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Research on the Teaching of Programming Courses

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***Abstract*—With the continuous development of educational informationization, in order to solve the problems faced by current programming courses such as "knowledge is forgotten quickly", "lack enough programming training", "playing mobile phones in class" etc., this paper firstly expounds the use of interactive classroom management system to improve the teaching quality of programming courses; then, it illustrates the use of online judge system to improve the students' hands-on programming skills and normalization of students' code. After a period of practice, many good results have been achieved. And we will continue to study and improve the teaching of programming courses.**

Keywords—Programming coruses; Online judge system; Interactive classroom management platform

I. INTRODUCTION

Today, with the further development of informatization and datamation, and the rise of concepts such as big data, cloud computing, and "Internet plus", computer-related majors such as "Computer Science and Technology", "Software Engineering", "Data Science and Big Data Technology", "Intelligent Science and Technology", etc. have become popular in most universities once again. The teaching effect of programming courses such as "C Language Programming", "C Plus Plus Language Programming", "Java Language Programming", and "Python Language Programming", etc. that as compulsory or main courses for these computer-related majors determines the ability level of students in related industries directly.

However, there are many problems in the current teaching of programming courses. Such as:

(1) Students can understand the knowledge and the code in the classroom , but they are easy to forget.

(2) Students are easy to play with mobile phones or do other things that are not related to the class.

(3) Students do not have enough consciousness to do sufficient coding training.

(4) The code written by the student is relatively non-standard.

(5) There is no way for students to write code and get timely inspection and feedback.

These directly lead to the failure of some students to pass the course assessment, and the teaching effect of the course is biased. How to improve the teaching effect has become an urgent problem to be solved.

Therefore, this paper takes the teaching of programming language called C++ as an example, improves the quality of classroom teaching through the introduction of interactive classroom management platform called "ketangpai", and improves students' interest in programming and ability of programming through online judge system [1]. Through a period of practice, the teaching effect has been improved significantly.

II. IMPROVE CLASSROOM TEACHING QUALITY THROUGH INTERACTIVE CLASSROOM MANAGEMENT PLATFORM

In traditional classroom teaching, the most important thing is the teacher's explanation. Teachers occasionally ask questions, and there are not many students who answer, and it is difficult to fully understand the level of understanding of all students. It is difficult for teachers to decide whether or not to further explain the relevant knowledge based on this. Especially in the current situation where almost everyone has a smartphone, traditional classroom teaching is difficult to prevent students from using mobile phones to do things that are not related to classroom content. As a result, although the teacher is very careful and detailed in class, there are very few students attending the class and the teaching effect is very poor.

With the continuous development of education informatization, in order to solve these problems, many online interactive classroom management platforms appear. In the teaching practice, we use one of the platforms called "ketangpai".

In this platform, the teacher first create a class, and then invite the students to join the class through the QR code or invitation code. Students join the class by scanning QR codes or input the invitation code through WeChat which is the most popular communication application in China . This process is very convenient and fast, because almost every Chinese student has already installed WeChat [2].

When preparing a lesson, the teacher can upload the PPTs used in the traditional classroom, and then add various interactive designs in the PPTs in advance. If the teacher do not use PPT in class, they can also design various interactive problems directly. The teacher can also assign pre-class tasks and inform students to complete them, upload relevant

materials for students to check in advance, and assign homework for students to do after class, etc.

During the class, the teacher can initiate attendance on the platform, and the student signs in by scanning the dynamic QR code through WeChat. In the sign-in process, the teacher can even use GPS information to prevent students from cheating. In the course of class, the teacher can initiate interactions by PPTs that have been added various interactive designs in advance. If you do not use PPT, you can also initiate test interactions directly. The questions can be multiple choice questions, judgment questions, short answer questions, etc. The teacher can ask all the students to answer, or extract one or more students to answer, or let the students scramble to answer. Then the students' WeChat will receive a prompt. After the students answered the questions through WeChat, the teacher can view the students' responses in real time through the platform. How many students answered correctly, how many students answered wrong, which students answered correctly, which students answered wrong, are clear at a glance. The teacher can decide whether or not to further explain the relevant knowledge according to the situation. The teacher can also initiate discussions so that students can speak freely. During the course of the class, if students have any questions, they can input questions directly through the mobile phone, and these questions will be displayed on the projection screen. The teacher can find problems and explain them in real time. Such interaction can not only grasp students' learning situation in real time, but also effectively avoid students using mobile phones to do irrelevant things.

After class, students need to complete the homework that the teacher has placed on the platform. In the process of doing homework, students can communicate with the teacher through the platform if they encounter any problems. The platform can check the similarity of the homework submitted by students. The teacher can see the similarity of students' homework and decide whether to return the homework. Then the teacher can make corrections and comments online through the platform, and students can see the result of correction through mobile phones.

The platform can also add counselors to the class, so that counselors can have a real-time understanding of students' attendance and learning, and then better supervise students' learning. Targeted management can be done to students with relatively serious absenteeism and poor grades. Because of students have more contact with counselors and are more afraid of counselors, the management effect will be better than that of teacher.

