The Application of PAD Teaching Method in Computer Network Course

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Abstract. As a new teaching mode and method, PAD has been developed in recent years. This teaching mode has been applied in the teaching of universities, ordinary primary and secondary schools and vocational colleges. It has achieved good teaching results. In order to improve teaching effect, improve the students' autonomy and enthusiasm and cultivate the independent innovative talents needed by the society, more and more computer teachers have also begun to apply PAD to the computer classroom. "Computer Network" is a basic and compulsory course for learning computers. "transmission media" in this course is selected as the specific content, and PAD is used for teaching design.

1. Introduction
People are now in an information age. The development of computer is an important foundation of information and computer network is an important support for the development of computer, computer network course is one of the required courses of computer major, its importance is also obvious. Computer network course is a subject that pays equal attention to both theory and practice. Let students fully participate in the classroom, not only can deepen students' understanding of theory, but also improve students' ability to use knowledge. knowledge learned can be skillfully applied to life, it can lay a solid foundation for the future employment. However, secondary vocational school's students have a poor learning foundation, such as not listening to the teacher in class, not paying attention in class, like playing mobile phones, and falling asleep in class[1]. In order to improve the teaching effect and enhance students' mastery of knowledge, teachers need to adopt teaching methods suitable for those students to design the teaching process. PAD is a new teaching method which combines the advantages of discussion teaching and imparting teaching. The teaching content of this paper is selected from the "transmission media below the physical layer" in Computer Network. It adopts the teaching method of PAD and carries out teaching design to fully mobilize students' learning interest and guide students to participate in the classroom, so as to enhance students' mastery of knowledge points.

2. PAD
Traditional knowledge teaching is difficult to arouse students' interest in learning, which leads to many classroom problems. For example, the current class's attendance rate is low, and it is very common for students to play with electronic devices, sleep in class and not attend class. How to turn the silent and one-way classroom into a two-way place for collision of ideas and enlightenment of wisdom, so that students are willing to "sit in the front row, raise their heads and ask questions", is a perennial topic for
teachers in various colleges and universities [2]. In order to achieve this goal, Professor Xuexin Zhang put forward a new teaching method and mode of "PAD".

In "CNKI", 35 articles were retrieved in the doctoral dissertation with PAD as the retrieval theme. A total of 62 articles were retrieved in EI journals, core journals and CSSCI, and the number of articles published showed a trend of gradual increase. The number of articles published is shown in Figure 1.

![Figure 1. Number of papers published](image)

The teaching method of PAD divides the classroom into two parts, one part of which is taught by the teacher, the other part is learned interactively by the students in the form of discussion. In time, PAD clearly divides the teaching process into three processes: Presentation, Assimilation and Discussion[1]. The teaching principle of PAD is to elaborate and blank. In the classroom, teachers only do heuristic and frame type teaching, such as interpretation of the learning objectives, chapter content between the logical structure[3]. Other time is left for students. Teachers assign tasks related to knowledge points, and students internalize, absorb and discuss knowledge according to the tasks. There are two main forms of PAD: in-class matching and inter-class matching, as shown in Figure 2 and Figure 3.

![Figure 2. The teaching process of in-class matching](image)

![Figure 3. The teaching process of inter-class matching](image)
3. Classroom Design and Implementation Based on PAD

In this lesson, PAD is adopted to design the teaching process of "transmission media". The teaching process of using PAD is shown in Figure 4.

![Figure 4. Teaching content and process](image)

3.1. Analysis of Teaching Content

The teacher is the leader of the teaching. To better complete the implementation of the teaching process, teachers need to make full preparation before class. The teaching content of this paper is "transmission media and channel multiplexing technology under the physical layer" in Computer Network, which is the content combining theory and practice, as well as the content combining abstract and concrete. Therefore, students are required to internalize and absorb relevant abstract knowledge and construct their own knowledge.

Knowledge and skills: master the classification and types of transmission media; Master the rules of twisted-pair making.

Process and method: Through the study of this class, understand the production process of twisted pair, enhance the students' hands-on production ability.

Emotions, attitudes and values: Eliminate the mystery of students' understanding of computer network, improve their interest in learning computer network, and cultivate students' ability of independent learning and cooperative learning.

3.2. Teaching Design and Teaching Process

3.2.1. Presentation

In the teaching process, we should grasp the key point of elaborative blankness[7]. In the traditional teaching class, the teacher only does the infusing teaching and gives all the knowledge points to the students, so that the students are in a passive state of acceptance. In PAD, the teacher is the guide for students to learn knowledge, teaches them the framework of knowledge, teaches them the important and difficult points and leaves space for students to explore independently, which is helpful to arouse students' interest in learning. In the process of exploration, the knowledge points for a profound understanding and mastery.

