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Retraction

Retracted: Curriculum Reform and Adaptive Teaching of Computer Education Based on Online Education and B5G Model

Wireless Communications and Mobile Computing

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] R. Tian and Y. Tang, "Curriculum Reform and Adaptive Teaching of Computer Education Based on Online Education and B5G Model," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 9636452, 15 pages, 2022.

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Research Article

Curriculum Reform and Adaptive Teaching of Computer Education Based on Online Education and B5G Model

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At present, my country's information and computer technology is developing rapidly, and the world has been widely integrated into the Internet age. Under the Internet teaching mode, the reform of computer courses is imminent. Teachers must reverse the traditional backward and lecture-style teaching methods, effectively integrate with information technology, and continue to expand. In this context, this paper briefly analyzes the reform and adjustment of computer education courses based on the B5G model and network education model and proposes specific reform strategies. Undoubtedly, its impact on education will be more direct, and the combination of B5G and artificial intelligence as representatives of emerging technologies will certainly pose new challenges to the educational thinking mode and will also lead to profound changes in the educational ecological model.

1. Introduction

Computers and the Internet are gradually used in education; distance education has been widely developed, through which it helps to alleviate the problems of insufficient teachers and mismatch of educational resources in education. Distance education can get rid of the shackles of time and space and adopt an innovative mode to get rid of the original education model, which helps to improve students' learning efficiency. The most important prerequisite for teaching online courses is the design of online teaching resources. When online courses are offered, students' learning situation should be fully considered to ensure the provision of sufficient and rich teaching resources, which is also an important prerequisite for students to complete their learning tasks and helps them to continuously expand their learning areas. The main body of teaching is set as the core curriculum, strengthening the review of core content and background introduction, and gradually carrying out diversified teaching work through various items such as group discussions and quizzes. In online teaching, teachers should also improve their own professional skills and comprehensive literacy, through the introduction of professional consulting services for teachers and related fields for students, so that teachers and students can grasp better research results and share information resources and teaching resources through the online platform, which can also promote good communication and learning.

Computer teaching in the online education mode mainly includes group cooperation and collaborative environment, through effective teacher assistance, effective supervision of the students' online learning process, and finally assessment for learning effects, so as to improve students' learning outcomes. By building a good collaborative learning environment, it helps students strengthen mutual communication and achieve teaching goals, but this process must strengthen the effective integration of organizational and spatial environment, teaching resources, and teaching environment; improve students' cooperative team consciousness through collaboration; and stimulate students' subjective initiative of learning.

If students encounter learning problems, they can look for relevant information or resources on the Internet or discuss and exchange answers with their friends on the Internet to achieve synchronous learning. Through synchronous and asynchronous discussions and other diversified ways, students can get rid of the constraints of time and space and use computers to transfer and exchange information in a timely manner, and teachers can provide guidance and mutual assistance to greatly improve students' learning effect. Through free discussion and exchange, students can choose different objects of communication according to their own ideas and learning progress, and the teacher will guide and help them to enter the classroom discussion step by step; no matter which discussion method is used, the teacher plays a guiding and supervisory role, truly giving the initiative back to the students and effectively improving students' learning initiative.

Teachers and students can communicate individually through the online platform to achieve one-to-one tutoring or one-to-many communication; teachers apply teaching software to be able to launch humanized tutoring, which helps bring the advantages of computer education into play, through the social way to follow up the students' recent stage of learning, effectively adjust the teaching strategy, and effectively get rid of the traditional lecture style and full of teaching constraints.

With the emergence and application of artificial intelligence (AI) technology, 4G network has become a bottleneck in the development of intelligent technology, B5G network not only has a large capacity and more extreme experience but also has a super high speed and the security of massive data transmission, enabling tens of thousands of devices to connect with each other at high speed and ultrasecure. Essentially, B5G network technology creates a three-dimensional digital environment that will open up the era of "B5G+AI+" globally. The widespread use of B5G network technology will profoundly affect and change the ecological environment in all areas of society. It goes without saying that its impact on education will be more direct, and the integration of B5G and artificial intelligence as the representative of emerging technologies will definitely pose new challenges to the thinking model in education and will also trigger profound changes in the ecological model of education.

There are few studies on B5G-enabled online education technologies. To this end, this paper explores the connotation of "B5G+network education" and uses the B5G model [1]. Using the guiding concept of "B5G mode serving online education," we construct a new model. This paper presents a forward-looking study and offers some constructive thoughts to promote the innovative development of education.

2. Related Work

As of January 30, 2021, there were 349 academic journal papers, 31 dissertations, 11 conference reports (8 domestic and 3 international), 4 books, 3 academic journals, and 172 special journals on online education and teaching by entering the keywords "online education + teaching" on China Knowledge Network. As shown in Figure 1, online education teaching and learning have received continuous attention in the past decade, reaching a peak in 2019. In contrast, the figures for 2020 are only down due to the impact of the new crown pneumonia epidemic and the fact that 2021 has just recently opened. This shows that the requirements of information-based teaching are calling, the majority of teachers and students are expecting, and online education teaching will eventually become mainstream.

In foreign countries, research on the application of online education to education and teaching has started earlier and has achieved more results [2]. In [3], they stated that based on the interaction and functionality of iPod Touch app, it can provide an instructional video to a specific learning requester to achieve independent learning. In [4], they stated that an attempt was made to study the effect of mobile applications on students' learning of new concepts, and the final mathematics test results showed that app media technology-assisted learning classes were more effective than traditional paper and pencil classroom instruction and that the app mobile learning approach promotes students' learning of new concepts and application of new knowledge. In [5], they proposed that we believe that we should proceed from seven different perspectives such as educational content, personalization, feedback, ease of use, interactivity, socialization, and assessment of higher-level human logical thinking skills to evaluate the effectiveness of the application process of educational APPs in terms of practicality and effectiveness. In [6], they pointed out that the U.S. Educational Technology Developer's guide manual states that developing effective educational apps can multiply learning opportunities for all learners and will also transform American education. The advanced technology and application techniques of foreign web education development are worth learning for domestic developers and app developers, especially in using web education to improve people's learning effectiveness.

In China, the research on online education teaching, especially the research on teaching app, is relatively small. Some educators in China began to try to transmit teaching resources and notices to learners with the help of online education media according to the actual teaching contents and to make exploration and inquiry on the innovation of teaching mode and teaching strategy. With the in-depth research of experts and scholars on mobile terminal teaching and the urgent demand of teachers and students, at present, domestic research on the application of online education to teaching mainly includes the following aspects.

