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Computer Education Curriculum Innovation Based on Flipped Classroom and Network Education Model

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ABSTRACT

This article conducts a series of research on computer network courses based on "flipped classroom." Teaching reform will be carried out for computer networks, but the results are mediocre. The author of this article has carefully considered and summarized computer network teaching based on his years of teaching experience and has put forward suggestions for widespread application. This article discusses the application of translation. The necessity and connotation of transitioning to classroom mode were emphasized, and the design of this teaching method was emphasized, adopting a three-step approach of "consolidating and improving knowledge after class." Therefore, teachers should start from their own perspective, based on process preview, in class learning, and after class review, find the connection point between flipped classroom and computer network courses, reflect on the problems in teaching, and adopt targeted teaching methods to solve problems. This article provides guidance for improving teachers' teaching level.

KEYWORDS

Computer Course, Flipped Classroom, Network Teaching Mode

INTRODUCTION

With the continuous development of Internet technology, the education sector has also ushered in a wave of informatization and personalized needs. In order to cultivate talents with high comprehensive quality, traditional education models can no longer meet the demand. Therefore, it is urgent and necessary to study the role of student professional knowledge and improve their expression ability. However, due to the characteristics of computer network courses and the complexity of knowledge points, students face significant difficulties in the learning process. Under the traditional teaching model, limited teaching time limits the depth and breadth of teaching, and students are unable to fully understand the learning content through the classroom, leading to a decline in learning interest. Meanwhile, the lack of interaction with teachers also limits students' understanding and learning outcomes. In this context, the introduction of the flipped classroom teaching model has become a modern teaching method. Flipped classroom teaching combines student preview, classroom learning, and postclass review by changing the order and method of traditional teaching, in order to improve the

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teaching quality of computer network courses. This article aims to provide reference for improving the teaching effectiveness of computer network courses through a series of studies on flipped classrooms.

LITERATURE REVIEW

The flipped classroom teaching model will become increasingly mature in the continuous efforts and practices of global educators, and revolutionary changes have occurred in global education (Boote et al., 2021). The flipped classroom teaching model replans the teaching and learning models preclass, during, and postclass to realize the flipping of the roles of teachers and students in teaching (Johnson et al., 2023). The traditional teaching process mainly includes preclass preview, classroom knowledge transfer, and postclass knowledge internalization. Preclass preview means that students simply read and understand the content of the textbook before class and does not require in-depth study (Adedoyin & Soykan, 2023). Knowledge transfer is completed by teachers in class, and knowledge is internalized by students through homework and operation postclass (Sofi-Karim et al., 2023). In this link, students will conduct a comprehensive and in-depth study of the content they have learned, not only stick to the textbooks. Knowledge internalization is completed in the classroom with the help of teachers and classmates to solve various problems encountered in extracurricular learning (Lufungulo et al., 2023). This teaching model is the flipped classroom. In the flipped classroom teaching model, the purpose of teachers' teaching is stronger, the autonomy of students' learning is improved, and the corresponding teaching effect is greatly improved. Through many demonstrations and practices in education, the flipped classroom will become a new concept and teaching model of today's teaching (Martin et al., 2023).

In this way, the precious time in the classroom will allow students to engage in active learning more wholeheartedly, so as to gather everyone's strength to discuss and solve the current challenges of localization and globalization (French et al., 2020). Relevant professors will not introduce relevant information in the classroom. This kind of information that needs to be known will be completed by students postclass according to their own actual conditions. The methods that can be selected include video viewing, audio listening, and electronic reading. At the same time, you can also communicate with your classmates online, and inquiries about relevant materials are no longer limited by time and place. Using this method, teachers and classmates can also have more time and opportunities for discussions and exchanges (Voigt et al., 2020). Postclass, students make targeted arrangements and adjustments to their actual situation, including their own learning content, rhythm, and form, which reflects stronger subjective initiative; teachers can use various forms, such as lectures, discussions, and assistance to meet different needs (Chua & Islam, 2021), including the needs of classmates and can better help their personalized learning. In this way, students can gain more knowledge from practice and have real experience.

MATERIALS AND METHODS

Flipped Classroom

The flipped classroom is a teaching model that inverts the traditional teaching sequence. In traditional teaching, teachers usually explain knowledge in the classroom, while students complete homework and exercises at home. The flipped classroom, on the other hand, reverses this process: students preview and learn independently outside the classroom, while engaging in practice, discussion, and application in the classroom. The advantages of the flipped classroom include:

1) Stimulating student interest: In traditional teaching methods, students mainly passively receive knowledge, which can easily lead to dullness and lack of motivation in learning. In flipped

classrooms, students can be exposed to the course content in advance through preview and self-directed learning, stimulating their interest and curiosity in knowledge.

2) Improving students' self-learning ability: In traditional teaching methods, students mainly rely on the teacher's explanation and guidance, lacking initiative and self-learning ability. In flipped classrooms, students need to preview and learn independently outside the classroom, which cultivates their self-learning ability and critical thinking.
3) Practice and applied knowledge: In traditional teaching methods, students have fewer opportunities to apply and practice the knowledge they have learned. In flipped classrooms, students can engage in practical activities and applications, such as group discussions, case studies, and project practice, in order to deepen their understanding and mastery of knowledge.
4) Improving interaction and cooperation between students and teachers: In traditional teaching methods, teachers mainly impart knowledge, and there is less interaction between students and teachers. In flipped classrooms, students can have more communication and interaction with teachers in the classroom, and teachers can also pay more attention to and guide students' learning process, promoting their learning outcomes.

