

Thinking and Practice of Online Teaching in the Context of the Normalization of the COVID-19 Epidemic

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Abstract

Today, when the new crown epidemic has become normal, college teaching must be ready for online teaching at any time, so how to ensure the quality of online teaching is a problem we must think about. In early 2020, in response to the COVID-19 outbreak, classes in the new semester were largely replaced by online teaching to ensure continued learning. Teachers are actively exploring effective online teaching methods to provide a good learning atmosphere for students at home to ensure that students have a good learning effect at home. This paper proposes an online teaching model based on active interaction, and discusses the design of teaching process and problems by taking the data structure course as an example.

Keywords

College Teaching; Online Teaching; Active Interaction; Teaching Process; Teaching Model.

1. Introduction

In early 2020, the outbreak of COVID-19 spread to most countries and regions around the world. In an effort to contain the spread of the novel coronavirus outbreak, universities across the country have been asked to delay the start of the spring semester until the outbreak is stabilized. The number of students unable to return to school as normal for their studies and life has reached a record high. In this case, Internet resources (such as MOOC) and online teaching become the best solutions [1]. Many schools and universities are now adopting a combination of online and offline teaching models to replace traditional teaching [2][3]. Courses are conducted online through different platforms, including its internal online classroom system, video conferencing, and open online education platforms such as XuetangX, CNMOOC, IMOOC, and Chinese University MOOC, which provides various courses to the Chinese public. Many prestigious university professors have been live-streaming their courses, playing recorded course videos, and using instant messaging apps like WeChat, QQ or online meeting systems to organize online classes for learning and discussion.

Online teaching has provided a solution to this crisis, but there are still many problems in the transition from offline teaching to online teaching [4].

There are some problems with online teaching. It can be difficult for teachers to tell if a student is sluggish or inattentive. At the same time, students may also not be able to ask questions in a timely manner to gain a better understanding. Another problem is that students who take online classes at home need self-discipline, which is difficult for many students who are addicted to games and the Internet. When taking online classes at home, they may not know how to control themselves. The home environment lacks the learning environment that schools have. Therefore, how to effectively implement online teaching is a topic worthy of research.

This study provides an effective teaching method for online teaching. The basic idea of this approach is a learning style based on active interaction. In the online teaching process, teachers

guide, check and manage students' learning through different types of questions, and students acquire knowledge by answering and solving problems. It also discusses the application of the teaching method based on active interaction in the data structure of the basic courses of computer majors.

2. Teaching Process Design

2.1. Teaching Mode

Active Interaction-Based Learning (AIBL) is a relatively new teaching system that has revolutionized the teaching and learning process in many different regions of the world and in every field of knowledge. It is an inquiry-based teaching method. The main idea is that the teaching process is discussed around the problem. That is, the teacher presents the teaching content to the students in the form of relevant questions and questions, and allows the students to answer these questions and solve the problems. In this process, students can acquire knowledge, develop intelligence, and develop skills. AIBL pedagogy regards problem solving as the basic process of teaching. In the teaching process, teachers can guide students to solve problems, teachers and students solve problems together, and students explore and solve problems independently. Therefore, teaching becomes a process with a clear purpose and can stimulate students' initiative [5].

In view of the current problems in online education, AIBL is introduced into the online teaching of data structure, an important professional basic course. The data structure teaching process is divided into three stages: online self-learning, live answering, and online practice. A learning philosophy based on active discussion is introduced into each teaching stage, and discussion becomes a bridge between teachers and students.

2.2. Internet Self-learning

The autonomous learning phase is knowledge-based learning. Teachers publish the content and requirements of this lesson in advance through the online platform (here we use Chaoxing Platform). The course content is divided into knowledge points and released to students in the form of MOOC, SPOC, short video, algorithm animation or other reference materials. These teaching resources include high-quality teaching resources built by us and by famous teachers, for example, the data structure and algorithm teaching video of Professor Zheng Junhui of Tsinghua University, the data structure MOOC video of Professor Chen Yue of Zhejiang University, etc. Selective recommendations are made based on the teaching content of each lesson.

The problem of autonomous learning is that it is difficult for students to master the knowledge points and difficulties. The discussion of the problem is used to solve this problem. Questions at this stage come from knowledge points. These discussion questions are not only a requirement for students' self-study, but also a guide for self-study. Students learn through these discussion questions and acquire knowledge by answering them. This requires each question to be clear, answerable, and actionable. Therefore, the quality of the question directly affects the learning effect.