First is the study of teaching network education design and implementation. In [7], they pointed out that fragmented learning based on smart phones and other network education has become a normal learning mode. In [8], they pointed out that the mobile learning system integrates technologies such as intelligent push, video annotation, Lucene full-text search, cluster analysis, and Android development. Learners can access microlesson videos and obtain high-quality microlesson resource information anytime and anywhere, while teachers can obtain microlesson analysis and statistical results, promoting the development of microlesson and mobile learning [9]. In [10], they pointed out that, in view of some problems and shortcomings in the current educational teaching apps, this paper takes the teaching practice of emotional recognition training app for children

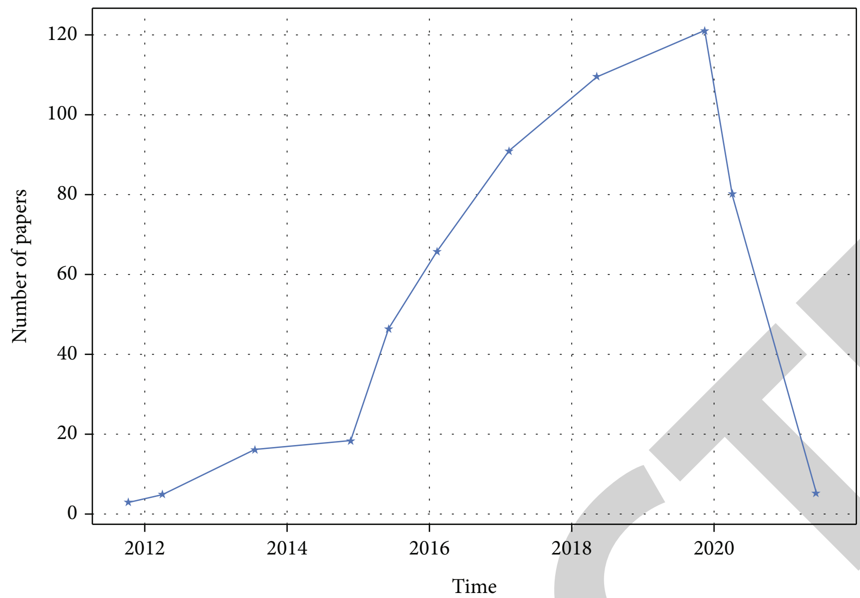

Figure 1: Number of papers published on “Online Education + Teaching” research from 2011 to 2021.

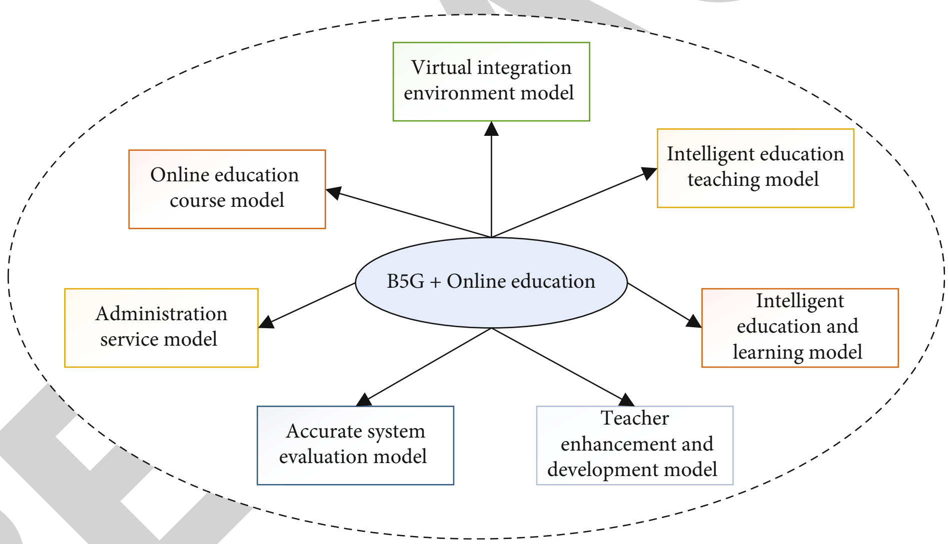

Figure 2: Educational ecological environment model.

with autism as the main case, introduces contextual interactive experiential learning strategies and contextual turn-based operational teaching strategies based on the Padagogy wheel learning model and Bloom’s theory of educational goal classification, and constructs a Pad-based educational app instructional design model. In [11], they pointed out that based on informal learning and microlearning theories, the principles and process of mobile learning resource design were proposed based on the characteristics of adult mobile learners, and on this basis, the personalized features of iOS were fully utilized to design and develop the mobile learning software “Earthquake Knowledge Easy Learning” based on iOS. The design and development of the iOS-based mobile learning software “Earthquake Knowledge Easy Learning” are based on the principles and processes of mobile learning resource design.

According to [12], education apps are no longer just an assistant for students’ learning outside the school classroom but have become a powerful “magic tool.” In [13], they pointed out that although mobile education apps can influence traditional education faster than computer Internet platform products, it is believed that it is difficult to create a strong learning atmosphere in the classroom by looking at a cold cell phone screen and completely abandoning offline face-to-face teaching, parental supervision, teacher’s discipline, and mutual encouragement and influence of partners around. In [14], they stated that through mobile education platform, informationization of educational

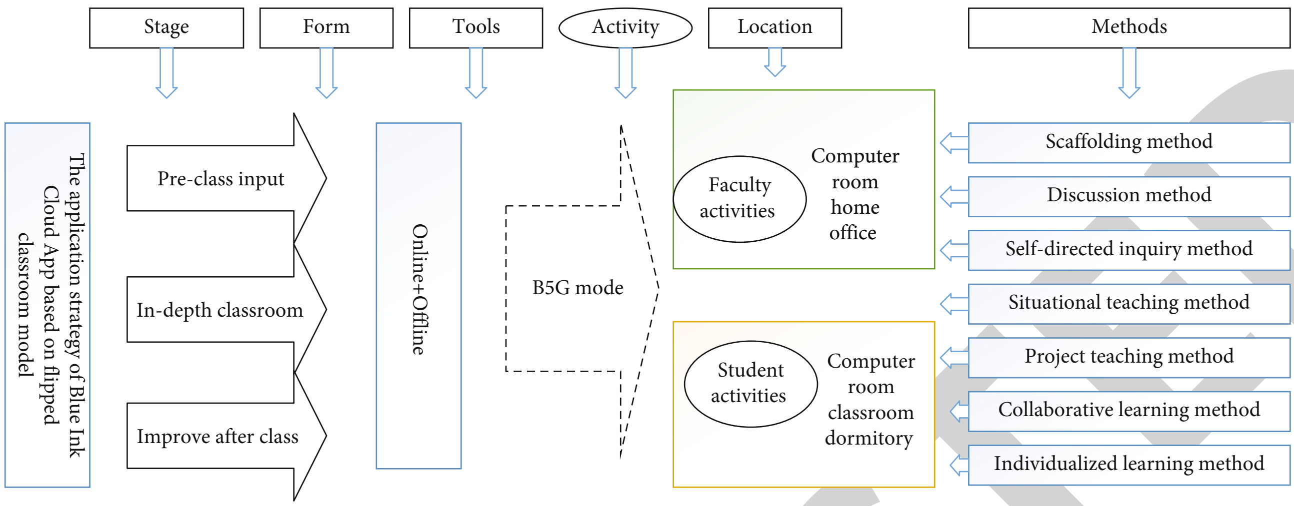

FIGURE 3: Application strategy based on the B5G model and online education.