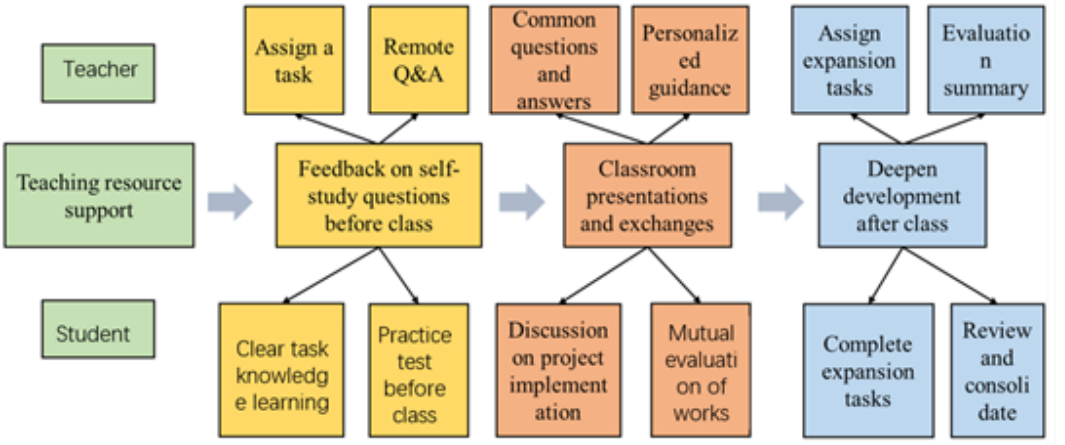
In summary, the "flipped classroom" teaching model can better cope with the challenges faced by traditional teaching methods by changing the way of learning and the role of teaching, stimulate students' interest, improve their self-learning and practical abilities, promote interaction and cooperation between students and teachers, and thus improve teaching effectiveness and learning outcomes.

The "flipped classroom" contains three types of flips: flipping of educational purposes, flipping of educational concepts, and flipping of teaching methods (Wong, 2023). In terms of teaching purpose, the previous teaching purpose based on students' acquisition of knowledge will be turned into a focus on cultivating students' learning and thinking abilities (Gamez-Montero et al., 2021). The "flipped classroom" teaching pays more attention to the learning process of the students, rather than only the learning results of the students; the inversion of the teaching concept, that is, the teaching subject has changed from the traditional teacher-led form to the student becoming the subject and centre of the classroom. In this way, they conduct targeted comments, doubts, and tutoring for different students, which is highly humanized and personalized, so as to sublime the effect of teaching.

The flipped classroom teaching model is a new teaching method, whose core idea is to reverse classroom teaching and extracurricular self-directed learning (Kang & Zhang, 2023). By allowing students to preview and learn textbook content in advance, and then engage in discussion, interaction, practice, and application in the classroom, it can stimulate students' interest and initiative in learning. The advantage of this teaching model is that it can greatly improve students' participation and self-learning ability, promote deep understanding and practical application of knowledge, and also reduce the teaching burden of teachers, improve teaching effectiveness and quality. In computer network courses, the flipped classroom teaching model can better cultivate students' practical abilities and teamwork spirit, thereby better adapting to the needs of future society (Sofi-Karim et al., 2023). It is another name for the teaching structure, which is a typical and stable teaching framework and activity program developed and established based on fixed teaching ideas and concepts (Duffy et al., 2021).

The "flipped classroom" teaching model is a teaching framework and program with unique flipping characteristics established based on teaching ideas (as shown in Figure 1). The flipped classroom model is a teaching model that reverses the traditional teaching sequence, placing the knowledge previously taught in the classroom for self-directed learning before class, and moving the exercises, assignments, and other activities that originally needed to be completed postclass to the classroom for practice and discussion (Debbağ & Yıldız, 2021). This approach aims to enhance students' engagement and deep-thinking abilities, while also better adapting to their personalized learning needs (Brandon, 2020). Specifically, the flipped classroom model includes the following three stages:

Figure 1. The overall framework structure of the flipped classroom teaching model



1) Preclass preview: Students can preview relevant knowledge points by reading, watching videos, listening to recordings, and can also use Internet resources, such as online education platforms and learning communities, to deepen understanding and expand ideas.
2) Classroom practice: In the classroom, teachers organize various practical activities, such as group cooperation, case studies, discussions, or demonstrations, to help students discover and solve problems through interaction, thus better understanding and mastering knowledge points.
3) After class extension: After the classroom ends, students can deepen and consolidate their knowledge through exercises, assignments, tasks, and other forms, so as to better apply it to practical life or learning.

Compared to traditional teaching methods, the flipped classroom model has the following differences:

1) Preclass preview: Students can independently learn relevant knowledge points before class, freeing up learning time and place, and can better target and solve personal understanding difficulties.
2) Classroom practice: Teachers can better utilize classroom time, promote various practical activities, and improve student participation and deep-thinking ability.
3) After class extension: Students can deepen and consolidate their knowledge through exercises, assignments, tasks, and other forms, which can better exert their subjective initiative and improve learning effectiveness.

Overall, the flipped classroom model can better adapt to the learning needs of today's information society, as well as promote personalized learning and innovative thinking among students.

