Teaching reform and practice based on OBE concept: Taking the course of Python programming and practice as an example

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Abstract. Python Programming and Practice is a professional course for computer related majors. Through teaching practice, and based on OBE (Outcome-based Education) concept of course reform, we have revised the course syllabus, reformulated the teaching plan, standardized the classroom teaching, adopted online and offline mixed teaching model to teach the basic knowledge online, and to teach with project case method in offline classroom teaching. The course is completely transformed into outcome-based teaching, which improves the depth and breadth of the course teaching, and improves the students' practical ability.

1 Introduction

OBE concept, also known as "output oriented education" or "results oriented education", mainly focuses on students' ability to achieve after the course [1].OBE is a core concept of engineering education certification, so it is particularly urgent to carry out education reform research under the guidance of OBE concept[2].

OBE is to clearly focus on and organize all links in the education system, develop different teaching plans according to different requirements around a goal, and provide different learning opportunities, so that all students can obtain the ability to be competent for work at the end of the learning process. OBE especially emphasizes what students have learned rather than what teachers have taught, which has changed from traditional teacher centered to student centered.OBE emphasizes the output rather than the input of the teaching process, the research-based teaching mode rather than the indoctrination teaching mode, and the personalized teaching rather than the "carriage" teaching. Personalized teaching requires teachers to accurately grasp each student's learning trajectory, and timely grasp each person's goal, foundation and process.

Taking the course "Python Programming and Practice" as an example, this paper introduces OBE education concept, sets course objectives, sets the course into different modules, and explores how to improve the teaching quality of the course by adopting the hybrid teaching method of online and offline.

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2 Classroom teaching reform based on OBE concept

Classroom is the main form of teaching implementation. Classroom teaching is the basis to enable students to achieve graduation requirements and training objectives. In order to meet the requirements of results oriented education, at least the following four changes should be achieved:

2.1 Change from indoctrination classroom to dialogue classroom

The traditional classroom is a "spoon fed" indoctrination classroom. Knowledge dominates the classroom. The dialogue classroom should achieve the dialogue of knowledge, thinking and mind. The dialogue of knowledge needs to transform one-way indoctrination into multi-directional communication, so that knowledge can be transferred, exchanged and interacted between teachers and students.

The class of "Python Programming and Practice" belongs to the dialogue class. In the class, students are willing to answer questions, snap answers, share and display, and even be able to teach some knowledge points. They can make documents of cutting-edge technologies to share with teachers and students[3].

2.2 Change from closed classroom to open classroom

The traditional classroom is closed, that is, the fixed teaching content is completed in a fixed place and a fixed time. In this mode, teaching activities revolve around teachers, classrooms and textbooks. Open classroom is to break through the three centers and realize the openness in time, space and content.

This course belongs to an open classroom. There are independent learning time and joint learning time in terms of time. Teachers will assign pre homework and post homework during independent learning time. In terms of space, classes are held in classrooms and computer rooms, and you can go to libraries and computer rooms in your spare time. In terms of content, instead of sticking to one textbook and several reference books, we will provide students with massive network resources, and the classroom can be open to the society and other professional students.

2.3 Change from knowledge class to ability class

The traditional classroom is dominated by knowledge. What we talk about is knowledge, what we learn is knowledge, and what we test is knowledge. In the class of this course, case teaching and project teaching are usually used. When students cooperate in groups, everyone has a clear job division, and they work together to complete each project; In their spare time, students formed many studios and undertook many practical projects.

2.4 Change from emphasis on learning and light on thinking to combination of learning and thinking

To a great extent, the traditional classroom has neglected the role of thinking in understanding and creating the world. In our classroom, students constantly think, rather than mechanically memorize, they constantly create, and gain a lot of fun, confidence and sense of gain.

3 Teaching design based on OBE concept

3.1 Course teaching objectives

The most important part of the course teaching is to define the teaching objectives of the course in the syllabus. This course introduces engineering education ideas, fully considers the actual needs of the market for professional talents, and determines the course teaching objectives from the aspects of knowledge, ability or skills, quality objectives, etc. See Table 1 for details.

Table 1. Course teaching objectives.

Knowledge objectives	M1. Be able to correctly understand the basic syntax of Python language, the installation and use of development environment, process control, object-oriented programming ideas, skillfully use lists, dictionaries, sets, tuples, and functions for coding, and be able to use Python for graphical user interface programming, web crawler, database operation, and other types of files M2. Can use Python to crawl data legally
Competency and skill objectives	M3. Master the basic tools required for program development, including development environment and documentation tools, understand the concept and significance of program correctness, and be able to debug and test programs M4. Be able to use Python language for algorithm analysis and design, software development and implementation of simple engineering problems, be familiar with project design process, methods and the application of theoretical knowledge learned in design, and design projects with specific industry knowledgeM5 . Self learning Python Web development framework
Literacy goals	M6. Through group experiments, cultivate students' interpersonal skills, communication skills, ability to receive and feedback information, and form a sense of teamwork M7. Develop good programming habits and write programs that conform to specifications

3.2 Content of courses

The course adopts the offline and online hybrid teaching method. Each teaching link is set up in the learning output based education mode. For the part of basic knowledge, the course is taught in the online mode. For the part that is difficult to understand, the offline case exercise and project training are used. The main teaching contents of the course are shown in Table 2.