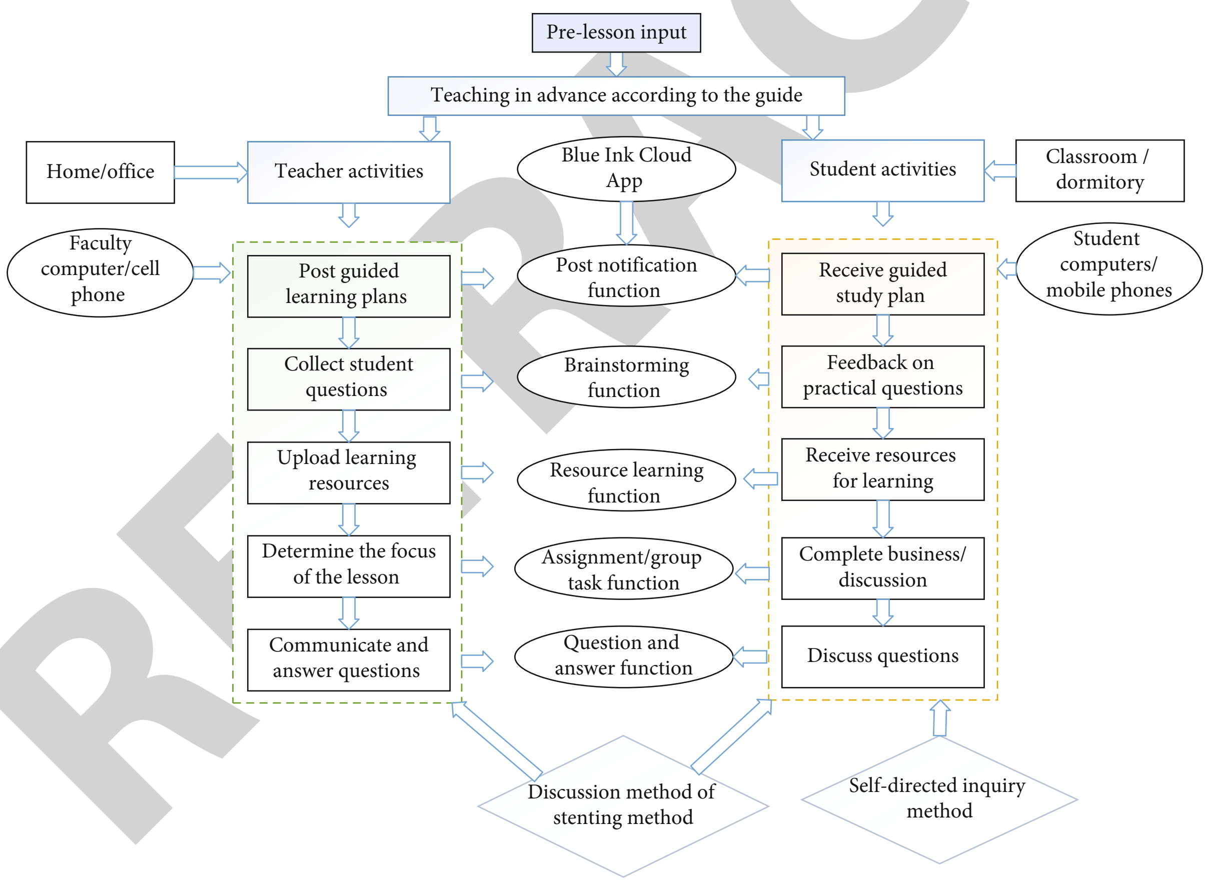

FIGURE 4: Precourse improvement strategy map.

resources can be realized, so that teachers and students in schools can interact and communicate with each other anytime and anywhere and realize the sharing of teaching results. In [15], they pointed out that IoT technology helps education apps to make intelligent perception of learning situations; highly integrate learning resources, learning partners, and other elements in the mobile learning environment; and realize deep interaction among various learning factors; cloud computing technology helps education apps to provide learners with self-service on-demand learning services [16].

Second is the study of online education reform teaching. In [17], they pointed out that, under the guidance of postmodernist teaching concept, the organic integration of the

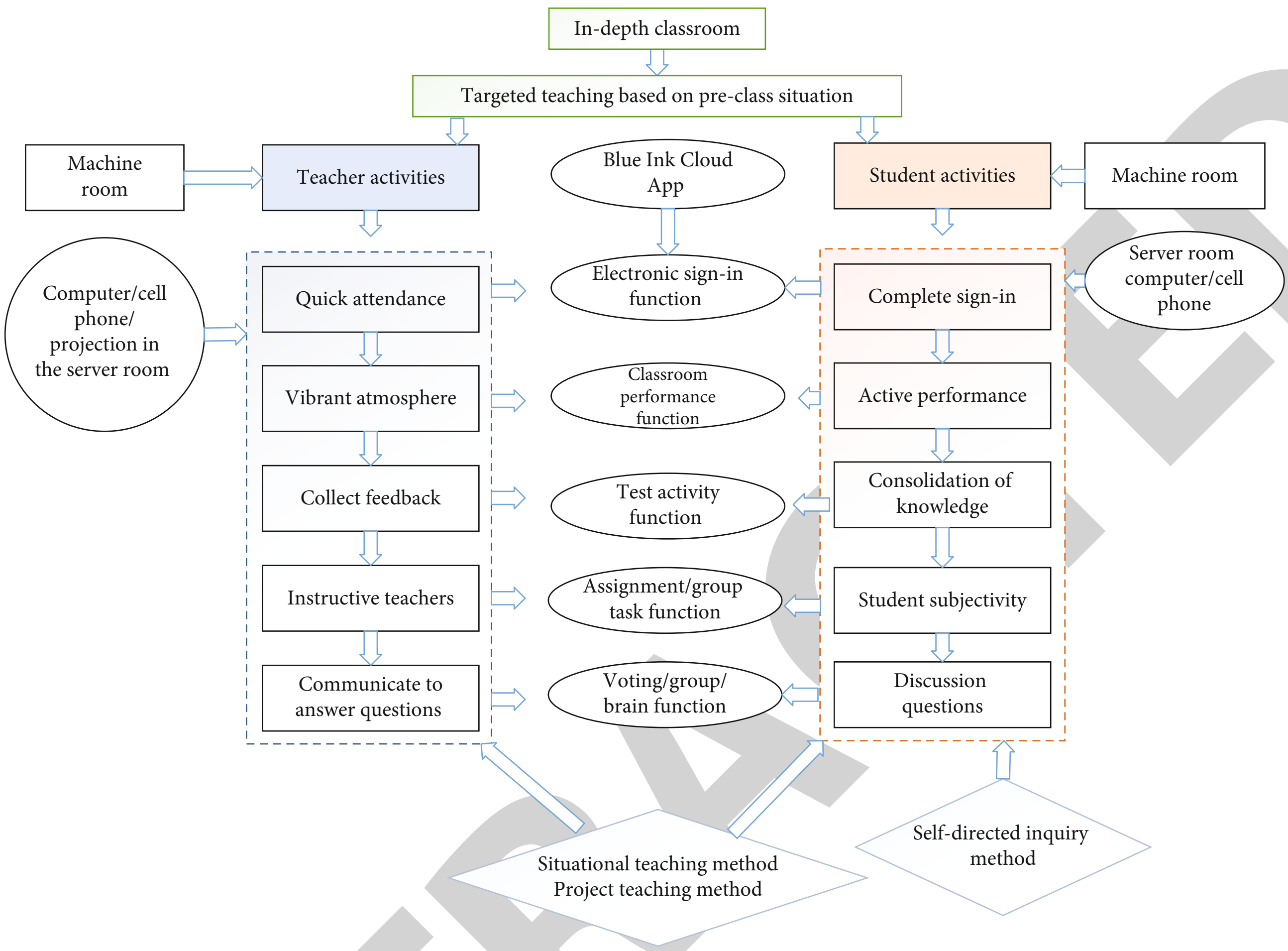

Figure 5: In-class improvement strategy map.

