class. Hypothesis 2: applying the teaching of English courses based on network learning space, students' collaborative learning ability and autonomous learning ability are improved. Verification method: after the experiment, verification is carried out through interviews and measurement methods. The students in the two classes were measured with the independent learning ability measurement table and the collaborative learning ability measurement table, and the independent sample  $t$ -test was carried out on the experimental data. If the measured data of the experimental class and the control class are significantly different and the scores of the experimental class are higher than those of the control class, then hypothesis 2 is established.

**5.2. Experimental Procedure.** During the experiment, students in the experimental class and the control class were observed in class. The experimental class adopted the

English course teaching method based on the network learning space, and the control class adopted the traditional information technology classroom teaching mode. Through classroom observation, it is found that the students in the experimental class are more active in the classroom, have a higher degree of participation in the questions raised by teachers, and have more active discussions among group members and between groups. They can ask their own questions and take the initiative. If you ask your classmates and teachers for advice, the classroom has a good learning atmosphere, which is conducive to the cultivation and development of students' interests. Compared with the experimental class, the students in the control class were not active enough in class. Most of the students lacked interest in classroom activities. Only a few students could raise their hands to answer the teacher's questions. Practice time for things is not related to classroom learning. Moreover, the students in the control class were rarely able to ask questions to the teachers and classmates and solve the problems. There was less discussion time between the students and the teachers and students, and they basically practiced alone. Therefore, in terms of classroom activity and students'

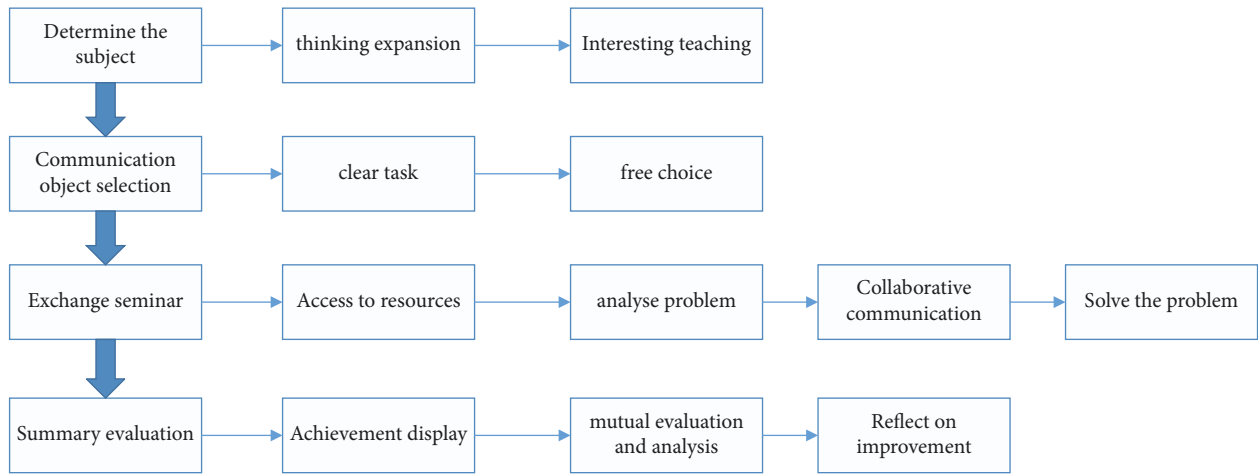


FIGURE 8: Communication and discussion mode in online learning space.