Table 2. Course content.

No	Teaching unit content	Course Objectives
1	Getting Started with Python, Number Types and Strings	M1, M3, M4, M7
2	Program control structure	M1, M4
3	Lists and tuples	M1, M4
4	Dictionary and Set	M1, M4
5	function	M1, M4
6	Classes and Objects	M1, M4
7	Modules, Errors, and Exceptions	M1, M3, M4
8	Graphical User Interface Programming	M1, M4
9	Graphical User Interface Programming	M1, M4, M5, M7
10	Web crawler, data analysis and visualization	M1, M2, M4, M6, M7

3.3 Online and offline hybrid teaching mode

The teaching is divided into three parts. The online knowledge points are explained. In class, the teaching is conducted through experiments, cases and projects. After class, the students' learning is tested through tests and experiments.

3.3.1 Online knowledge point explanation

Teachers upload materials to the teaching support platform in advance, including: (1) syllabus, teaching calendar, courseware PPT, teaching plan, e-book, video and other teaching resources. (2) Upload software or software installation guidance documents. (3) Teachers prepare interactive materials to consolidate classroom knowledge points and improve the interactive effect of classroom teaching. If the courseware is used, test interaction can be interspersed in the courseware, and multiple choice questions, judgment questions, and subjective questions can be used interchangeably. On the one hand, it is to catch the students' attention and prevent them from burnout and inertia; On the other hand, it is also an indispensable part of formative evaluation. If it is an experimental course without courseware, you can issue quick answers to urge students to follow the pace of teachers and actively complete programming experiments[4]. (4) A course question bank has been prepared to generate test papers for the convenience of testing at the end of each course. After each course is completed, an online test will be conducted immediately, which can improve students' attention in class and urge them to actively participate in classroom teaching. (5) Upload the course assignments, and students can try to complete the assignments after self-study to test the learning effect. (6) Upload the recorded video of knowledge points of the course, put it on the teaching platform, and explain the knowledge points for students to preview before class. The course video should not be too large to facilitate students' learning and searching.

Through the study of this course, students also became interested in the recording of teaching videos, because each team work requires students to record and display videos, and students also participate in the recording process of teaching videos. In the future, under each video, you can link the videos recorded by each class of students. I believe that the video quality will be higher and higher, and students' interest in learning will be greatly improved.

3.3.2 Classroom teaching

The use of hybrid teaching cannot follow the traditional teaching methods and methods, especially the course "Python Programming and Practice". Because of its strong practicality and application, students need to practice and practice more to master it. The traditional teacher led teaching methods cannot achieve good teaching results. On the other hand, online and offline hybrid teaching is more appropriate, that is, to guide students to conduct online learning first, and then teachers can guide students to experiment through a large number of cases or projects in class to achieve the teaching objectives.

3.3.3 Self study after class

After class, teachers will arrange online tests and experiments, and students will test their mastery of basic knowledge and practice ability by completing tests and experiment reports.

3.4 Course assessment

If the course adopts online and offline hybrid teaching mode based on OBE concept, the course evaluation also needs to be reformed to stimulate students. Therefore, establishing a

scientific and systematic learning evaluation mechanism has become the focus of teachers' attention. See Table 3 for details of the course evaluation. The specific proportion can be divided by teachers according to the course content.

Table 3. Course process assessment form.

Achievement items	Distribution	Evaluation method	Itemized distribution	Explain
Peacetime performance	70%	Practical evaluation	Attendance 10% (online)	1 point will be deducted for each absence from class, and 1 point will be deducted for each three times of being late. Deduct 10 points at most
			Classroom performance 10% (offline)	1 point will be added if the question is answered correctly, and 10 points will be added at most
		Practical evaluation	Experiment 40% (online+offline)	Full score: 40, 4 experiments in total
			Test 40% (online)	Full score: 40, 8 tests in total
Final exam	30%	Final big assignment	30% (online+offline)	30 points for project source code, 30 points for project paper, 10 points for project video, 30 points for defense and mutual evaluation

3.5 Concluding

According to the characteristics of Python language, this paper puts forward the teaching mode of "Python programming and practice" course, which adopts OBE teaching philosophy, online and offline mixed teaching mode, online is the teaching of basic knowledge, and offline project case teaching, which not only improves students' interest, makes them better master the basic programming methods and skills, but also improves students' ability to learn independently, solve problems and participate in projects.

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