concept of flipped classroom and MOOCs, the MF teaching mode is proposed, and the teaching reform practice is carried out for public courses, professional foundation courses, and professional core competence cultivation, which has good universality and effectiveness and has a positive effect on promoting the common construction, sharing, and innovative application of online open courses in China and realizing talent cultivation goals. In [18], they pointed out that to break the shortcomings of traditional teaching evaluation of singularity and comprehensively understand students' learning performance both online and offline, the evaluation of online learning, teachers, or teaching managers can create corresponding evaluation activities with the help of online learning platform. In [19], they pointed out that the use of flipped classroom app in classroom teaching, the integration of teaching content into PPT and WeChat, real-time question and answer in the classroom, and interaction through the software enable teachers to dynamically obtain the learning status of students in real time. In [20], they pointed out that we should fully and deeply explore the mutual internal relationship between each knowledge point when designing classroom teaching content, divide the video classroom teaching design units by knowledge points, and push various learning resources through the mobile app to guide the majority of students to efficiently and actively participate in integrating into classroom learning, helping them to quickly complete effective learning and find the interlinking of knowledge.

Fourth is a study on the use of online education to improve students' learning effectiveness. In [21], they stated that students, on the other hand, use the mobile learning app to find learning resources and carry out independent learning on their own or in small groups according to teachers' guidance, record their learning progress and the questions that arise in the learning process in the learning support system provided by the smart campus, and test the learning effect through simple questions provided by teachers. In [22], they pointed out that combining online and offline teaching and sharing teaching resources are conducive to improving students' classroom participation, optimizing learning effects, and breaking the time and space limitations of learning. According to [23], it has the feature of not being restricted by any time and place, which truly combines "online and offline" learning, teachers' classroom lectures, and students' independent learning outside of class, stimulating teachers' enthusiasm for teaching. According to [24], we believe that the use of English dubbing app in teaching can greatly improve students' learning interest and efficiency and has a very positive effect on students' English learning experience. In [25], they stated that through the effective

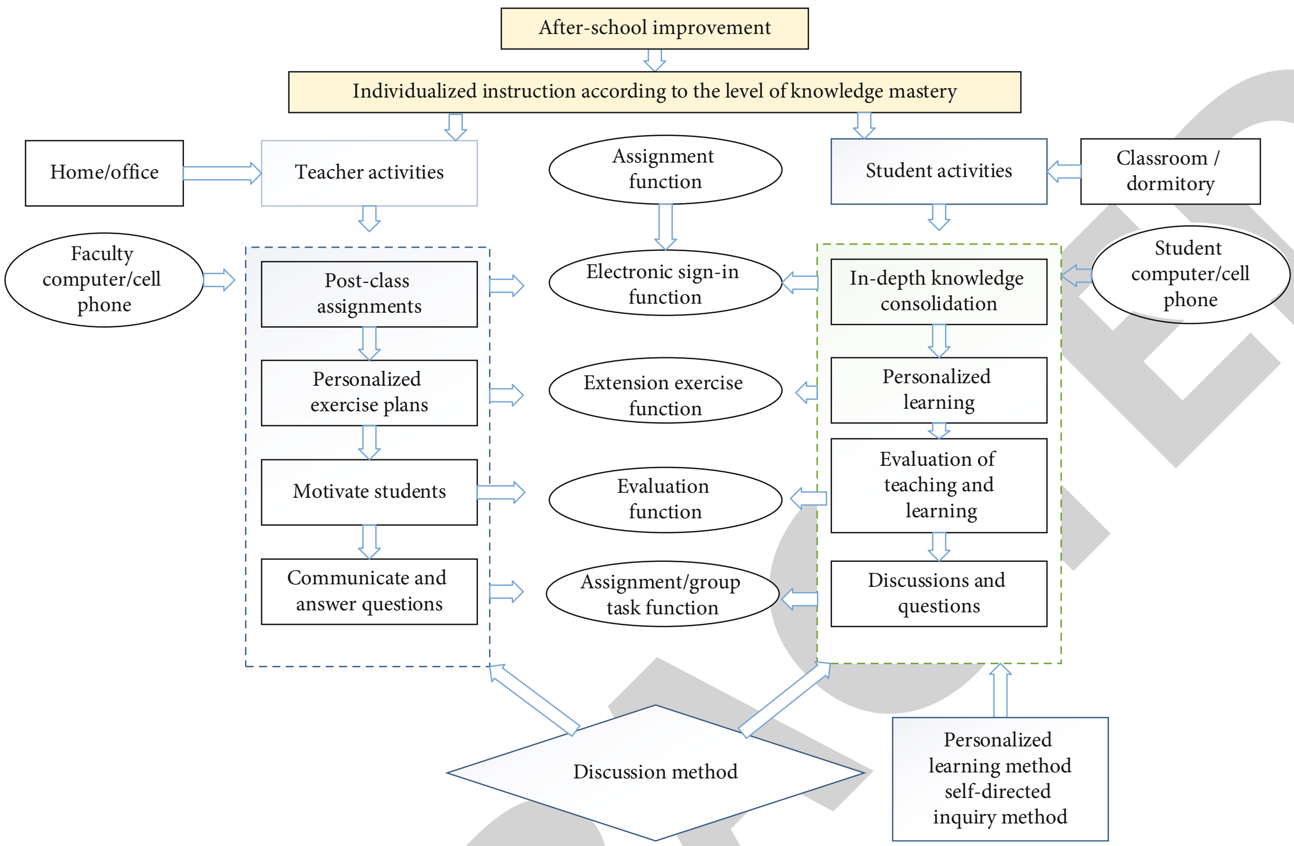

Figure 6: Postcourse improvement strategy map.

combination of online education platform and classroom aerobics learning, students can easily learn aerobics knowledge and techniques through the online education platform as well as be interested in the classroom learning of aerobics course.

It can be seen that there is a wide variety of online education at home and abroad, involving various subjects and applications to the field of education, which can basically meet the current requirements of teachers and students. There are many research results on the development, application, teaching models, and strategies of education-based online education, but there are relatively few studies on the application of education-based online education for students and the strategies to improve their learning effectiveness.

3. Methods

We construct a new model of intelligent education ecosystem in B5G mode with "virtual-real integrated education environment mode, intelligent teaching mode, network curriculum mode, intelligent learning mode, teacher development mode, intelligent evaluation mode, and management service mode," as shown in Figure 2.

