Research on the Strategy of Promoting Python Teaching by Online Practice Platform

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Abstract. This paper studies the application of the online practice platform in the teaching of Python programming course. Compare the advantages and disadvantages of the traditional classroom and the hybrid classroom combined with the online practice platform, and make statistics on the classroom scene, assignment completion, examination score analysis, etc. Teaching practice has proved that the hybrid classroom teaching mode combined with online training platform can not only reduce the workload of teachers' evaluation of homework, but also improve students' interest in learning, and the most important thing is to improve the quality of classroom teaching and students' learning effect.

Keywords: Online practice platform · Python teaching · Hybrid classroom · Learning effect

1 Introduction

In recent years, with the development of big data analysis and artificial intelligence, Python has become a hot spot. Because of its simplicity and powerful function, a number of domestic colleges and universities take Python language as an introductory course for students to learn programming. Under the current situation of "Internet plus education" [1], we should seize the great influence of the internet on education and develop a new teaching method that is more suitable for the new thing Python. Practice is the best way to learn programming, and the online practice platform (OPP) is produced under this background. Through hybrid classroom combined with OPP, it can not only make up for the lack of practical links in MOOC, but also reduce the heavy task of teachers reading a large number of code assignment. Most importantly, it can also improve students' learning interest and learning effect.

2 Traditional Teaching Methods

The traditional teaching methods mainly include offline classroom face-to-face teaching and watching massive open online courses (MOOC).

V. Balakrishnan et al. (Eds.): ICMEIM 2022, AHSSEH 6, pp. 664–674, 2022.
https://doi.org/10.2991/978-94-6463-044-2_85

2.1 Face to Face Teaching Classroom

Face-to-face teaching classroom is taught on site by teachers, who is used to improve learning enthusiasm and teaching quality by Multimedia Assisted Teaching (such as slide, animation, audio and video, etc.) [2]. The teaching quality may be guaranteed to a certain extent under the vivid explanation of teachers and on-site supervision and guidance, but its shortcomings are also obvious.

1) Students' subjective kinetic energy is weak. From beginning to end, teachers instill knowledge on the podium and students passively accept them. According to relevant research, students can only have 20 min to concentrate [3]. Most students are often in a state of paralysis after listening to classes for a long time, distracted and unable to understand the knowledge in time. In order to improve students' attention, teachers need to actively arrange interactive discussion, random questions and other links. This does improve some effects, but students are still passively participating. To effectively improve the learning effect, the most important thing is to improve students' learning initiative.
2) The class content cannot be reviewed. After the teacher's on-site teaching, students often have some knowledge that they do not understand, digest and master firmly. Because they can't watch the teacher's explanation repeatedly, this part of the content may always become a dead corner of knowledge.
3) The quality of assignment after class is poor. That has always been a common problem in many courses in colleges and universities. Many students with poor learning enthusiasm often don't take their assignment seriously, since they probably fill it boring, tedious and time-consuming and might as well copy it directly. In this way, assignment can not only consolidate learning, but also aggravate students' boredom of the course. Especially for Python, a course with high requirements for practical ability, the traditional pen writing assignment is not very helpful. "Writing a hundred pages with a pen is not as good as typing a short paragraph with a keyboard." has long become the consensus of programming courses.
4) The workload of marking assignment and test-papers is heavy. The assignment of programming courses, as everyone knows, is often to design and code a program. If it is submitted in paper, the correctness of the program cannot be verified, and it is difficult to write and read; If it is submitted as electronic file through email, when there are a large number of students, there will be problems such as difficult assignment collection, time-consuming and laborious verification of program correctness, as we can't expect each program can be run directly. In addition, running the program directly also has a certain security risk to the teaching host.
5) The workload of setting questions and marking papers in the exam is heavy. Examination questions generally need to take into account the aspects of low repetition rate, comprehensive question types, difficult and easy gradients, wide coverage of knowledge points and uniform distribution of scores. Therefore, a high-quality examination paper often needs a lot of time and energy of teachers. The marking and grading also have a large workload, especially the programming questions which answers are not unique, and the readability of handwritten programs is low. How to evaluate scientifically and fairly has always been the "worry point" of teachers.