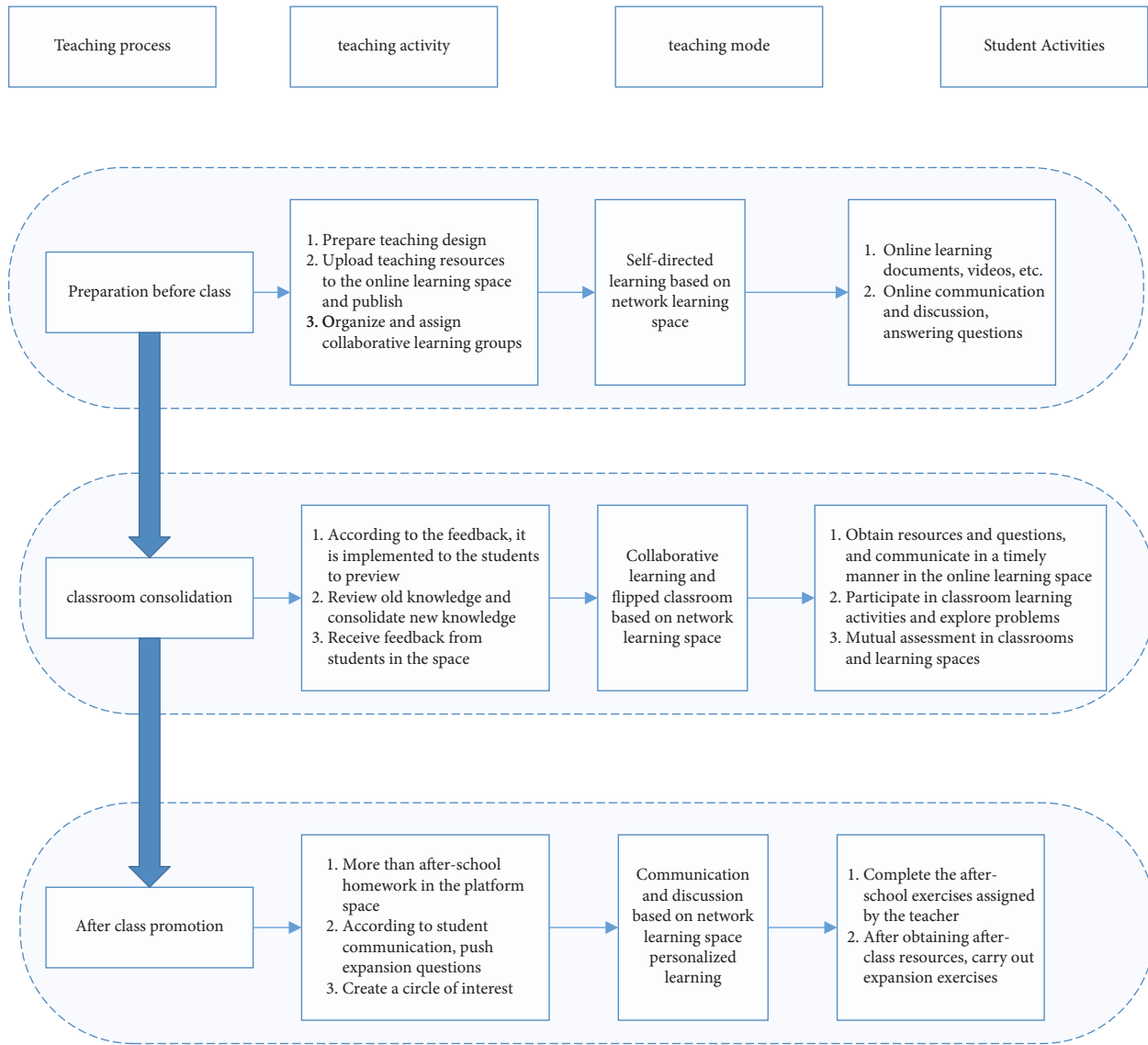


FIGURE 9: Teaching process based on Online learning space.



TABLE 1: Collaborative attitude group statistics.

	Grouping	<i>N</i>	<i>J</i> -means	Standard deviation
Total score	Test group	40	34.45	1.920
	Control group	40	33.12	1.343

TABLE 2: Independent sample *t*-test results for collaborative attitude.

Grouping	<i>N</i>	<i>J</i> -means	Standard deviation	Saliency	Sig. (bilateral)
Test group	40	34.45	1.325	0.014	0.001
Control group	40	33.12			0.001

TABLE 3: Applications of online learning spaces.