In this study, strategies will be designed and implemented in three stages: precourse engagement, classroom depth, and postcourse improvement. According to the specific content and the learning characteristics of secondary school students, the improvement of students' learning effect of computer courses will be divided into three stages: the preclass stage is the main learning part to improve the level of learning commitment; the in-class stage is the face-to-face part to improve the classroom in-depth participation; and the postclass part is the consolidation and evaluation part to improve the level of academic achievement. From the above three stages, a computer network education application strategy based on the B5G model is designed, as detailed in Figure 3.

Ecoenvironment teaching is an important application scenario of education digital reform in the direction of "5G +Smart Education." In traditional ecological environment-related teaching, students' perception of the environment is static and fragmented due to the limitation of teaching time and space, and their cognition of the process mechanism is isolated and lagging behind, lacking two-way interaction between teachers and students and students' independent exploration. Currently, with the advancement of technology, emerging technologies represented by 5G network are gradually integrated into daily school life and learning, which brings new opportunities for ecological environment teaching. Immersive experience and personalized learning are expected to become a new path to crack the traditional teaching problems. With the support of new information technology such as 5G, a digital twin space of "integration of space and sky" can be created to construct a holographic, spatial, and temporal immersive ecoenvironment teaching space, learning space, and independent exploration space,

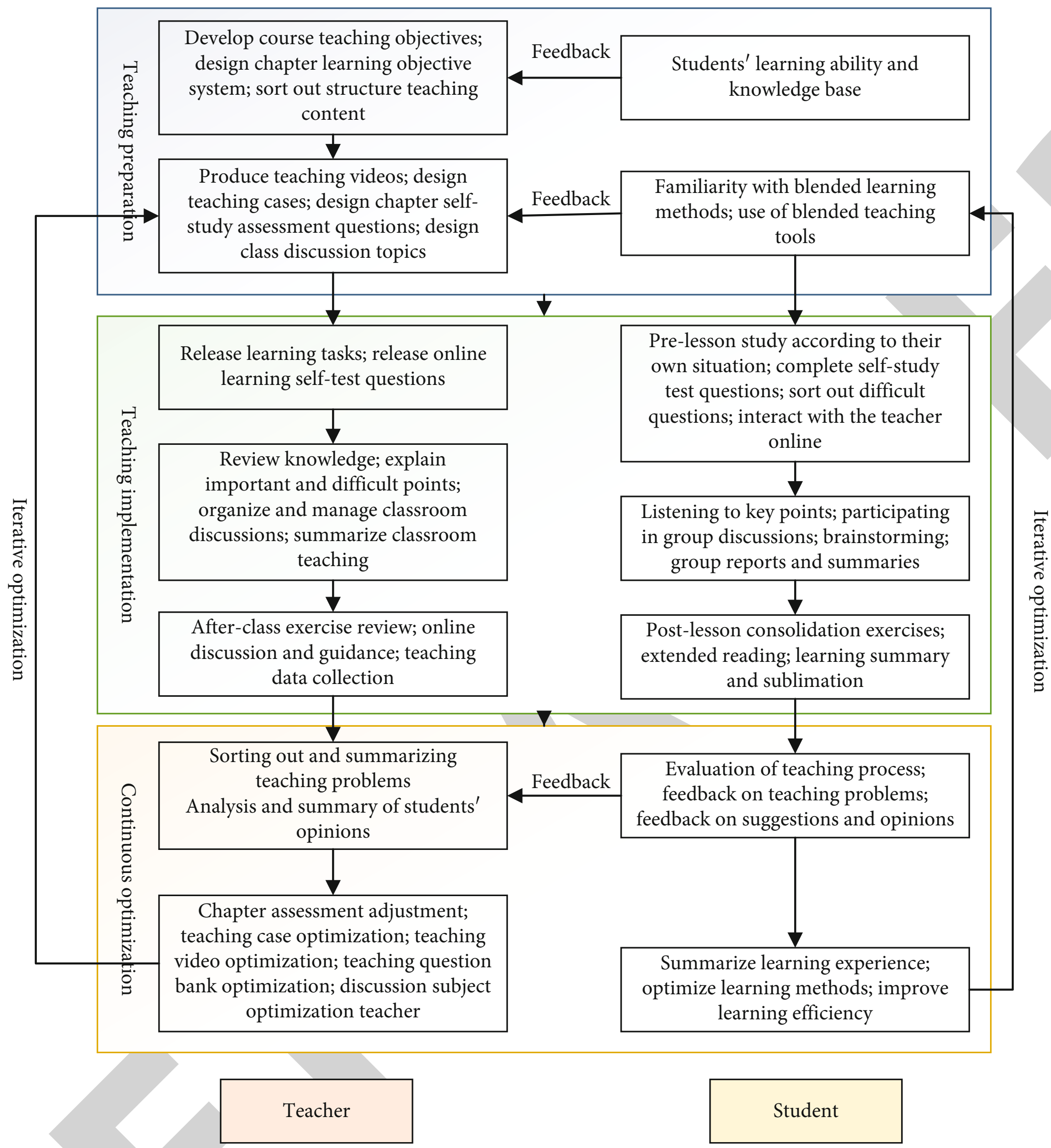

Figure 7: Adaptive teaching flow chart.

Table 1: Adaptive hybrid course teaching assessment design table.

Assessment form	Assessment content	Grading basis	Percentage of scores
Online self-study assessment	Self-directed learning	Achievement of self-study objectives	10%
Learning process assessment	Learning attitude	Online learning hours, discussion frequency	10%
Classroom task assessment	Application ability	Classroom task score	15%
After-class assignments	Knowledge literacy	Score of postclass exercises	10%
Teaching feedback	Course participation	Teaching interaction and assessment	5%
Comprehensive assessment at the end of the period	Knowledge retention, application ability	Closed-book exam scores	50%

Table 2: Comparison of the scores of the posttest of learning engagement in the experimental class.

Name	Sample size	Min	Maximum value	Mean	Standard deviation	Median
Pretest score	46	17.000	87.000	38.505	12.558	36.550
Posttest score	46	36.000	118.000	89.414	19.816	90.000

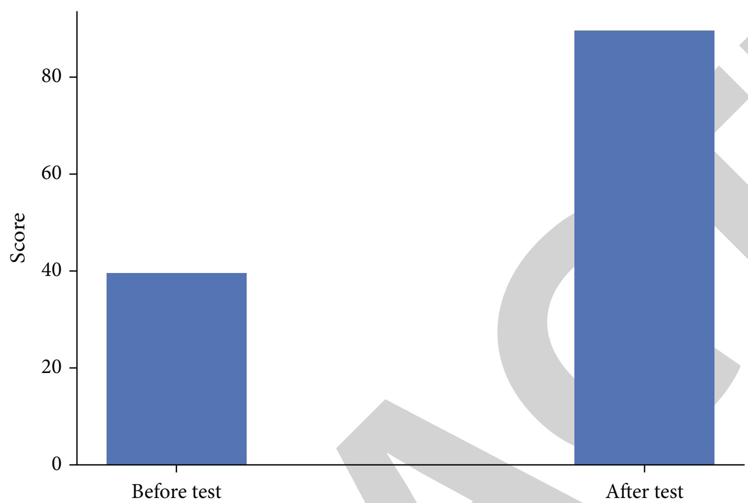

Figure 8: Comparison of pretest scores of learning engagement in the experimental class.

where differentiated and personalized teaching can be explored and implemented.