Taking students as the centre is an important advantage of the "flipped classroom", and students' subjective initiative and participation in classroom learning are effectively improved (Al-Abdullatif, 2020). In the flipped classroom, it is very good for students to become the main body of learning (Zhu, 2022). Its outstanding feature is that it is more subjective for the communication between teachers, students, and classmates. In this teaching method, teaching in the traditional sense is completed in class time. Students can make independent arrangements in terms of learning time, learning progress, problem-solving, and other aspects according to the relevant materials provided by teachers and

their own conditions, so as to fully apply themselves. The main body is displayed, making learning more active and efficient; the personalized teaching featuring independent choice allows students to independently choose the learning content that suits them; and the interactive teaching oriented by solving puzzles enhances the teamwork. While acquiring knowledge, students can also enhance communication and feelings with teachers and other students. In this exchange of perceptions, students have been greatly improved in the extension of social skills and knowledge, so that people's emotions, wisdom, and knowledge are deeply integrated (Roque-Hernández et al., 2023). Students' self-efficacy has been developed and improved in the flipped classroom.

Basic Courses of Computer Application

The basic course of computer application is an extremely important public course for all majors (Qian et al., 2022). It is the basis for cultivating students' use of computers, and the majors and benefits are wide. It also lays a solid foundation of computer skills for subsequent courses and professional learning. The main contents of the course include Windows operating technology, basic computer knowledge, word processing software Word, spreadsheet Excel, electronic manuscript PowerPoint, and computer network applications (Jin, 2023).

The basic courses of computer applications play an extremely important role and position in today's society (Zapata-Cuervo et al., 2023).

1) Developing computer literacy: Basic courses in computer applications can help students master the basic operation and usage skills of computers and improve their computer literacy (Yoldoshevna, 2023). Computers have become the fundamental tools of modern society, and they are necessary for various tasks and problem-solving in academic, professional, and daily life.
2) Promoting adaptability in the information age: With the rapid development of information technology, computers have penetrated into all aspects of various industries (Fernández de Caleya et al., 2023). Studying basic computer application courses can help students adapt to the development requirements of the information age, master the basic knowledge and application methods of information technology, and lay a solid foundation for future learning and work.
3) Enhancing problem-solving skills: The computer application fundamentals course focuses on cultivating students' logical thinking and problem-solving abilities. By learning computer application technology, students can learn to analyse problems, find solutions, and use computer tools for practical operations and verification. This ability is crucial in solving practical problems and facing complex situations.
4) Opening up career development opportunities: Computer technology has penetrated into various industries, and mastering the basic knowledge of computer applications can open up vast career development opportunities for students. Whether in the information technology (IT) industry, talents with a certain understanding and mastery of computer applications are very popular.

In summary, the basic courses of computer applications are of great significance for students' personal development, adaptation to the information society, and career development. It not only helps students master computer technology but also cultivates their problem-solving ability and innovative thinking, laying a solid foundation for their future development.

Taking the course "Fundamentals of Computer Applications" as an example, the current teaching method mainly consists of face-to-face teaching+experiments (or computer-based exercises). Teachers explain basic concepts, operational skills, and software applications related to computers in the classroom and then lead students to conduct experiments or computer-based exercises. This teaching method is relatively more focused on students' practical skills compared to traditional lecture-based teaching methods, but there are several challenges:

1) Students have limited self-learning abilities: They can only have experimental opportunities in the classroom, and their time in the classroom is limited, making it difficult to give each student sufficient practical opportunities. Therefore, students need to have a certain level of self-learning ability in order to better understand and master the course content.
2) Difficulty in managing teaching time for teachers: Due to limited classroom time, teachers need to explain a large amount of content in a short period of time and take into account the experimental operation time of students. This requires teachers to be highly proficient in the course content and possess certain teaching skills and time management abilities.

To address the above challenges, a flipped classroom teaching model can be adopted for optimization. The specific implementation methods are as follows:

1) Design preview content: Before the course starts, teachers can design some preview content in advance, such as allowing students to read relevant literature, watch videos. This can effectively stimulate students' interest in learning and provide a deeper understanding of the course content in the classroom.
2) Guide students to learn independently: Guide students to learn independently through online education platforms, learning communities, and other Internet resources. Students can use these resources for exercises, assignments, and tasks to deeply expand and consolidate their knowledge, so as to better apply it to practical life or learning.
3) Classroom interactive practice: In the classroom, teachers can organize various interactive practice activities, such as group cooperation, case studies, discussions, or demonstrations, so that students can discover and solve problems in interaction, thereby better understanding and mastering knowledge points.

The flipped classroom teaching model can better tap into students' subjective initiative, promote their active learning and thinking, enhance their practical operation ability, and improve learning effectiveness.

ITMCT Teaching Model

The Inverted, blended, collaborative, and traditional teaching modes (ITMCT) teaching model is further developed on the basis of the flipped classroom.

The flipped classroom is a teaching model that reverses the traditional teaching sequence, allowing students to preview relevant content before class and then engage in practice and discussion in the classroom. This approach can stimulate students' interest and initiative in learning and improve their participation and deep-thinking ability. The ITMCT teaching model, on the other hand, combines various teaching methods, such as information technology, educational gamification, cooperative learning, and personalized learning on the basis of the flipped classroom, further improving teaching effectiveness and student learning motivation.

The inverted classroom is an important component of the ITMCT teaching model, while other teaching methods, such as gamification of education, cooperative learning, personalized learning. At the same time, the ITMCT teaching model also places greater emphasis on the support of information technology, utilizing online teaching platforms, multimedia courseware to provide students with richer and more personalized learning resources.