Play the small video of installing the network cable. Through the process of installing the network cable in the video, let the students summarize the video content, lead to the twisted pair wire, and then lead to the concept of transmission media. Then on the content of this summary for elaboration, for
example: the use of real objects to carry out the twisted pair of wire elaboration, the use of pictures or videos to explain the characteristics of cable, optical cable, cable transmission process. The final result is the mind map shown in Figure 5.

![Mind map](image)

**Figure 5.** Mind maps for "Transmission Media"

### 3.2.2. Assimilation

Knowledge internalization process is an important part of effective teaching. In order to better promote the learning process, teachers should according to the students as well as the basis of knowledge, the difficulty of the set reasonable or hierarchical operation and takes the form of "bright, test and help", so as to achieve according to their aptitude. It can promote the development of each student and complete the purpose of knowledge internalization. As the basic form of homework, "bright, test and help" is a channel connecting teaching and discussion. It is open, reflective and summative[6], which is conducive to arousing students' enthusiasm and guiding their divergent and creative thinking.

Ask the students to summarize their knowledge and expand the mind map according to the "bright, test and help", and arrange the specific task -- the production process of twipline and the matters needing attention during the production process. The specific requirements of "bright, test and help" are shown in Table 1. And put forward the topic of thinking: what kind of transmission media is commonly used now, and why it is most widely used (thinking from the perspective of materials, characteristics, technology, countries)\

| Bright | It is required to list at least one content that you feel most deeply, gain the most learning process. |
|--------|--------------------------------------------------------------------------------------------------|
| Test   | It is required to list at least one content you've understood that you think might be confusing to others. |
| Help   | It is required to list at least one problem you don't understand. |

### 3.2.3. Discussion

The discussion was divided into four parts: group discussion, random check by teachers, free questions and teacher summary. In the discussion section, teachers should play a guiding role in enhancing the width and depth of students' thinking and avoiding excessive deviation of the topics discussed in this lesson. In the discussion stage, the class should be divided into groups according to the principle of
"homogeneity among groups and heterogeneity within groups"[8]. The number of members in the group should be 3-5, which is the best. At the same time, seats of members in the group should be arranged reasonably. The way can help students to communicate.

Group discussion, group share "bright, test and help", and for group in answering questions, the team cooperation to complete the test of twisted pair, and sums up the production rules of twisted pair, and group evaluation according to as shown in table 2 (each title 5 scale, more in line with the title, the higher the score) to evaluate team members. After the group discussion, the teacher organizes the whole class discussion, and each group shares the unanswered questions in the group in turn. Then the teacher randomly selects 2 ~ 4 groups, and the group members share the essence of the group discussion and show the twisted pair produced and the rules summarized in the production process. Teachers can also show the selected parts of the previous homework of "bright, test and help" to everyone and invite them to speak. Finally, a summary of the section of "Transmission media" can be made.

| Topic                                                                 | The First Member | The second Member |
|----------------------------------------------------------------------|------------------|-------------------|
| For the most part, he was active and engaged.                        |                  |                   |
| His opinion enlighten me.                                           |                  |                   |
| He urged the other members of the team to join in.                  |                  |                   |
| He is able to complete the work and study tasks that should be done on time. |                  |                   |
| I am satisfied with his performance.                                 |                  |                   |
| He made outstanding contributions to the group.                      |                  |                   |
| I would like to be assigned to another group with him if there is another chance. |                  |                   |

3.2.4. Evaluation
Evaluation is an important part of the teaching process. According to students' classroom performance, members' mutual evaluation and the completion of homework, an objective and fair evaluation of students is conducive to stimulating students' competitive psychology, enabling students to actively participate in the teaching process and improving the teaching effect. Ask the leader of each group to evaluate the members of the group and evaluate the performance of the other groups. The teacher evaluates the class according to the group evaluation form and the twisted pair produced by the group.

4. Conclusion
The requirements of the new era for talents have changed, so should change our teaching methods. Based on the characteristics of students and courses, this paper designs the teaching process of "transmission media below the physical layer" by applying PAD. The way arouses students' interest, improves students' ability of independent learning and cooperatives learning and cultivates high-quality talents needed in the new era. In the process of teaching, we should use a variety of evaluation methods to fairly and objectiely evaluate the students. We can help them build up confidence in learning and improve their sense of participation in learning.

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