



Research and Practice on Advanced Language Programming Teaching Mode Based on O2O

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Abstract. There is no doubt that O2O-based teaching mode is a requirement for university's courses in the current information society. The course offering that base on O2O teaching mode needs the whole teaching team to understand and change the teaching philosophy in the first place. The construction of O2O teaching resources which is the common product of the whole teaching team requires the cooperation of the whole teaching team, and it is a continuous improvement dynamic process. In advanced language teaching process over the last two years, aiming at developing computational thinking abilities of academician, the author not only has made repeated operation and modification of the previous O2O online and offline flipped classroom teaching mode, but also summarized some more perfect experiments of flipped classroom teaching mode according to the feedback of students and teachers. In brief, it provides good experience and methods for the future individualized quality education.

Keywords: Advanced language programming · Computational thinking
Flipped classroom · O2O

1 Analysis of the New Era Teaching Mode

The advent of the Internet age and the rapid development of mobile Internet has driven a qualitative change in the teaching model of higher education. For different levels of institutions and students, they use MOOC (Massive Open Online Courses) teaching mode and SPOC (Small Private Online Course) teaching mode. The main objective of the reform of teaching mode is to improve teachers' teaching efficiency and students' learning efficiency, and enhance the computational thinking ability of teachers and students'.

1.1 MOOC Teaching Mode

In the present context of information society, «Ten years development plan of education information (2011–2020)» has put forward the core task of higher education, “Promote the in-depth integration of information technology and higher education, innovate in personnel training mode” [1]. MOOC was first applied by Dave Coymar of Prince Edward Island University in Canada and Brian Alexander of the National

Institute of Liberal Technology in 2008. Some of the world's leading universities have launched MOOC online courses. In 2013, Tsinghua University established "School Education Research Center" and it is also the first university in China to launch the MOOC course [2].

Courses based on MOOKS are generally established by some key university masters, without the restriction of source, time and place [3]. Students study from the beginning to the end (certificate) in the platform independently; it focuses on process-based assessment to achieve a high quality of resource sharing. But not all types of schools and students could be able to accept this teaching model. Students and teachers are virtual contact, and they lack understanding in the processes of teaching. Meanwhile, there is a problem that graduation certificates cannot be recognized by one another.

1.2 SPOC Teaching Mode

SPOC is a mixed teaching model, it's an improvement of the MOOC mode and O2O-based teaching mode [4]. It can make virtual contact between teachers and students like MOOC online, and also achieve the real contact between teachers and students which like the traditional class. It is an organic combination of MOOC teaching mode and traditional teaching mode [5].

Besides, SPOC has two modes. One is that using the resources on the network learning platform as a supplementary learning tool for students to broaden their horizons. Another is flipped classroom, it asks students to study online first, and then teachers Q&A in the classroom, so that teachers and students can exchange roles.

1.3 O2O Teaching Mode Based on Flipped Classroom

The research object of this article is the advanced language programming courses. O2O-based Flipped Classroom teaching mode is adopted for the characteristics of students in the school. The teaching process is one that requires continuous learning and practice. Base on the experience of other universities' MOOC and SPOC teaching modes, we can make O2O-based Flipped Classroom teaching mode suitable for our school. Usually, it could deepen and improve the teaching mode of SPOC, which not only improves teachers' teaching quality and efficiency, but also increases students' free space and learning efficiency.

2 Network Platform Resources Construction

In science and engineering colleges, advanced language programming courses are basic computer courses. The teaching process is composed of instructional design, teaching contents, teaching methods, homework assignments, assessment methods, network resources and so on. The establishment of these systems cannot be separated from the requirements of the National Education Steering Committee which devotes to the cultivation of contemporary college students [6].

2.1 Team Teaching Concept Changes

As the basic course of computer science, the two main discipline abilities of advanced language programming capacity training objectives is that the cognitive ability of computer and the ability of computer to solve problems. Thus, computational thinking ability is the core content of computer-based teaching abilities. Therefore, the goal of personnel training has gradually transformed from application talents oriented for process to innovative talents oriented for many fields.

In the teaching exploration of advanced language programming courses, the teaching methods have changed a lot, they gradually shifting from the methods that focusing on solving problems by programming to the methods that base on case-driven or to the methods and concepts which base on computational thinking and these methods all focus on algorithmic analysis. The classroom teaching methods has changed from traditional teacher-centered methods to methods based on network resources but still teacher-centered, then to the teaching methods called Flipped Classroom which is based on O2O online and offline simultaneous learning that is student-centered.

The O2O-based teaching mode is a task that can be accomplished only with the support and cooperation of the teaching team. It is a complete teaching process that only when everyone's ideas and concepts are transformed.

2.2 Video Resource Building

Video resources are an important part of network platform resource construction. From the point of view of content of the organization, there need to be driven by the case-based, and focus on algorithmic analysis and the context to inherit. In order to prevent students tired while watching the video, teachers need to limit the video size and don't take too much time on the explanation of knowledge points and usually it's better to be within 10 min.