The ITMCT teaching model is a diversified teaching model based on information technology, which combines multiple teaching methods to improve teaching effectiveness and student learning motivation. The ITMCT teaching model usually includes the following aspects:

1) Information technology support: The ITMCT teaching model utilizes information technology tools to support the teaching process, such as using electronic whiteboards, multimedia courseware, online teaching platforms, etc.
2) Gamification of education: The ITMCT teaching model combines game design concepts with teaching and stimulates students' interest and initiative in learning through gamification.
3) Collaborative learning: The ITMCT teaching model encourages students to collaborate with each other and improve their learning outcomes through team learning and collaborative projects.
4) Inverted classroom: The ITMCT teaching model adopts an inverted classroom approach, allowing students to independently learn relevant knowledge before class and then engage in practice and discussion in the classroom.
5) Personalized learning: The ITMCT teaching model provides personalized learning plans and resources for each student by identifying their learning needs and differences.
6) Blended learning: The ITMCT teaching model adopts a mixed approach of traditional teaching and online education, allowing students to learn in different environments and scenarios and improving their learning outcomes.

The ITMCT teaching model can enhance students' learning motivation and interest, promote student interaction and cooperation, and cultivate team spirit. Diversified teaching methods can meet the needs of different types of students. This model can provide personalized learning plans and resources, making student learning more targeted and effective. It should be noted that the ITMCT teaching model requires teachers to have a high level of information technology and teaching experience, while also considering teaching costs and investment in teaching resources.

$$Q = F\left(A_T, A_S, P\right) \tag{1}$$

In the formula, Q represents the inquiry-based teaching mode, F is a process function, A_T is the action set of the teacher, and A_s is the action set of the learner. P indicates the probing question asked. In general, A_T and A_S have the following action sets:

$$A_T = \left\{\mathrm{q}, \mathrm{i}, \mathrm{r}, \mathrm{h}, \mathrm{c}\right\} \tag{2}$$

$$A_S = \left\{1, \mathrm{t}, \mathrm{a}, \mathrm{d}, \mathrm{m}\right\} \tag{3}$$

Among them, q in A_T means setting exploratory questions, stimulating learning motivation and inquiry motivation, i means raising inspiring questions, providing guidance on learning strategies, r means providing guidance.

Incorporating the important teaching concept of the Computational Thinking (CT) method into inquiry-based teaching, using the CT method allows learners to inquire into learning, so as to better exert the effectiveness of the two and comprehensively use the CT teaching strategies to build a teacher-led learner as the main body, a new mode of thinking teaching with the purpose of ability training (Ntsiful et al., 2023). Its mathematical model is expressed as:

$$Q_{\mathrm{CT}} = F\left(A_T^{'}, A_S^{'}, P, CT\right) \tag{4}$$

In the formula, Q_{CT} represents the inquiry-based teaching mode based on CT, and CT represents computational thinking. The meanings of $F()$ and P are the same as those in (1), A_T is the action set of teaching, and A_S is the action set of the learner. Apparently, there are:

$$\begin{aligned} A_T &\subset A_T \\ A_S &\subset A_S \end{aligned} \tag{5}$$

Under normal circumstances, A_T adds CT recursion reasoning to guide learners to learn and then adds CT recursion reasoning of thinking and solving problems.

Formal Quantification of Teaching Model

In order to quantitatively express the effect of TMCT in both teaching and learning, we have E to represent the teaching effect and C to represent the learner's CT ability. According to the development of the five-step teaching activity of inquiry-based teaching, each parameter in formulas (2) and (3) corresponds to the use of the CT method. We can obtain the teaching effect function E and CT function of each step in the teaching activity and the change of each step. The situation is described as follows:

Step 1: Situation creation, "probing questions" are asked, and the q and g parameters are changed. We can get the following increments:

$$E_1 = f_1\left(q_{CT}\right) \tag{6}$$

$$C_1 = g_1\left(l_{CT}\right) \tag{7}$$

In the formula, $q_{CT} \in A_T$ means that the teacher sets an inquiry-based question with CT. $\mathrm{l}_{\mathrm{CT}} \in A_S$ means that the learner enters the learning situation and forms the learning psychology. E represents the teaching effect of the first step of ITMCT. g is the CT capability quality function of l_{CT}, and C represents the CT capability training effect of the first step of TMCT.

Step 2: The computational thinking method inspires learners to think, the i and t parameters change, and we can get the following increments:

$$E_2 = f_2\left(i_{CT}\right) \tag{8}$$

$$C_2 = g_2\left(t_{CT}\right) \tag{9}$$

Through the five teaching activity steps of the whole process, the changes of the CT method parameters of the teacher and the learner, and we can get the following systematic formula:

$$C_{\mathrm{S}}^{\mathrm{CT}} = C_1 + C_2 + C_3 + C_4 + C_5 \tag{10}$$

Therefore, this formalized result expression fully shows that in the ITMCT teaching model, the method set between A_T and A_S uses CT methods to inspire and guide learners to solve problems more quickly, thereby increasing the communication between A_T and A_S to develop the habit of scientific thinking. In this way, learners can master CT methods and improve their CT capabilities.