2.3. Live Classes and Discussion Questions

The biggest problem with online education is the lack of interaction between teachers and students. Teachers cannot track student work. Stage live and answer questions are designed to solve problems. This phase consists of three main activities: testing, question and answer, and knowledge application.

Tests are the results of evaluating students' self-directed learning. At the beginning of each live stream, we take a quiz for 15-20 minutes depending on the student's learning. Through such

tests, teachers can master students' learning situation, and can effectively stimulate students' learning motivation. Use the Chaoxing Platform online test to complete the test. The online test of Chaoxing Platform is a very useful tool. It can ask questions in an objective or subjective form. Students answer these questions on the platform, and the results are immediately fed back and displayed in visual form. Based on the test, the teacher can further explain what the student did not understand or grasp.

Question and answer is an important activity of teacher-student interaction. In the teaching of data structure, we used Tencent's multi-person cloud conference solution, Tencent Conference. It can support real-time sharing and communication with excellent video and audio quality. In particular, during the epidemic, Tencent Conference provided 300 people with unlimited meeting functions for free to users across the country. With the help of Tencent Conference, teachers and students can communicate face-to-face through the Internet to discuss problems encountered in self-directed learning.

The application of knowledge is the focus of the live class and is also based on discussion questions. According to the teaching content, teachers set up application scenarios, put forward requirements, and guide students to refine application problems. Students then try to use what they have learned to analyze and solve problems. Further, they can raise new discussion questions and work hard to solve them, so that students' thinking is always in line with the rhythm of the classroom and is in a state of upward spiral.

2.4. Online Practice

Strong practicability is an important feature of data structure courses, which must also be paid attention to in online teaching. We use an online test platform to train students' practical ability. After each lesson, teachers post tests or practice questions (algorithms and programming) on the OpenJudge platform. The platform will test the algorithmic programs submitted by the students, and then give the results and scores. The platform will give a list of the answers of the students in the class, and it can also stimulate competition among students and promote their learning. And, we introduce ACM and Mathematical Contest in Modeling topics to empower students to learn more and go further.

3. Design Discussion Questions

3.1. Self-learning Problems

Self-directed learning questions are used to guide students to learn independently. These questions are instructive because the main purpose of this stage is to understand and acquire knowledge. For example, when learning linear tables, the first question asked is the first level of knowledge points, linear tables, such as what is the logical relationship between the data elements in the linear table? Please describe the logical structure of the linear table? Give three examples of life that can be described by linear tables, etc. Then ask questions at the second layer of knowledge points while learning the sequence table. For example, the question: write the storage structure of the sequence list in C language? Explain the advantages and disadvantages of sequence listings? When would you choose to use a sequence table? Finally, when learning linked lists, the question of the third-level knowledge points is raised. For example, questions like: Implement an algorithm that inserts nodes after a given node and analyze its time complexity? Implement an algorithm that inserts nodes before a given node and analyzes its time complexity? How to improve the insert-after algorithm to reduce the complexity from $O(n)$ to $O(1)$, and write the corresponding algorithm.

Self-directed learning questions form a task list for students to learn on their own. It guides students through the teaching resources provided by teachers. By answering questions and completing tasks, students gradually understand and master the course content.

3.2. Application of the Subject

The purpose of solving practical problems is to deepen students' understanding of what they have learned and learn to apply it to solve practical problems. In this way, the process of analyzing and solving problems is essentially the process of students' understanding and application of knowledge. Through this application scenario, students can further understand the logical structure of linear tables, the logical structure of circular tables, and can use different storage structures for a logical structure, and the implementation of specific algorithms depends on the storage structure. Students learn to define their own data elements and data structures according to the needs of a specific problem.

3.3. Online Test

The online test is used to develop practical online exercises such as students' programming ability and algorithm design ability. These questions can be divided into two categories: basic questions and broad questions. Set basic questions based on knowledge points. A wide range of questions are themes from the ACM, programming competitions, and the Mathematical Contest in Modeling for able students. After the programming is completed, log in to the online evaluation platform, and students can quickly obtain the program running results. Through the online jury platform, students can compete with their classmates to stimulate their enthusiasm for learning.

4. Conclusion

Since the outbreak of COVID-19, the practice of teachers and students has proved the feasibility of online teaching, realizing "no class, no learning". So far, we have completed the online teaching for this semester. The questionnaire survey shows that students welcome this teaching mode very much, and the average score of each unit test even exceeds the traditional offline teaching in the past.

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