See Figure 4 for a map of precourse improvement strategies.

The same combination of online and offline methods is used for the midclass improvement strategy to improve students' learning effectiveness. The teacher uses the functions of "electronic sign-in," "class performance," "test activity," "polling/group task/brainstorming," and "Q&A" to achieve quick attendance, active atmosphere, and motivation; consolidate knowledge; reflect students' main position; develop group collaboration; and communicate with students to answer questions. In communication with students to answer questions, students learn in a targeted way according to the situation before the class. Both online and offline activities are mainly done in the computer room. The specific strategy is shown in Figure 5.

The postlesson improvement strategy for students to improve their learning effectiveness uses an online+offline approach. The teacher uses the functions of "homework assignment," "extended practice," "evaluation," and "question and answer" to assign homework for students to consolidate their knowledge in depth, provide students with personalized learning solutions, motivate students with various evaluation methods, and maintain communication with students to answer questions. Online and offline activities are completed by teachers mainly at home/office and by students mainly in classrooms/dormitories, depending on the actual situation. The specific strategies are shown in Figure 6.

Further, we design an adaptive teaching framework for computer education courses. In addition to the hybrid online and offline teaching, adaptive teaching focuses on the timely feedback of teaching effect, timely summary of teaching process, and adaptive learning selection based on students' learning base in the hybrid teaching process. Therefore, in the adaptive teaching based on mobile network terminal teaching, firstly, design the course teaching system, including course objectives, chapter objectives, multidimensional course learning path, and course teaching feedback path; secondly, sort out and reconstruct the teaching content according to the teaching objectives, build the teaching knowledge points with as high cohesion and low coupling as possible, and make teaching microcourses; finally, build a process course assessment system, which can fully reflect the course learning process, self-learning process, and course comprehensive ability and effect of comprehensive learning ability of the course.

(1) Teaching process design

Adaptive teaching should firstly design the overall goal of course teaching and build a three-level teaching goal system of chapters and the corresponding achievement standards; secondly, sort out the course teaching content, and form short teaching videos and corresponding teaching materials of about 12 minutes in length to support the underlying teaching goals; finally, publish teaching contents through mobile teaching app, WeChat public number, and online teaching platform; carry out classroom teaching; analyze students' learning effects and problems; and continuously optimize subsequent course teaching activities. The

Table 3: t-test in experimental classes.

		Mean	Standard deviation	Pairing difference SEM	Difference 95% CI		t	Degree of freedom	Significance (two-tailed)
					Lower	Upper			
Pairing 1	Pretest score-posttest score	-49.915	24.192	3.565	-57.095	-42.727	-13.992	45	0.000

Table 4: Comparison of the scores of the posttest of learning engagement in the control class.

Name	Sample size	Min	Maximum value	Mean	Standard deviation	Median
Pretest score	44	18.000	85.000	38.228	12.755	36.000
Posttest score	44	28.000	55.000	39.550	6.429	38.505

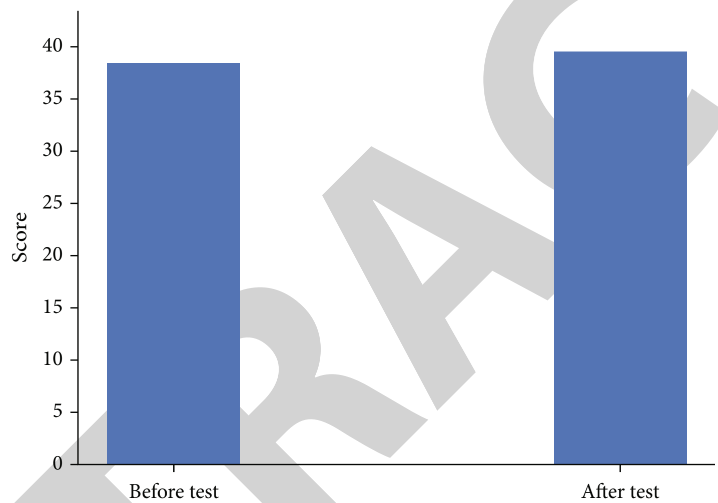

Figure 9: Comparison of the mean scores on the pretest and posttest of learning engagement in the control class.

specific adaptive teaching design process is shown in Figure 7.

(1) Teaching preparation. The teaching preparation of adaptive teaching occupies an important position in the whole teaching process, is a teaching link that is continuously optimized according to teaching feedback iteratively and continuously, and is the teaching link that consumes the most teachers' energy in the whole teaching implementation process. According to the training plan, students' learning ability, and learning foundation, teachers should set the course teaching objectives and construct the chapter learning objective system, with low cohesion and high coupling among the objectives, so as to build a complete learning path for the leapfrog learning of students with different learning bases. On the basis of the construction of the teaching goal system, the existing teaching contents are sorted out and reconstructed to form a learning content system around each teaching goal with different difficulty and different paths of chapter learning goal completion and make corresponding teaching videos for online learning, design teaching cases, classroom discussion topics, and a test bank for students' self-study goal achievement self-test. Based on the analysis of students' ability to master the use of mobile teaching tools, we select suitable mobile teaching tools to carry out blended teaching

(2) Instructional implementation. The implementation process of adaptive teaching is mainly divided into three stages, before, during, and after class. Before class, teachers release the next class learning tasks, online learning resources, and online learning self-test questions on the mobile teaching platform according to the teaching schedule and notify the learning tasks to each student through WeChat group, QQ group, and mobile teaching platform. Students choose the learning path according to their

Table 5: t-test of pretest scores of learning engagement in the control class.

		Mean	Standard deviation	Pairing difference SEM	Difference 95% CI Lower	Difference 95% CI Upper	t	Degree of freedom	Significance (two-tailed)
Pairing 1	Pretest score-posttest score	-1.275	14.985	2.258	-5.829	3.283	-0.565	44	0.575

Table 6: Comparison of the scores of the posttest of learning engagement between the two classes.