Task-driven teaching is mainly based on "tasks" to drive teaching, and "tasks" are the "central" points, learners learn around "tasks", and teachers teach around "tasks". In order to better express the process of "task"-driven teaching, we use the following mathematical model to express:

$$Q = F\left(A_T, A_S, \mathrm{T}\right) \tag{11}$$

In such a model, $F()$ is a process function, the other is the action set of the teacher, A is the action set of the learner, and T is the main task in the teaching activity. In task-driven teaching activities, the richer the content of T, the better the teacher can design a classroom, the richer the classroom activities will be, and the more harmonious the classroom atmosphere will be. Under the guidance of A_T, A_S can quickly acquire corresponding subject knowledge for good learning "tasks". In general, A_S and A_T have the following action sets and relationships:

$$A_T = \left\{\mathrm{m}, \mathrm{d}, \mathrm{s}, \mathrm{i}, \mathrm{e}\right\} \tag{12}$$

$$A_s = \left\{\mathrm{p}, \mathrm{l}, \mathrm{u}, \mathrm{c}, \mathrm{a}, \mathrm{r}\right\} \tag{13}$$

In the formula, m in A_T represents the teacher's preparation before class, including teaching objectives, teaching tasks, teaching process, and assignment of tasks to learners' classroom learning; d means that the teacher conducts classroom teaching, task design, including how to design knowledge problems that make learners think and learn for selected tasks, how to state the design problems, how to enable learners to find the entrance to solve the problem, and how to make learners find available information, etc. to solve the problem in the stated problem.

In the CT-based task-driven teaching process, we can formalize the teaching model as the following mathematical model:

$$Q_{\mathrm{CT}} = F\left(A_T^{'}, A_S^{'}, \mathrm{T}, \mathrm{CT}\right) \tag{14}$$

At this time, we use u_1 to indicate that the learner understands the task and the goal, and u_2 indicates that the learner explores new knowledge driven by the task. In this process, we have the following relationship:

$$\mathrm{u}_1 + \mathrm{u}_2 = \mathrm{u}_{CT} \tag{15}$$

In the CT-based task-driven teaching process, the teacher should use the CT method to design tasks, present the tasks, implement the tasks, and summarize and evaluate them; and they need to act as assistants to give corresponding teaching and guidance to the problems encountered by the learners in the learning process, providing effective information for learners to complete the assigned learning

tasks. Learners need to be proactive with the help of teachers, sort out knowledge by themselves, build their own learning models, and complete teaching tasks. Through such education and training, learners can better use the CT method after mastering the corresponding knowledge; learners can learn from each other and expand it.

RESULTS AND ANALYSIS

Analysis of Systematic Teaching Practice Based on Thinking Process

Due to the limited time for teaching practice, the teaching content is selected from the content of the first chapter of *Computer Network Fundamentals*, that is, an overview of computer network foundations (Zhu, 2022). Before the start of the course, it was used for the two classes of the 2021 digital media and application major of the Secondary Vocational School(Nanjing, Jiangsu, China). Two sections are mentioned before the first chapter. After the teaching practice is over, the content of the first three chapters mentioned during this period is tested, the first and second tests. The results are shown in Figure 3.

The results in Figure 2 show that the number of students in the teaching practice class and the teaching comparison class is equal, with 36 students; the highest score for the teaching practice class is 91, the highest score for the teaching comparison class is 94; the lowest score for the teaching practice class is 41. The minimum score of the teaching comparison class is 42; the passing rate of the teaching practice class is 81.00%, and the passing rate of the teaching comparison class is 86.00%; the excellent rate of the teaching practice class is 3.00%, and the excellent rate of the teaching comparison class is 5.50%, the average score of the teaching practice class was 66.47, and the average score of the teaching comparison class was 68.03. It can be seen that the learning level of the 2021 digital media of the M Secondary Vocational School is equivalent to that of the students in the two major classes, which meets the requirements of teaching practice.