In the process of organizing video, the first problem is the lack of video funding, the second is that time is running out and the third is that whether video is recorded by a professional or self-teaching department. These issues are mutually restricting. In a time-intensive situation, we could not employ professional video recording staffs due to the lack of funds. The main solution to these problems is not to require special funds and professional video recording staffs, but lower demand standards and use local resources to record videos by teachers themselves. Each chapter is divided by different teachers to complete and teachers organize video resources according to the knowledge points.

We use the following two video recording methods to organize video resources.

1. Classroom video. We use video recorder to record real classroom, then the teachers divide the video into a series of video clips according to knowledge point and time. Such videos are endorsed by some students, they could not only feel the classroom atmosphere, but also they can experience the teaching methods of different teachers. Video recording can easily be organized, but the most of students will feel that it is slow of online learning. The videos which explain one or more related knowledge points in more than 10 min are suitable for students with poor receptivity who feels

difficult to understand the certain knowledge points. It can be used as an emergency solution to the construction of network resources as well.

2. Record video. It means to record screen by recording software. This screen recording process seems simple, in fact, it is not. It requires the teachers to design the courseware in advance, moderate teaching speed and try not to pause for too much time. PPT and programming environment needs to be switched smoothly.

The teachers need to clip the screencast video and throw a question when a certain point of knowledge is over. If students cannot answer back, there is a need to go back to the position where teachers design to learn again.

Screen recording video is actually just a machine screen video, students cannot see the teacher, so there is a lack of close feeling. The next step is to integrate teachers into the video, at the same time updates video resources regularly according to the requirements of teaching materials and other aspects.

2.3 Test Database Resource Construction

The purpose of the resource construction of the test database is to achieve the process and the comprehensive final assessment.

The Question Types in respect of mastering degree of knowledge points: Single or Multiple choices, Completion, True or False.

The Question Types in respect of Analyzing problem and understanding ability: Programming completion, Programming error correction.

The Question Types in respect of mastering degree of algorithm and ability of solving problems: Program design.

The construction of the test database is a dynamic construction process, it is supposed to improve and update constantly along with different periods, different stages of development, different training objectives.

2.4 Fair Use Other Platform Resources

At present, many comparatively mature e-learning platforms have been developed, it is a waste of time to develop another e-learning platform by university itself. However, none of these platforms fully meet the requirements of teaching. It requires us to use a combination of two or three platforms effectively in order to complete the teaching process, in other words, use different platforms comprehensively.

For instance, E-learning platforms cover the function of basic video learning, teacher-student interaction, student management, automatic examination of the objective questions. The authors develop an examine system for programming test and a final comprehensive examination system. These three systems have been used organically and we have received good teaching results.

3 Teaching Process

3.1 Teaching Content and the Course Preparation

The authors have developed a complete teaching system based on the O2O flipped classroom teaching mode, which mainly reflects in the following aspects.

1. The degree of flipping. It is unsuitable for most universities to flip the advanced language programming teaching completely, and it is necessary to teach properly according to the characteristics of students and difficulty level of knowledge points. It is indispensable to emphasize and promote important algorithms in class and even illustrate their roles in practical fields.
2. Teaching calendar. The author added the main explanation, Q&A session during the courses, and offered student the previewing content, reviewing content and school assignment etc. This is shown in Table 1.
3. The teaching plan. Redesign the content of the teaching plan according to the teaching calendar, point out the key and difficult points of this course, and mark whether it is synchronized with the teaching calendar.
4. Assign the Homework and arrange classroom questioning. Teachers publish the previewing content and reviewing content in the classroom or by other interaction tools such as QQ Groups and WeChat Groups, grasp the real learning situation and common problems of students through classroom questioning, and explain mutual problems.
5. Supervise and urge studying. Teachers could understand the learning situation of students by seeing video Ruminant ratio on the network platforms, learn about questions that raised by students through discussion forums on other interactive tools and platforms. Through test scores of the network platforms, teachers could understand the students' masteries of the previous knowledge. Teachers release learning status of students through the QQ group or WeChat group, and urge students who have not lean well to pay close attention to learning.

3.2 Studying Process of Student

The students can learn knowledge points directly through the resources of network platforms by themselves at any time and anywhere, these resources not only can help students complete learning tasks as normal, but also could help curious students to learn more about the subsequent chapters. If the student's learning process is chaotic and unexpected, teachers cannot master their learning situation and solve the problems in time. Therefore under the unified teaching progress, all students should complete tasks online according to pre-set content, and regard this as a part of process assessment in order to supervise and control their learning progress.

Students online learning methods include the following two situations.

1. See video recording video. Videos with mission points are suitable for self-study, the explaining speed of the videos is much faster than the classroom. The task points are set according to the relevant knowledge points. For students, completing

Table 1. Teaching calendar paradigm.