At the same time, the teacher can also add senior grade students who are good at class as teaching assistants. To a certain extent, it solves the problem that a teacher does not have enough time and energy to solve a large number of students' questions. Moreover, the relationship between students and students is intimate, and there is no barrier to communication, which is conducive to better solving the questions. By grouping, a senior student can help and coach several students. Practice has proved that senior students' tutoring effectiveness is often better than that of teacher, because of students are more willing to contact and consult with students.

In addition, the platform can also initiate interactive topics, record students' performance, post notifications, etc.

Through the use of the interactive classroom management platform, it achieved a series of good results. Such as:

(1)The classroom participation rate of students has been significantly improved.

(2)The use of mobile phones to do irrelevant things has been significantly reduced.

(3)Teachers are more easily to master students' learning and adjust their teaching.

(4)The teaching effect has obviously improved, and students get better academic performance in the test.

III. IMPROVE STUDENTS' PROGRAMMING SKILLS THROUGH ONLINE JUDGE SYSTEM

Most of the students have a problem that is less hands-on programming in learning programming courses. This not only affects the students' ability to program in the future, but also makes the knowledge of programming theory easier to forget. Even a small number of students have written the code, and can't get real-time feedback on whether it's correct or not. How to improve the initiative of students to write codes and provide a means of detecting and feeding back the code written in real time is a problem we need to consider [3,4,5].

For this, The author of this paper and several teachers who teach the same course developed an online judge system similar to many colleges' ACM competition training system [6]. The system uses the Browser-Server model, and the teachers or students can easily access the system using a browser.

The teacher created accounts according to student's student ID in advance and then tells the students or informs the students to register on the system during the first class and teaches them to use the system.

The teacher established a library of programming topics in advance in the system. Each topic includes problem description, input requirements, output requirements, input examples, output examples, input test data, correct output results, longest program execution time and maximum occupied storage space. These topics include all kinds of difficulty. There are some basic topics for students to consolidate their knowledge, some difficult topics for students to improve their thinking and programming skills, and some very difficult topics for students who are very interested in programming to training to participate in the programming competition. Then, after each course, the teacher selects several related topics from the topics library as the assignment, specify the completion object and completion time, and inform the students.

Students access the system through a browser to view assignments. Then write the program directly in the input box of each topic or copy the program written in other

development environment to the input box. When the student submits the answer, the system compiles the program and evaluates the correctness of the program based on the pre-set input , output test data, the specified longest program execution time and the specified maximum occupied storage space. If the program is completely correct, the display is "Accepted", otherwise the cause of the error is displayed, which may include "Compile Error", "Runtime Error", "Wrong Answer", "Time Limit Exceeded", "Memory Limit Exceeded", "Presentation Error", etc. If there is an error, the student will need to modify and resubmit the answer according to the error prompt until it is correct. If the student has no way to solve the mistake, he can turn to the teacher for help. The teacher can view the answers each version submitted by the student in the system, analyze and tell the student what the problem is.

The system will display a leaderboard in real time. The leaderboard is based on the number of questions completed by the students. If the number is the same, the ranking is based on the completion time. Because of the students' comparison psychology, this can well stimulate students' programming interest and improve their motivation for programming. At the same time, because of the mechanical and rigor of system testing, this requires students to be more standardized in programming. Therefore, the use of the system not only improves the students' interest and motivation in programming, but also improves the programming level and program standardization of the students [7].

The system can be used for the final course examination too. The teacher put forward examination questions and set the corresponding score in advance. Students answer questions at the prescribed time and place according to the arrangement of the school. Students can know their examination results on the spot when they finish answering questions. This greatly improves the efficiency of teachers correcting examination papers.,

In addition, the system can also be used for the programming competition of school, and ACM competition participants selection, etc. These will also contribute to the improvement of teaching quality [8]. The college organizes the contest of programming every year, and students can participate in competitions with various programming languages. This will not only help to test students' programming ability, improve students' interest in programming, but also improve the quality of teaching.

Through several semester use, the teaching effect has been significantly improved. The students' hands-on programming skills has been improved significantly too.

IV. CONCLUSIONS

Based on a series of problems faced by the current programming courses, this paper explains how to use the interactive classroom management platform to improve the teaching effect of programming courses and how to use the online judge system to improve the students' hands-on programming skills. And through a period of practice, it achieved a good effect.

However, there are still some shortcomings and improvements, such as:

(1) Let senior students become teaching assistants, leading to the occupation of time and the impact on learning of senior students. Economic compensation is a good incentive for these students, but it also involves the issue of funding. After all, it is not appropriate for the teacher to pay these money individually.

(2)The interactive classroom management platform and the online judge system can not be integrated into a platform, which brings a certain degree of inconvenience to the actual application. So the next step of our main work is how to add the related functions of interactive classroom management system into the online evaluation system developed by ourselves.

(3) How to make use of the school's video recording room to record various kinds of teaching short videos, enrich the teaching links, and increase the channels for students to study independently after class.

In conclusion, teaching is a dynamic process. With the continuous development of society and the continuous reform of education, more new questions will appear, teaching of all courses (including programming courses) must be continually reformed. More new teaching methods and teaching mode will appear, and more modern technology will be used in teaching too. Therefore, we must maintain the vitality of teaching through constant study and follow-up.

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