2.2 MOOC

MOOC is a large-scale open online course rising in recent decades. Many apex universities have set up their own online learning platforms. While providing a large number of free courses, they also have more mature learning and management systems. It has the following advantages [4]:

1) Diversification of tool resources: MOOC integrate a variety of social networking tools and various forms of digital resources to form diversified learning tools and rich curriculum resources.
2) Easy to use: break through the limitations of time and space of traditional courses, and relying on the Internet, learners around the world can learn the courses of famous colleges and universities at home and abroad.
3) Wide audience: it breaks through the limitation of the number of traditional courses and can meet the needs of large-scale course learners.
4) Independent and autonomous learning progress: you can play back the knowledge points you don't understand in real time, and you can do the knowledge point test questions to ensure that you can learn the follow-up courses on the basis of mastering this knowledge point.

However, the common shortcomings of most traditional courses also exist in MOOC, and MOOC also has some other fatal shortcomings [5]:

1) Rely heavily on students' self-discipline and self-study ability: without teachers' on-site supervision, learning progress and learning effect completely depend on students' own learning initiative. However, the most of students have poor learning initiative, they often skip the course video and plagiarize assignment, and many students can't even finish the course. In the end, MOOC is equal to self-study, and self-study is equal to not learning.
2) Unable to obtain teaching feedback in real time: MOOC teaching is like broadcasting, and students can only listen passively. For the questions existing in students, it is difficult for teachers to know and be answered in time, so that it is also difficult for teachers to adjust the learning contents and methods in time according to the students' learning situation.

3 Hybrid Classroom Based on OPP

Online and offline hybrid teaching is a new teaching method in the Internet era [6]. Colleges and universities are also constantly exploring the hybrid teaching mode in the practice program design course [7, 8]. The OPP assists the teaching of the program design course, effectively arousing students' interest, and also helping teachers to analyze students' responses in real time [9]. Combined with the teaching method of "online + offline" teaching while practicing [10] and the OPP, we have designed a hybrid classroom teaching mode of "teaching while practicing" for Python programming courses. This mode combines the advantages of traditional classroom and MOOC, and can also greatly improve students' learning initiative and reduce teachers' workload.

3.1 Adhere to Face-To-Face Teaching as the Basic Teaching Method

Compared with online MOOC teaching, when teaching the same content in different classes, on-site face-to-face teaching may be mechanical for teachers because it needs to be repeated many times. However, face-to-face teaching can drive students' learning enthusiasm to a certain extent, find and solve learning difficulties in time, so as to ensure classroom order, teaching quality and learning progress.

3.2 Learning Now, Practicing Now

Use the OPP for synchronous practice in class. For the learning of programming courses, the most important thing is to be able to use it. One practice is better than reciting grammar ten times.

In the lesson preparation stage, we will enter a lot of program examples and exercises into OPP. In class, after each knowledge of grammar or library, we will use the online programming function of OPP to demonstrate a few program examples on site. During the demonstration, each student will be required to practice synchronously on OPP. After that, we will arrange additional exercises in OPP for consolidation exercises. On the teacher side of OPP, we can monitor the completion of students' practice in real time, timely understand the mastery of the knowledge, and then make targeted adjustments to the later teaching content and progress. "Learning now, practicing now" avoids the boring and boring teaching of "scripted teaching" and greatly improves students' enthusiasm for learning.

3.3 Quiz in Class

We conduct a quiz OPP before get out of class. We can use the platform's filtering classifier to form a targeted set of quiz questions from a large question bank in a fraction of the time. The evaluation function of the platform can be judged automatically on site, which will not increase the workload of teachers. On the one hand, as pressure, the in-class quiz can provide students with learning motivation. On the other hand, it can also test the learning quality of this class, find teaching weaknesses, and provide a basis for teachers to adjust teaching methods and focus in time.

3.4 Full Recording

Video recording will be conducted throughout the class. The screen showing PPT and the microphone of the teacher are recorded in real time, then the recorded video, PPT and other relevant materials will be uploaded to OPP.