Figure 2. Analysis of pretest scores

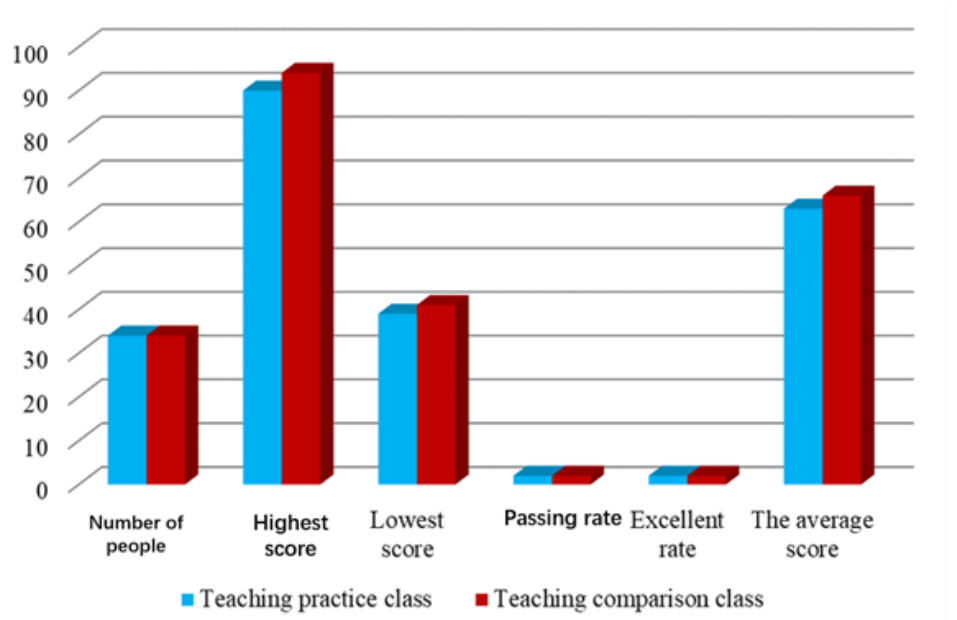
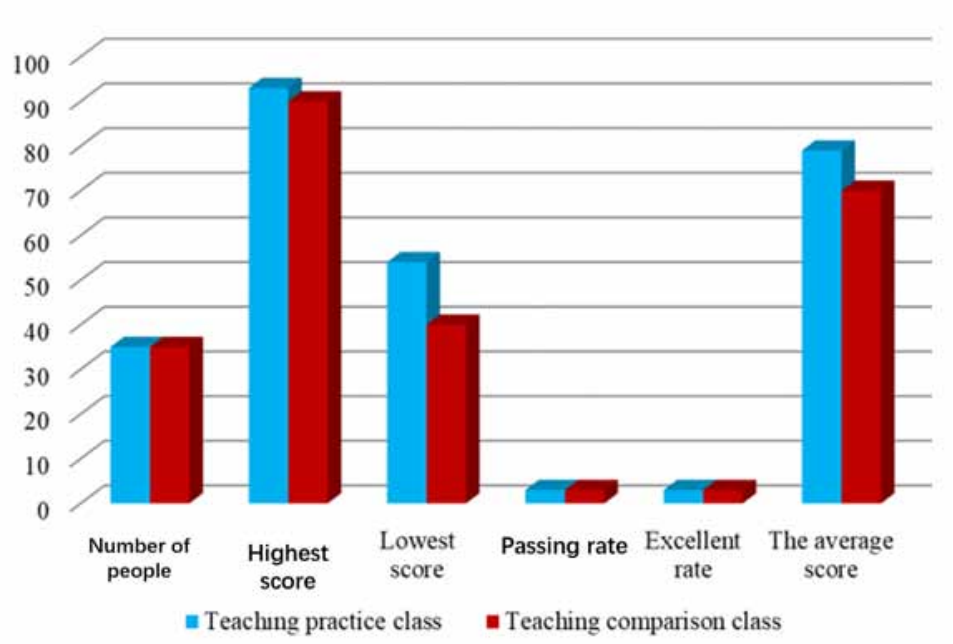


Figure 3. Posttest score analysis



The results in Figure 3 show that after a period of teaching practice, the highest score of the teaching practice class is 95, and the lowest score is 43. The passing rate of the practice class is 97.00%, and the passing rate of the teaching class is 91.60%; The excellent rate of the teaching practice class is 19.40%, and the excellent rate of the teaching control class is 8.00%; From the post test score data, the average score of the teaching practice class is 80.75 points, and the average score of the control class is 72.11 points.

Analysis of the Learner's Ability

The experimental teaching method of the computer application basic course was carried out in the "flipped classroom" in the traditional class to further test the actuality of the model in practice. The effectiveness of deepening the understanding and cognition of students' changing learning attitude, stimulating learning interest, and improving are shown in Figure 4.

As shown in Figure 4, the students in the experimental class are far more capable of autonomous learning than the students in the traditional class. They can formulate study plans based on their learning goals, plan and reasonably arrange the time for autonomous learning, reflect and summarize the theoretical knowledge learned in a timely manner, flexibly apply the theoretical knowledge to practice to improve operational skills, and record the doubts encountered in self-learning and feedback to teachers. The students' autonomous learning ability in the experimental class was 44.9%, 26.9%, 42.8%, and 50.1% higher than that in the traditional class, respectively. Students use the learning resources provided by teachers for preclass preview and understanding of knowledge points before class. The "flipped classroom" model teaching puts forward certain requirements for students' self-learning ability. Teaching, its independent learning ability, problem analysis, problem solving, and learning participation have been exercised and improved.

It can be seen from Figure 5 that students can take the initiative to undertake group tasks in group task activities and are willing to share high-quality learning resources with their classmates during their learning. They have the courage to express their own opinions in exchanges and discussions. If

Figure 4. Analysis of students' autonomous learning ability in experimental class and traditional class (in %)