Name	Sample size	Min	Maximum value	Mean	Standard deviation	Median
Control class	44	28.000	55.000	39.550	6.429	38.000
Experimental class	46	36.000	118.000	89.415	19.818	90.500

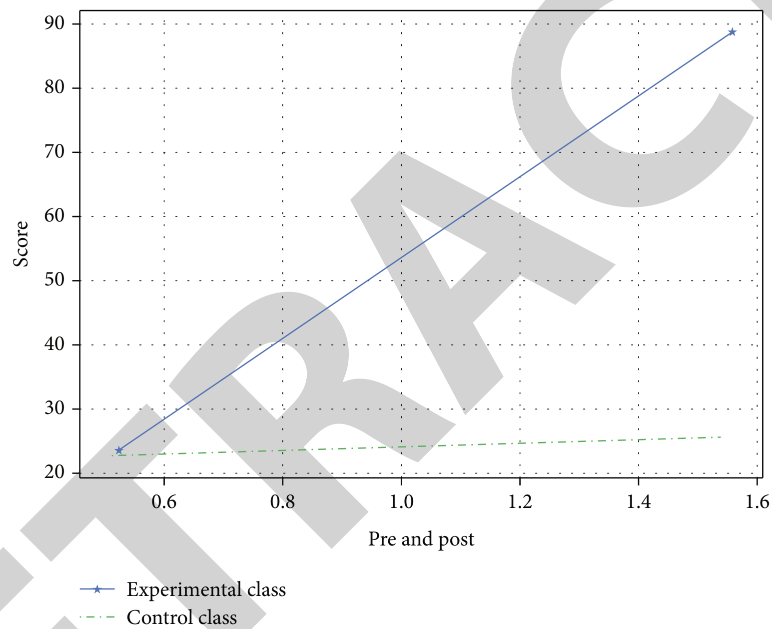

Figure 10: Pre- and posttest comparison of learning engagement scores.

learning ability and learning foundation, carry out preclass online learning, complete self-study test questions, sort out knowledge points and difficult problems, and interact with teachers on preclass learning and feedback. During the class, the teacher should first review, carry out short classroom teaching, propose classroom discussion topics, and organize students to brainstorm and carry out classroom discussion according to the predivided groups. The teacher should carry out discussion guidance at the right time and finally sort out and summarize the classroom teaching content and topic discussion, find out the problems and shortcomings of the discussion process, and help students raise awareness and deepen their understanding of what they have learned. Students should listen carefully to the teacher's explanation of important and difficult points and participate in teaching activities focusing on their own difficult problems; actively brainstorm, participate in group class discussions, and actively undertake group discussion tasks and reporting of discussion results. After the class, teachers should carefully review students' online practice questions, answer and discuss common problems through bulletin boards, answer individual problems through peer-to-peer format, and provide online guidance for students' knowledge expansion learning; collect and organize teaching data such as teaching effect data and students' knowledge mastery data to provide data basis for later teaching improvement. Students should complete the later consolidation exercises of classroom teaching, carry out a lot

Table 7: Percentage of classroom participation score items in both classes.

Class	Percentage of classroom participation score items									
Control class	Classroom sign-in 20%	Classroom discipline and performance 80%								
Experimental class	Classroom sign-in 20%	Video resource learning 5%	Non-video resource learning 5%	Test 20%	Light live broadcast/ discussion 5%	Brainstorm 5%	Voting questionnaire 5%	Homework/ group task 15%	Classroom performance 15%	Being praised by the teacher will add 5%

Table 8: Comparison of classroom participation scores between the two classes.

Name	Sample size	Min	Maximum value	Mean	Standard deviation	Median
Control class	46	44.000	90.000	68.000	10.978	65.000
Experimental class	46	50.500	91.500	73.785	10.273	74.000

of extracurricular knowledge reading and exploration, and summarize, sublimate, and internalize what they have learned

(3) Continuous optimization. The focus of adaptive teaching is the independent choice of learning and continuous optimization of teaching interaction according to students' needs, so only by ensuring the continuous iterative optimization of teaching activities can the adaptive hybrid teaching activities be implemented well. Teachers should collect teaching evaluations from students, problems in the teaching process, and opinions and suggestions on the teaching implementation process in time after each lesson; analyze and evaluate the problems and shortcomings in the teaching process of the course by combining the recorded data of students' self-study before the lesson and consolidation of learning after the lesson; and optimize and improve the teaching materials and teaching process for the next lesson, so that the teaching process can be continuously optimized

(2) Course assessment design

Adaptive teaching focuses on the independent selectivity of students' learning, the interactivity of teaching activities, and the continuous optimization of the teaching process, so the course assessment should take into account both the learning process and the achievement of learning objectives. The purpose of social statistics course assessment is to detect the degree of achievement of students' learning objectives. Therefore, the adaptive hybrid course teaching should be able to reflect students' theoretical knowledge, practical application of knowledge, independent learning ability, learning effort and attitude, and participation in teaching activities and classroom performance, as well as the overall learning effect of the course. The assessment scheme of the adaptive hybrid social statistics course is shown in Table 1.

Adaptive teaching combines online and offline teaching, provides different learning paths for students with different learning abilities and learning bases through a multilevel assessment goal system, builds multiple teaching feedback paths, enhances the characteristics of blended teaching according to the material, effectively saves class time, and enhances students' enthusiasm in teaching activities. At the same time, teachers achieve continuous iterative optimization of teaching activities through teaching feedback data such as students' learning effect, students' evaluation, and teaching feedback; students continuously optimize their learning ability and professional knowledge through their own learning feedback and continuous iteration through extended reading and mobile teaching tools after class and finally achieve continuous iterative optimization of teaching and learning.

4. Case Study

The experimental class used the B5G model-based online education application strategy to intervene in the study, and the strategy included online learning, combined with online education support and integrated online and offline evaluation to assist teaching, while the control class applied the traditional classroom teaching method to teach. After the experiment, questionnaire surveys were conducted on the learning engagement levels of the two classes, respectively, and the data obtained from the pretest surveys were compared and analyzed. The classroom participation and academic performance before and after the experiment were also compared to comprehensively analyze the before and after changes of students' learning effects in computer courses.

4.1. Analysis of the Effect of Learning Engagement Level. From Table 2, the average score of students' learning engagement increased from 39.50 to 89.41 after the

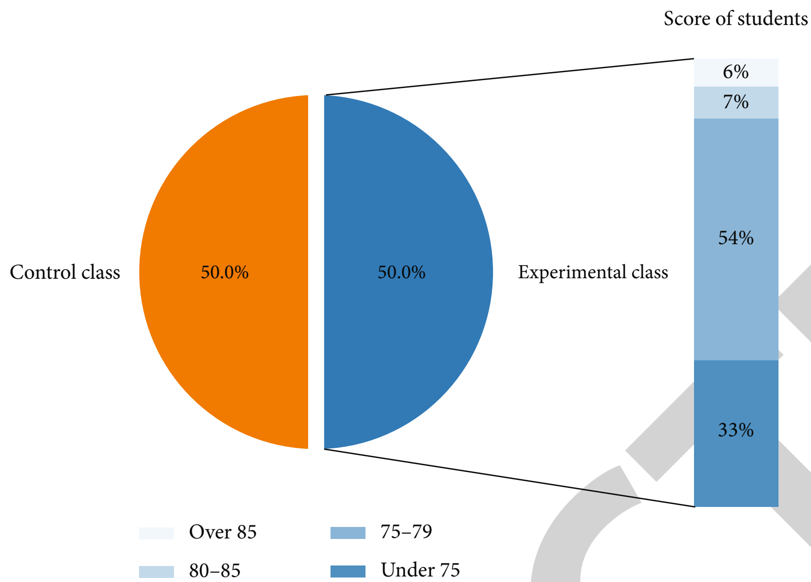

FIGURE 11: Comparison of the mean classroom participation scores between the control class and the experimental class.

TABLE 9: Comparison of the scores of the posttest of academic achievement of experimental classes.