Question	Very much in line (%)	Meet (%)	Basically meet (%)	Incompatible (%)	Very inconsistent (%)
1. You are using the online learning space because of a teacher's request	40	17.5	22.5	12.5	7.5
2. You are using the online learning space for your learning needs	10	15	25	35	15
3. Do you think the online learning space has made the course more interesting	75	15	7.5	2.5	0
4. Do you think the course resources in the online learning space are helpful for the learning of information technology courses	75	17.5	7.5	0	0
5. Your willingness to continue using the online learning space in the future	55	25	7.5	7.5	0

enthusiasm, the students in the experimental class performed better than those in the control class.

*5.2.1. Analysis of Teaching Effect.* This section mainly starts from the analysis of the results of the comparative experiment, compares the classroom performance, works, and achievements of the control class and the experimental class, and analyzes the teaching effect of English course teaching and traditional teaching based on the network learning space. Finally, the collaborative ability results are obtained.

After analyzing the experiment of this research, the collaborative learning ability of the two classes was measured again to find out whether there was a difference in the level of collaborative learning ability between the two classes after the experiment [1]. Analysis of the independent sample *t*-test results of "collaborative attitude" is shown in Tables 1 and 2.

From Table 1, it can be seen that the average value of the experimental class is 34.45, and the average value of the control class is 33.12. It can be seen that the average value of the experimental class is 1.325 higher than that of the control class. It can be seen from Table 2 that  $p = 0.001$  and  $p < 0.05$ , indicating that the two classes cooperated after the experiment. Attitudes differ markedly. From the data level, it can be considered that the teaching process of this experimental study can improve the collaborative attitude of students.

*5.2.2. Analysis of Learning Situation in Network Learning Space.* The students' learning effect in the experimental class is investigated to understand the students' evaluation of the

learning effect and the degree of satisfaction with the online learning space after the experiment. In order to understand the learning situation of students in the online learning space, this research made a scale based on excellent master's and doctoral dissertations. After filling in the data, the students imported the data into SPSS software and obtained an Alpha coefficient of  $0.857 > 0.8$ , with good reliability. The questionnaire divides the survey of the learning situation of the online learning space into two parts, namely, the survey and analysis of the application attitude and the application effect. (1) Results and analysis of application attitude for students' attitude towards the application of online learning space: this study set five questions, designed from the attitude and importance of online learning space, and the questionnaire design adopted a five-point Likert scale form from the data level to analyze the students' application attitude. The specific structure is shown in Table 3. According to the data obtained in Table 3, most of the students (80%) use the online learning space because of the teacher's request in the early stage of learning. This is in line with the current education situation in China. Students' cognition of learning comes from multiple sources. Due to the guidance of teachers and the fact that students in junior high school do not have the ability to find online learning spaces by themselves, teachers need to guide in the early stage of teaching; after the teaching practice based on online learning spaces, 90% of students believe that online learning spaces become more interesting, and interesting classes help attract students' attention; more than 90% of students believe that this way of teaching is helpful for course learning and can



improve classroom efficiency; 80% of classmates said that, in the future days, they will continue to use the online learning space. After teaching practice, students have a preliminary understanding of the online learning space, most students believe that the online learning space has a positive impact on their own learning, and most of the students have also recognized the importance of the online learning space and expressed that the online learning space will continue to be used in subsequent studies. (2) Application effect results and analysis: for the application effect of students on the online learning space, this study set five questions to analyze the learning effect of students in the online learning space. The specific investigation results are shown in Table 3.

## 6. Conclusion

Through the experimental data obtained from the experimental research of English course teaching based on the network learning space, the data is analyzed, processed, and summarized, and the following conclusions are initially obtained in this research. The teaching of English courses based on the network learning space can improve students' interest in learning to a certain extent and stimulate their passion for learning English courses, which can be reflected from the students' performance. The teaching based on the network learning space has the interest that the traditional classroom does not have. After the teaching method is changed, the autonomy of the students is improved, and the open network learning space provides a stage for the personalized development of the students. Through the classroom performance of the experimental class and the control class, the students in the experimental class are active in class and raise their hands positively, and the final performance evaluation is also better than that of the control class.