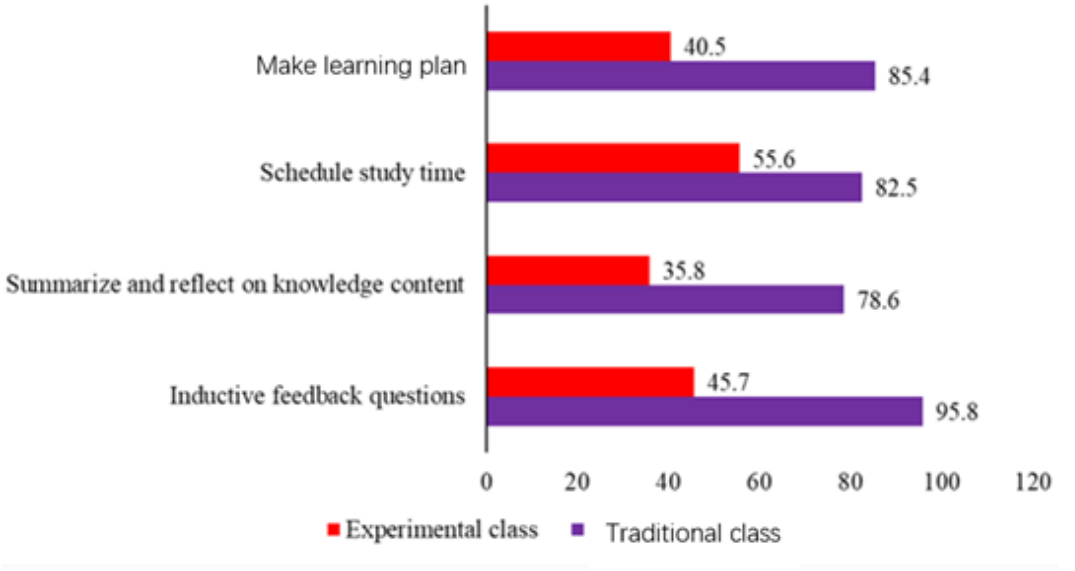
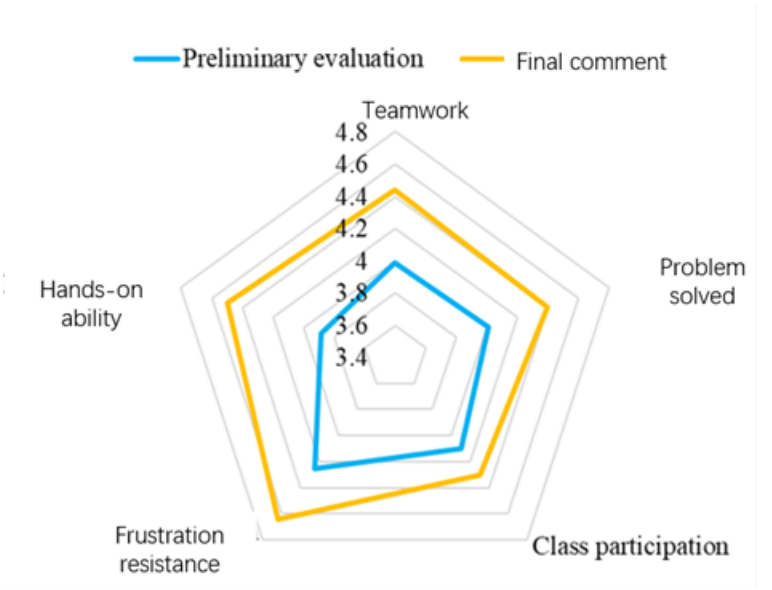


Figure 5. Analysis of the cooperative ability of students in the experimental class and the traditional class (in %)



students encounter difficult problems in learning, they can actively help themselves solve relevant problems. The performance of the students in the experimental class was 36.9%, 23.9%, 30.7%, and 35.8% higher than that of the students in the traditional class, respectively. For activities, the vast majority of students can be closely linked to the learning tasks, the group work is clear, and the group members perform their own duties and can actively participate in group exchanges and discussions. In group cooperation, group members help each other, supervise each other, learn from each other,

learn to suggest and express their own ideas, and group members grow and progress together. The "flipped classroom" teaching model is helpful to improve students' teamwork ability and cooperative learning ability.

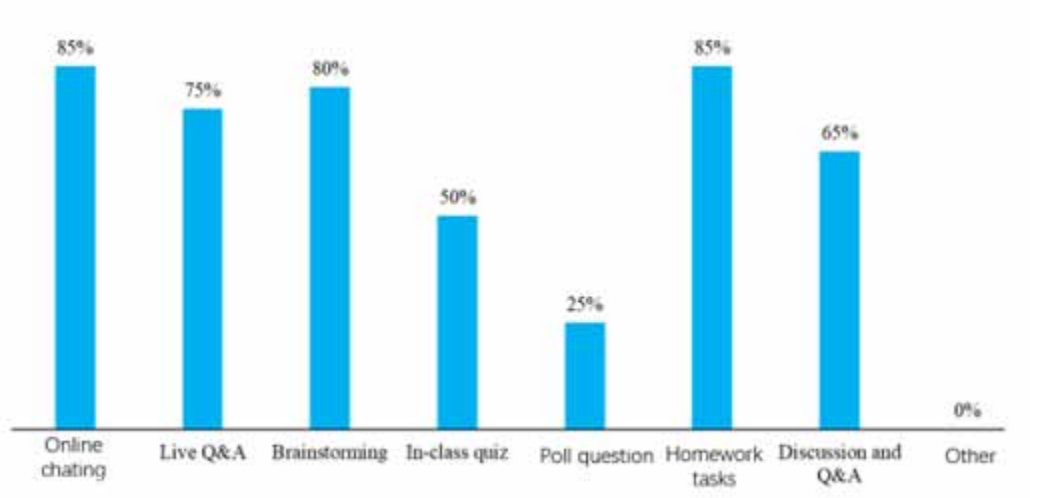
As shown in Figure 6, the learning motivation changed significantly before and after the experiment. In the teaching process, the experimental class adopts a task-driven teaching method, and at the same time, with the help of digital network resources, the learning of basic computer courses in colleges is no longer boring, and the students' interest in learning is improved. By completing the learning tasks, students use computers to improve their understanding of the university's basic computer courses, so the students' learning motivation has improved.

Analysis of Practical Applications

The development of education cannot be separated from constantly exploring new teaching models and methods to adapt to the rapidly changing social needs. In computer network courses, the flipped classroom teaching model, as a remarkable innovative approach, has attracted widespread attention and research. However, like any other teaching method, the flipped classroom also has some limitations. Here, we will explore the application and limitations of the flipped classroom teaching model in computer network courses, in order to provide useful thinking and decision-making basis for educators.