Classroom recording has three functions:

1) Similar to MOOC, students can review the courses at any time on OPP;
2) It can facilitate the exchange and learning within the course group;
3) It can help teachers improve language wording and strengthen the transition between different contents after class, so as to improve the quality of teaching. Activity design of teachers and students in Participatory Learing

3.5 Complete Assignment Online

At the end of each class, teachers can select appropriate exercises from the question bank and assign them to students. We can use the filtering mechanism of OPP to screen exercises according to the question type, introduction, label (knowledge points) and difficulty, and quickly find the target exercises in the massive question bank. When necessary, teachers can also design and publish exercises suitable for their students. Assignment is mainly programming questions, supplemented by blank filling questions, focusing on training students' practical ability, so as to achieve the teaching purpose of learning for application. Teachers set the deadline for assignment on OPP, urge students to complete their assignment on time, and turn on the anti cheating function of OPP to minimize assignment plagiarism and improve the quality of assignment.

Students directly complete and submit it on OPP, which can automatically complete the evaluation and generates real-time statistical data. The automatic evaluation function of OPP can greatly reduce the workload of job collection and evaluation. Through the background statistics, teachers can easily know the weaknesses of students in the current curriculum, timely adjust the teaching content and teaching methods, or arrange Q & A and tutorial.

3.6 Conduct Online Examinations

We conduct the final exam on OPP. Using the functions of randomly assembling test papers and manually assembling test papers of OPP can greatly reduce the workload of paper production, accurately control the difficulty of topics and the distribution of knowledge points, and minimize the repetition with the test papers of previous years. There is no need to print the test paper for the online examination, and the students answer directly on OPP, which not only responds to the national call for "paperless office", protects the environment, but also avoids the difficulty of writing code with a pen for programming courses such as Python. Using OPP to evaluate and score directly greatly reduces the workload of marking, avoids various errors in manual marking, and makes marking more rapid and fair.

4 Teaching Effect of Hybrid Classroom with OPP

Our four classes study Python basic courses simultaneously, with about 50 people in each class. Two classes (A and B) use traditional classroom teaching and two classes (C and D) use hybrid classroom teaching. There are 16 lessons in this course, including 6 separate experimental lessons (lesson 5, 7, 9, 11, 14 and 16).

4.1 Comparison of Classroom Situation

Both traditional classroom and hybrid classroom adopt multimedia teaching. The difference is that the hybrid classroom is arranged in the computer room, using OPP for in class exercises and quizzes, and recording the whole process of the teacher's screen, while the traditional class does not.

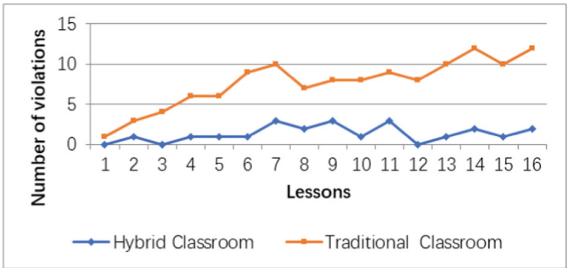

Fig. 1. Comparison of the number of violations in classroom [Owner-draw]

We recorded the number of discipline violations in four classes (sleeping, chatting and watching irrelevant content in class), as shown in Fig. 1.

As can be seen from the figure, the number of violators in traditional classroom is 4.5 times that in hybrid classroom. It shows that students' attention, learning interest and enthusiasm are much better in hybrid classroom.

We can see that with the deepening of the course content, the increasing trend of disciplinary violations in traditional classrooms is very obvious. This shows that some students gradually lose interest or even get tired of learning because they can't keep up with the progress due to insufficient practice. The number of discipline violations in the hybrid classroom has been relatively stable, and the total number has been maintained within 3 person times, which shows that the hybrid classroom teaching method always has a strong attraction to students.

4.2 Comparison of Assignment

The assignment content of the traditional classroom is mainly the exercises in the textbook, and the students submit it to the teacher in the form of electronic documents after completion. The assignment of the hybrid classroom is released on the OPP, and students complete directly on OPP. We made statistics on the situation of the four classes' assignment completion, recorded the number of suspected plagiarism and the number of people who failed to complete the assignment within the specified time.