Week	Month. Date	Time	Lecture content	Classroom questions	Experiment	Review and preview
1	3.1	2	Chapter two data type, operator and expression Instance 1: The difference between two numbers Instance 2: Calculate the area of the circle 1 Type of data 2 Constants and variables	1. What is the meaning of different data types of data? 2. How to calculate the variable's memory size? 3. What are the keywords defining data types? 4. How to define data 3.14 as a symbolic constant? 5. What is the meaning of variables? 6. What's the difference between character constants and string constants? 7. What is the rule of identifier? 8. What's the meaning of ASCII? 9. What is the ASCII of the character 'b'?	2	Review: 1. The five types of data that make up the number of bytes in memory? 2. How to calculate the number of bytes in a variable? 3. What's the C++ definition rules of the identifier? Preview: 1. How to calculate the remainder of two integers? 2. What's the meaning of self-plus and self-add? 3. How to calculate the value of the assignment expression? 4. What's the rule of data type conversion? 5. Understand the C input and output rules 6. In VC6.0 editor, compile and run instance 1, examples 2 and 3.4 7. Record the problem cannot be understood in the preview

the task points shows that they have mastered a certain amount of knowledge and completed the teacher's arrangement about related issues in advance.

2. Classroom video. The videos are from the real classroom, they contain more detailed explanations about the teaching content and are particularly suitable for students who have a low starting point or poor acceptance. They can successfully complete the task points and preview content by watching the classroom videos at first and then watching recording videos.

3. Process of teacher-student interaction. If students have problems with their learning, they can interact with the teachers through multiple channels. The first platform is a forum of online learning, where Questions can be answered by teachers or another students; the second platform is QQ Groups, it will be set to have a “Homework” form, teachers not only can assign homework in class but also can post problems in the “Homework” to show where students need to review and preview. Students can either ask questions by writing or by leaving voice mail, by program screenshots as well. The same questions can also be answered by other students or teachers; the WeChat group can also complete the teacher-student interaction process. With QQ groups and WeChat groups, teachers can regularly release the students’ online learning progress and status of online homework completion of students. The status of students’ video watching in a section is as shown in Table 2.

Table 2. The status of students video watching in a section.

Name	Video viewing	Total viewing time	Ruminant ratio
Yuchen Tang		3.5 minutes	106.57%
Xiaodong Chen		4.0 minutes	123.21%
Daolu Li		10.6 minutes	324.4%
Zhenbin Wei		3.6 minutes	111.44%

3.3 Assessment Process

The exam resources need to be established on different network platforms in order to achieve the process of assessment and the final comprehensive assessment. Process assessment is mainly to examine the learning outcomes of different stages of students, and also play a supervisory role to promote students learning at the same time. The final assessment is mainly to assess students’ comprehensive ability. Process assessment is divided into two types, the one is to examine how the students master the basic knowledge points. The main questions include multiple choice questions and blank questions. At the end of each chapter, the questions will be posted on the network platforms and teachers set the limited answer time in order to make sure that students complete questions in a certain time. The second is to understand the students’ mastery of algorithms and problem-solving skills. The main question type is programming and it will be released on the operating system platform after explaining the structure of the choice of programming.

Table 3 shows Student statistic of online learning scores, the table indicate that the teacher focused on video scores and process test scores.

Table 3. Student statistic of online learning scores.

Name	Student ID ↑	Course video (50%)	Examination (50%)	Consolidated results ↑
Yuchen Tang	1603010120	50.0	50.0	100.0
Xiaodong Chen	1603010101	46.99	49.17	96.16
Daolu Li	1503050106	37.35	48.33	85.68
Zhenbin Wei	1603010124	36.75	41.67	78.42

4 Conclusions

Actually, it is viable to enhance the creativity and quality of education through in-depth integration of the “Internet +” and personnel training. Teaching reform and innovation is a dynamic process that requires the teaching team to work together. Do not stick to one form of teaching mode, we should learn the good ideas of MOOC platforms of key institutions and improve SPOC inadequacy, and then control the degree of flipped classroom. The resources on the network learning platforms should not only ensure the normal teaching needs, but also provide the preconceived knowledge that needs to be paved, such as basic computer knowledge, someone needs to understand some of them before learning advanced language. The platforms also need to provide extended knowledge about the related courses. It will lay the foundation for students to solve problems in other classes or projects later.

References

1. China Education and Research Network. <http://www.edu.cn/html/info/10plan/ghfb.shtml#fb03>. Accessed 15 Mar 2018
2. Chen, X., Wang, D.: Development history and main characteristics of MOOC. *Mod. Educ. Technol.* **23**(11), 5–10 (2013)
3. Fox, A., Patterson, D.A., Ilson, R.: Software engineering curriculum technology transfer: lessons learned from MOOCs and SPOCs. Technical report, UC Berkeley (2014)
4. Kang, Y.: Online education’s “post-MOOC era”—SPOC resolution. *Tsinghua J. Educ.* **35**(1), 85–93 (2014)
5. Jiang, Z., Zhang, Y., Li, X.: Learning behavior analysis and prediction based on MOOC data. *J. Comput. Res. Dev.* **52**(3), 614–628 (2015)
6. Yuan, S., Liu, X.: Status and common problems of MOOC practice in China’s universities from the reports of the MOOC practice in China’s universities. *Mod. Distance Educ. Res.* **20**(4), 3–12 (2014)