## Data Availability

The dataset can be accessed upon request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

## References

- [1] G. D. Kuh, "What we're learning about student engagement from NSSE: benchmarks for effective educational practices," *Change: The Magazine of Higher Learning*, vol. 35, no. 2, pp. 24–32, 2003.
- [2] K. S. Floyd, S. J. Harrington, and J. Santiago, "The effect of engagement and perceived course value on deep and surface learning strategies," *Informing Science: The International Journal of an Emerging Transdiscipline*, vol. 12, pp. 181–190, 2009.
- [3] F. Marton and R. Säljö, "On qualitative differences in learning: I-outcome and process," *British Journal of Educational Psychology*, vol. 46, no. 1, pp. 4–11, 1976.
- [4] J. Biggs, D. Kember, and D. Y. P. Leung, "The revised two-factor study process questionnaire: r-SPQ-2F," *British Journal of Educational Psychology*, vol. 71, no. 1, pp. 133–149, 2001.
- [5] J. H. Flavell, "Metacognition and cognitive monitoring: a new area of cognitive developmental inquiry [J]," *American Psychologist*, vol. 34, no. 10, pp. 906–911, 1979.
- [6] G. Geitz, D. J. T. Brinke, and P. A. Kirschner, "Goal orientation, deep learning, and sustainable feedback in higher business education," *Journal of Teaching in International Business*, vol. 26, no. 4, pp. 273–292, 2015.
- [7] D. Samuels-Peretz, L. Dvorkin Camiel, K. Teeley, and G. Banerjee, "Digitally inspired thinking: can social media lead to deep learning in higher education?" *College Teaching*, vol. 65, no. 1, pp. 32–39, 2017.
- [8] M. A. Peters, "Deep learning, education and the final stage of automation," *Educational Philosophy and Theory*, vol. 20, no. 6–7, pp. 549–553, 2018.
- [9] Y. Engeström, *From Teams to Knots: Activity-Theoretical Studies of Collaboration and Learning at Work*, Cambridge University Press, New York, USA, 2008.
- [10] Y. Engeström, *Learning by Expanding: An Activity-Theoretical Approach to Developmental Research*, Cambridge University Press, New York, USA, 2015.
- [11] Y. Engeström, "New forms of learning in co-configuration work," *Journal of Workplace Learning*, vol. 16, no. 1/2, pp. 11–21, 2004.
- [12] Y. Engeström, *Studies in Expansive Learning: Learning what Is Not Yet There*, Cambridge University Press, New York, USA, 2016.
- [13] Y. Engeström, A. Kajamaa, P. Lahtinen, and A. Sannino, "Toward a grammar of collaboration," *Mind, Culture and Activity*, vol. 22, no. 2, pp. 92–111, 2015.
- [14] Y. Engeström, R. Miettinen, and R. Punamäki, *Perspectives on Activity Theory*, Cambridge University Press, New York, USA, 1999.
- [15] Y. Engeström, J. Rantavuori, and H. Kerosuo, "Expansive learning in a library: actions, cycles and deviations from instructional intentions," *Vocations and Learning*, vol. 6, no. 1, pp. 81–106, 2013.
- [16] Y. Engeström and A. Sannino, "Discursive manifestations of contradictions in organizational change efforts," *Journal of Organizational Change Management*, vol. 24, no. 3, pp. 368–387, 2011.
- [17] Y. Engeström and A. Sannino, "Expansive learning on the move: insights from ongoing research/El aprendizaje expansivo en movimiento: aportaciones de la investigación en curso," *Infancia Y Aprendizaje*, vol. 39, no. 3, pp. 401–435, 2016.
- [18] Y. Engeström and A. Sannino, "Studies of expansive learning: foundations, findings and future challenges," *Educational Research Review*, vol. 5, no. 1, pp. 1–24, 2010.
- [19] A. Haapasaari, Y. Engeström, and H. Kerosuo, "The emergence of learners' transformative agency in a Change Laboratory intervention," *Journal of Education and Work*, vol. 29, no. 2, pp. 232–262, 2016.
- [20] J. Hughes, N. Jewson, and L. Unwin, *Communities of Practice: Critical Perspectives*, Routledge, London, United Kingdom, 2007.
- [21] D. H. Jonassen and L. Rohrer-Murphy, "Activity theory as a framework for designing constructivist learning environments," *Educational Technology Research & Development*, vol. 47, no. 1, pp. 61–79, 1999.