4.2.1 Number of Assignment Plagiarism

We counted the number of assignments suspected of plagiarism, as shown in Fig. 2.

From Fig. 2, we can see that the number of assignment plagiarism in the traditional classroom is more than five times that in the hybrid classroom. If considering that the question type of the traditional classroom is mainly filled in the blank, the degree of assignment plagiarism in the traditional classroom is more serious. This shows that OPP has played an important role in preventing assignment plagiarism. On the other hand, it also shows that students in hybrid classroom have higher learning enthusiasm.

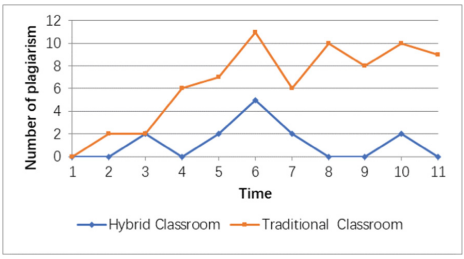

Fig. 2. Comparison of number of assignment plagiarism [Owner-draw]

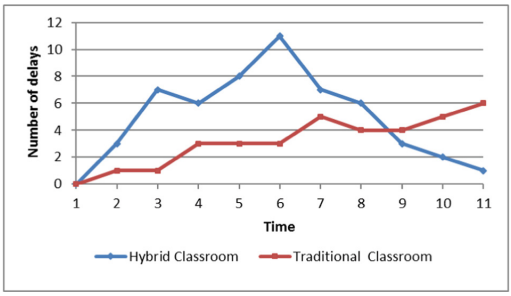

Fig. 3. Times of assignment not handed in on time [Owner-draw]

4.2.2 Comparison of the Number of Assignment not Completed Within the Specified Time

Traditional classroom assignments are sent to the teacher's email in the form of electronic document attachments. We counted the number of assignments received after the specified time and the number of outstanding assignments. The assignment of the hybrid classroom is completed through OPP. The deadline for the completion of assignment is set on OPP, and the number of assignment that has not been completed at the deadline is counted.

As can be seen from Fig. 3, there are many unfinished assignments in two types of classes, especially in the hybrid classroom. But the fact that assignment is not completed on time does not mean that students do not spend time on assignment. Figure 4 is the learning situation statistics of the third assignment on OPP.

As seen from Fig. 4, students spend more time on assignment. The main reasons are as follows:

1) The assignment in hybrid classroom is mainly programming, which leads to more time-consuming;
2) The anti plagiarism function of OPP plays a certain role, while the role of traditional classroom is more plagiarism;
3) There is an automatic evaluation function on OOP. Each programming question often has multiple evaluation items. In order to pass all the evaluation items, students often need a long time to debug.

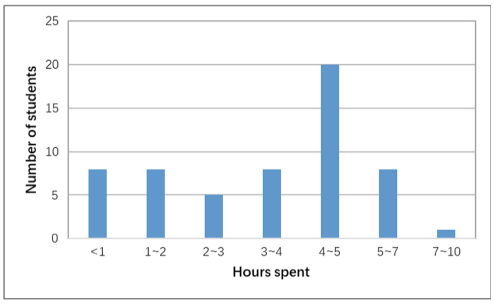

Fig. 4. Time spent on the 3rd assignment [Owner-draw]

From the statistical data, students are willing to spend more extra-curricular time on the course to complete their assignments, which also shows that students have a strong interest in the course. No pains, no gains. Hybrid classroom teaching also improves students' learning effect. No pains, no gains. Hybrid classroom teaching also improves students' learning effect.

4.2.3 Comparison of Collection Assignments

Traditional classroom assignments are collected through e-mail. Due to the large time range for students to hand in homework, teachers often review one copy when they receive it, and do not concentrate time to collect it. We estimate the approximate time of a collection operation: it takes about 1 min to open the mailbox, click the e-mail, download and save the attachments smoothly. In this way, it takes about 50 min to collect the homework of a complete class (50 people) ideally. In fact, many times students do not submit homework as required, such as:

1) Failing to name the document as required, or failing to verify the name or student number of the operator from the sender and the subject of the email;
2) When there are multiple files, they are not packaged;
3) Failing to upload the assignment to the attachment;
4) The Python program source file is not submitted directly, but pasted into the doc document.