1) Emphasis on classroom interaction: The flipped classroom emphasizes student interaction and participation in the classroom but may not be suitable for some students who are introverted, have difficulty expressing themselves, or require more personal time. Therefore, while implementing flipped classrooms, traditional teaching methods can be combined with various teaching methods and forms to meet the learning needs of different types of students.
2) Technical requirements: The flipped classroom requires students to have certain technical operational abilities, including using electronic devices, browsing web pages. This may pose difficulties for areas or students with poor technical conditions. Schools can provide training and support for technical operations to help students master necessary technical skills or provide corresponding equipment and resources to ensure that students can smoothly participate in flipped classroom learning.

Figure 6. Teaching model satisfaction survey



3) Student autonomy: The flipped classroom requires students to have a certain degree of self-learning ability and self-discipline, otherwise, it may lead to some students having poor learning outcomes in the preview stage. Teachers can stimulate students' interest in learning and cultivate their self-learning ability by designing attractive teaching content and methods, thereby improving the effectiveness of the preview process.
4) Teacher preparation work: The flipped classroom requires teachers to prepare a large amount of teaching resources and guidance materials in advance, which puts higher requirements on their teaching ability and time arrangement. Schools can provide teachers with relevant training and support to help them better prepare and manage flipped classroom teaching and improve their teaching quality and effectiveness.
5) Evaluation methods: Traditional examination and evaluation methods may not fully adapt to the flipped classroom teaching model, and evaluation methods need to be redesigned and adjusted. In the future, we will consider redesigning and adjusting the evaluation methods to adopt more flexible and diverse methods, such as project assignments, group discussions, etc., to adapt to the characteristics of the flipped classroom teaching model.

Therefore, although the flipped classroom teaching model has its advantages, in practical application, the above limitations still need to be considered and solved to ensure that it can better serve the goals of education and teaching.

In practical life, the flipped classroom teaching model can have the following specific applications in computer network courses:

1) Creating multimedia teaching resources: Teachers can create various forms of teaching resources, including video explanations, online courseware, interactive teaching games, for students to preview before class.
2) Advocate for student discussion and cooperation: During the preview stage, students can engage in discussions and exchanges through online platforms, work together to solve problems, and stimulate their interest and participation in learning.
3) Practical learning tasks: Put the teaching of theoretical knowledge in the preclass preview stage and conduct more practical learning tasks in the classroom, such as programming practice, case analysis, etc. to improve students' hands-on ability and problem-solving ability.
4) Personalized tutoring: Students may encounter difficulties and doubts during the preview process, and teachers can provide personalized tutoring and guidance for individual students to improve their learning effectiveness.
5) Resource integration and sharing: Encourage students to actively search and integrate relevant learning resources during the preview process and share them with classmates in the classroom to promote their information retrieval and sharing abilities.

Through the above practical applications, the flipped classroom teaching model can better leverage its advantages, improve the teaching effectiveness of computer network courses, and cultivate students' self-learning and practical abilities.

Regarding the development direction of the flipped classroom teaching model in computer network courses, this article provides the following suggestions:

1) Introducing virtual reality and augmented reality technology: Through virtual reality and augmented reality technology, students can be provided with a more immersive learning experience. Students can improve their practical skills by conducting practical operations and observing network topology diagrams through virtual laboratories.
2) Combining artificial intelligence technology: By utilizing artificial intelligence technology, personalized adjustments can be made to teaching content and learning paths based on student learning situations and feedback, providing customized learning support.

3) Strengthen project practice and team collaboration: Encourage students to engage in more project practice and team collaboration in the flipped classroom model and improve their practical application and team collaboration abilities by solving problems and completing project tasks in practice.
4) Provide online resources and interactive platforms: Build a comprehensive online resource library and interactive platform for students to preview, discuss, and share. Teachers can create rich and diverse teaching resources and interact with students to promote knowledge transfer and learning interaction.
5) Deepen teacher professional development: Provide training and support for teachers to enhance their understanding and application ability of the flipped classroom teaching model. At the same time, encourage teachers to conduct teaching practice research, continuously improve and optimize the flipped classroom teaching model.

Through the above development directions, the flipped classroom teaching model is expected to achieve more personalized, practical, and interactive teaching in computer network courses, improving students' learning effectiveness and ability levels.

CONCLUSION

With the continuous development of Internet technology, the demand for informatization and personalization in the field of education is increasing. In order to cultivate talents with high comprehensive quality, traditional education models can no longer meet the needs, so it is necessary to study the role of students' professional knowledge and improve their expression ability. In computer network courses, students face significant difficulties due to the complexity of knowledge points. Under the traditional teaching model, limited teaching time limits the depth and breadth of teaching, and students are unable to fully understand the learning content, resulting in a decrease in learning interest. At the same time, the lack of interaction with teachers also limits students' understanding and learning outcomes. To address these issues, the introduction of the flipped classroom teaching model has become a modern teaching method. Flipped classroom teaching improves the teaching quality of computer network courses by changing the order and methods of traditional teaching, combining student preview, classroom learning, and postclass review. This article aimed to provide a reference for improving the teaching effectiveness of computer network courses through a series of studies on flipped classrooms.

DATA AVAILABILITY

The figures used to support the findings of this study are included in the article.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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