Name	Sample size	Min	Maximum value	Mean	Standard deviation	Median
Pretest score	46	36.000	90.500	62.285	13.529	62.000
Posttest score	46	42.000	99.000	71.108	12.822	71.000

experiment, and the effect of the experiment was obvious. The comparison graph is shown in Figure 8.

To examine the difference of learning engagement of the experimental classes before and after the experiment, paired-sample t-tests were conducted.

Table 3 shows that the probability of significance $P = 0.000$ (value less than 0.001, uniformly shown as 0.000). Therefore, there was a very significant increase in students' learning engagement after using the strategies to improve their learning process, indicating that the strategies were applied significantly.

According to the analysis of the data of the pre- and posttests of the learning engagement questionnaire in the control class, the learning engagement scores were calculated separately, and the pre- and posttest data obtained are shown in Table 4.

As in Table 4, the mean score of students' learning engagement after the traditional approach changed from 38.23 to 39.50 with insignificant level differences. The comparison graph of the mean scores of the pre- and posttests of learning engagement in the control class is shown in Figure 9.

In order to examine the differences in learning engagement of the control class before and after traditional teaching, paired-sample t-tests were conducted based on the pretest scores and posttest scores of learning engagement of the control class, and the results of SPSS output are shown in Table 5 below.

As shown in Table 5, the significance probability of $P = 0.576 > 0.05$ shows that the participation rate of learning activities in comparable classes did not change significantly before and after the experimental study. Therefore, compared with the class, the participation rate did not significantly improve and basically remained unchanged.

According to the analysis of the data obtained from the experimental course and the data obtained from the follow-up survey after the control course, the estimated training cost is calculated, as shown in Table 6.

As shown in Table 6, after the completion of the experiment, the average division of the control group by 39.50 and the average division of the experimental group by 89.41 show that after the completion of the experiment, the overall performance of the students in the experimental class is still positive, while the performance level of the control class is still at a low level. As shown in Figure 10, the average scores obtained by the two classes in the prelearning and postlearning tests are compared.

4.2. Classroom Participation Score Evaluation Methods for Experimental and Control Classes. The experimental class used the online education system to automatically record students' class participation, which was weighted by a percentage system with the following percentages: 20% for class sign-in, 5% for video resource learning, 5% for non-video resource learning, 20% for tests, 5% for light live/discussion, 5% for brainstorming, 5% for voting questionnaires, 15% for homework/group tasks, 15% for class performance, and 5% for being liked by the teacher. The control class used the teacher to manually record students' class participation, with

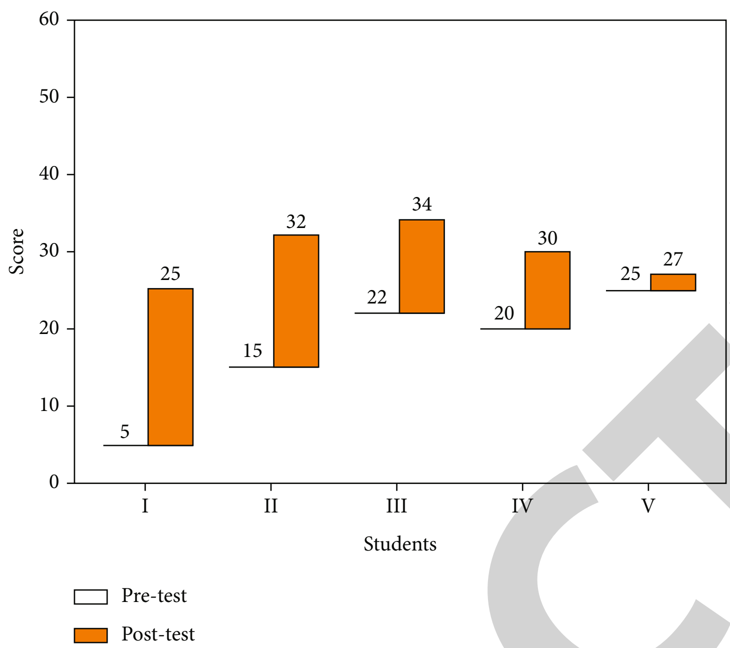

Figure 12: Comparison of the pretest and posttest scores of the academic achievement of the experimental class.

Table 10: Comparison of the scores of the posttest of academic achievement in the control class.

Name	Sample size	Min	Maximum value	Mean	Standard deviation	Median
Pretest score	44	31.000	94.000	61.817	15.255	60.050
Posttest score	44	26.000	92.000	62.478	15.044	63.000

Table 11: t-test of academic achievement pre- and posttest scores of control classes.

		Mean	Standard deviation	Pairing difference standard error mean	Difference 95% confidence interval Lower limit	Difference 95% confidence interval Upper limit	t	Degree of freedom	Significance (two-tailed)
Pairing 1	Pretest score-posttest score	-1.275	14.985	2.255	-5.827	3.281	-562	44	.575

Table 12: Comparison of academic achievement posttest scores between the two classes.

Control class	Sample size	Min	Maximum value	Mean	Standard deviation	Median
Pretest score	44	28.000	91.000	62.488	15.044	62.500
Experimental class	44	44.000	97.000	71.108	12.822	71.000

percentages weighted as 20% for roll call sign-in and 80% for class discipline and performance. The specific comparison table is shown in Table 7.

After the experiment, the participation data of the experimental class and the control class were analyzed. These data were calculated for their participation in the classroom, respectively, as shown in Table 8.

It can be seen from Table 8 that after the experiment, the average participation rate of the control class was 67.00 and the average participation rate of the experimental class was 73.78. After the experiment, the overall classroom participation rate of students was at a good level, while the classroom participation rate of students was still at a satisfactory level compared with the class. As shown in Figure 11, the comparison of the average participation rate between the class and the experimental class is shown in Figure 11.

(2) Analysis of the effect of academic achievement level

The data from the pre- and posttests of the experimental classes were analyzed, and their academic achievement scores were calculated separately, and the pre- and posttests data obtained are shown in Table 9.

It can be seen from Table 9 that after the experiment, the average score of students increased from 62.28 to 71.11, and the experimental results were obvious. As shown in Figure 12, the average scores of the experimental class before and after the test are compared.

The pre- and posttest data of the control class were analyzed, and their academic achievement scores were calculated separately, and the obtained pre- and posttest data are shown in Table 10.

As can be seen in Table 10, the average score of academic achievement of the control class students after the traditional approach changed from 61.82 to 62.47, with no significant difference in level. In order to test the difference of class performance before and after traditional teaching, a sampling test was carried out according to the results of the control class. The test results are shown in Table 11.

According to the performance data analysis of the experimental course and the subsequent performance index analysis by grade, the performance index is calculated, as shown in Table 12.

5. Conclusion

In general, under the network teaching mode, teachers should combine the requirements of students' teaching standards and cognitive laws, establish a student-centered teaching concept, and further strengthen the reform of computer courses. In the learning process, it is not limited by time and space, combined with the advantages of online learning resources, so that students can obtain diversified information content, and through the effective combination with traditional teaching mode, provide students with dynamic learning materials, and improve the update level of information resources, which can help improve students' learning interest, broaden students' learning vision, and help them grow and develop faster.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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