The above situations will greatly increase the collection time. The total collection time of classes with 50 students is basically more than 2 h.

Contrary, the assignments of hybrid classroom are committed online through OPP, so the collection of assignment hardly consumes teachers' time. Teachers can even track the completion of assignments in real time.

4.2.4 Comparison of Review Assignments

In the traditional classroom, it is difficult to review the programming questions, which account for a large proportion in the assignments. In most cases, the review method is as follows: run the program directly. If the output is correct, it is directly considered that

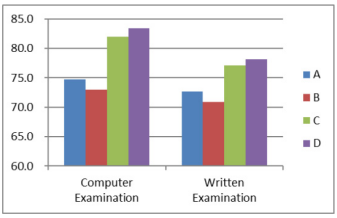

Fig. 5. Comparison of examination average scores [Owner-draw]

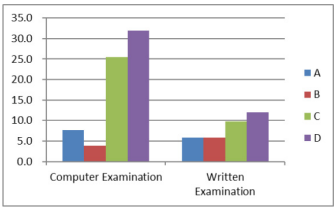

Fig. 6. Comparison of excellent rate of examination [Owner-draw]

the program is correct, regardless of the small errors; If the output is incorrect, simply browse the source code to find out the general reason for the error. Even so, due to the limited time and energy of teachers, they can only select part of students' assignments for review. Obviously, it is difficult to find students' problems in traditional classroom.

Due to the automatic evaluation function of the OPP, teachers only need to view and analyze the completion of assignment after the deadline. Of course, teachers will often track students' answers and give timely guidance to the problems found.

To sum up, the OPP has great advantages not only in the completion efficiency and quality of assignment, but also in the collection and evaluation of assignment.

4.3 Comparison of Examination Results

Examination result is an important index to evaluate teaching quality. In order to ensure the fairness of the examination and the sufficiency of the test evidence, OPP is not adopted in this examination, and the traditional examination method is still adopted. The examination includes computer test and written test.

As can be seen from Fig. 5 and Fig. 6, the performance of hybrid classroom teaching is far ahead of the traditional classroom, especially the computer test, and the excellent rate is several times that of the traditional classroom. For the course of Python programming, which pays attention to learning for application, the computer test can better reflect the students' mastery of this skill.

5 Conclusions

Compared with traditional classroom, the hybrid classroom with OPP has incomparable advantages in stimulating students' subjective initiative, maintaining classroom order,

reducing teachers' burden, following the forefront of science and technology and so on. However, it also has the following problems:

1) Taking up too much time after class will affect the comprehensive development of students. The hybrid classroom has greatly improved students' interest in learning, but the advantages and disadvantages will inevitably affect students' learning of other courses, especially the breakthrough after-school homework on OPP, which takes up too much after-school time and energy and affects students' comprehensive development. Therefore, in the teaching practice of hybrid classroom, we need to assign homework scientifically at a fixed point, quantitatively and with a fixed goal.
2) Theoretical study is slightly insufficient. Hybrid classroom focuses on improving learning interest, improving hands-on and practical ability, and paying attention to learning for application. Although practice and interest will promote the study of theory, it is still short in comparison. This has been reflected from the examination results: compared with the computer test results, the written test results of the hybrid classroom are not so strong. Therefore, in the teaching practice of hybrid classroom, we also need to pay attention to the explanation of theoretical knowledge, and appropriately add some theoretical topics in classroom exercises and after-school homework.
3) Various problems may occur during the use of the platform. There are great differences in the basis of students' use of computers. Because some students have received computer education for a short time, there may be a certain threshold for them to use OPP for the first time. Therefore, in the early stage of course teaching, we cannot ignore the guidance of OPP use, so as to avoid falling behind at the beginning. In addition, the OPP itself may also have some defects, such as abnormal display of test cases, unfriendly error prompts, etc., which requires our teachers to find and correct or guide in time, so as not to affect the learning enthusiasm after causing great trouble to students.

However, the above shortcomings can be properly solved through our teachers' timely adjustment and improvement. The hybrid classroom combined with OPP is still an epoch-making teaching method for Python teaching.

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