Discussion on the Teaching Reform of Python Language Programming Course for Engineering Majors Based on OBE

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Abstract: Pyhon has a simple language structure and is free and open source. Therefore, more and more colleges and universities set it as a required course of engineering programming language. By analyzing the advantages of python language teaching, and based on the concept of Outcome-based Education (OBE), this paper puts forward the teaching reform idea of python language programming public course in ordinary colleges and universities.

Key words: Python Programming Language; Results Guide; OBE; Teaching Reform

1. Introduction

OBE is a new educational concept developed in recent years that takes students as the center, results as the requirement, and continuous improvement as the mechanism. It has become the mainstream idea of education reform in western countries, which is widely adopted by engineering education majors and applicable to all engineering professional courses. As the core course of computer science, python language programming has gradually become a required course for other engineering majors with the development of big data and artificial intelligence technology. How to make students combine the professional courses with artificial intelligence technology in the learning process of python language, so as to keep up with the pace of scientific and technological development in today's society has become an urgent problem to be solved. Therefore, many colleges and universities have put forward many advanced teaching ideas, methods and means for python language programming courses according to the development of their various engineering majors, including many teaching reform ideas about OBE education concept. Zhu[1] proposed to quickly master basic knowledge through comparison method in the python language programming course under the background of new engineering, and improve students' ability

to solve complex problems by project-driven. Ling[2] proposed to divide the course content into three types of teaching methods: "basic class", "advanced class" and "development class", in order to improve students 'programming thinking and programming ability. He[3] introduced the project-driven teaching method and proposed to use the lottery system as a coherent project-driven teaching reform idea to stimulate students' learning enthusiasm and improve their subjective initiative. Wu[4] constructed a four-in-one teaching system of "online teaching + offline teaching + comprehensive evaluation + subject competition" to cultivate students' innovation ability and engineering practice ability, so as to improve the quality of teaching. Wang[5] proposed a hierarchical blended teaching model of curriculum, which aims to highlight students' dominant position, meet the learning needs of students at different levels, and truly improve students' practical ability. Li[6], from the perspective of teaching material construction, proposed to discuss the content of three-dimensional teaching material resource construction according to the disciplinary characteristics of different engineering specialties, which explored a new model for the construction of supporting teaching materials for computer competence training of new engineering talents.

Although the above course teaching reform of Python language programming has been discussed and researched in depth from the teaching method, process, means and other aspects, it has not been fundamentally combined with the actual situation of the combination of various engineering majors and artificial intelligence to carry out an in-depth analysis and discussion of the course. Therefore, this paper mainly starts from the course teaching design of python language program design, and researches and discusses the course teaching reform based on the concept of OBE from various perspectives such as teaching mode and teaching

content[1-3].

2 Instructional Design of Python Programming Course

2.1 Teaching Advantages of Python Language

Python language is different from other teaching languages such as C, C++, etc., with the characteristics of easy to learn and light on syntax and heavy on problem solving. For engineering majors, python is easy to learn and has a simple syntax structure, so even for undergraduates with a weak foundation, they don't need to spend a lot of time on learning grammar.

Python language is also the main machine language carrier for the development of big data and artificial intelligence technology, which has unique advantages in scientific computing, data processing, data analysis, artificial intelligence and other aspects. In the current wave of the world's scientific and technological development, it has become a trend to see how professional technology can be combined with artificial intelligence technology, and how to deal with engineering problems in related professions by means of artificial intelligence. Therefore, many universities in China use python language as the programming language of choice for computer-based public classes for engineering students.

2.2 Teaching Mode of Python Language

As an emerging programming language course, python should avoid repeating the "technical description" teaching mode of the previous C programming course, i.e., the teaching implementation process is dogmatic, and the relevance of the introduction and development links is weak, which leads to low acceptance by students and insufficient in-depth mastery of the language. Introducing the concept of OBE, a project-driven approach can be adopted to reform the teaching mode.First, the teacher directly provides students with sample application projects containing the applications to be mastered in this classroom, and students run the program and observe the results of the program in conjunction with the project's task list, answering the questions on the task list. Then, the teacher explains the knowledge based on the exploration process of the students' independent research. Finally, students practice variations on the sample program, applying what

they have learned to redesign new projects to solve new problems[4].

Take the Body Mass Index (BMI) as an example, Figure 1 is the python programming code of the BMI calculator, and Figure 2 is the reference standard of BMI. The whole teaching process can be divided into the following steps:

```python
height = float(input("Height (metre): "))
weight = float(input("Weight (kilogram): "))
BMI = weight / (height**2)
BMI = round(BMI, 1)
print("BMI:", BMI)
if BMI >= 30.0:
    print("Obese")
if BMI >= 25.0 and BMI <= 29.9:
    print("Overweight")
if BMI >= 18.5 and BMI <= 24.9:
    print("Healthy Weight")
if BMI < 18.5:
    print("Underweight")
```

Figure 1. BMI Calculator

Project	WHO standard	Asian standard	Chinese standard
Thin	<18.5	<18.5	<18.5
normal	18.5-24.9	18.5-22.9	18.5-23.9
overweight	≥25	≥23	≥24
Fat	25.0~29.9	23~24.9	24~27.9
corpulent	30.0~34.9	25~29.9	≥28
Severe obesity	35.0~39.9	≥30	≥30
Extremely severe obesity	≥40.0		

Figure 2. Reference Standard for BMI Body Mass Index

(1) Introduction to the project

Discuss with students how to measure a person's physical health? What common criteria exist? Introduce the topic of the lesson: using Body Mass Index (BMI) to assess one's physical health.

(2) Conceptual Explanation

Provide students with the "BMI Calculator" program and ask them to input their height and weight to calculate their own or others' BMI and get a judgment of their health status. The teacher will also explain the choice structure with the sample program. Explain the rules and problems that need to be paid attention to when writing programs using IF conditional statements in Python.

(3) Program Modification

Provide the adolescent version of the Body Mass

Index comparison table and ask students to modify the sample program to design the adolescent version of the BMI calculator based on male and female genders and fat and thin classifications applicable to adolescents[5].

(4) New Program Task Generation

Ask a new programming problem and ask students to design a small program incorporating the conditional statements learned in this lesson.

(5) Summarize

Summarize to explain two aspects: on the one hand, what we have learned in this lesson about body mass index and physical health status, and on the other hand, the choice of structure and the precautions to be taken when using conditional statements in python.

The project-task-driven teaching mode is somewhat similar to the teaching mode of flipped classroom. Students can also be teachers in the process of interaction. In the process of self-improvement, they not only fully grasp the professional knowledge of PYTHON language, but also expand the knowledge of other fields. The above example is still relatively simple, but it fully illustrates the advantages of project-driven teaching mode. This teaching mode can be used in the classroom and can also be used in practice. In the process of practical teaching, for conditional colleges and universities, related engineering problems can even be simulated by GPU servers with complex structures such as neural networks. For colleges and universities with relatively weak hardware conditions, a single computer can be used to deal with some engineering-related data acquisition, data preprocessing and data visualization and other practical operations.

Through the teaching process of classroom and practice, students 'practice and ability to analyze problems have been improved, which provides a strong guarantee for students to solve engineering problems related to their major in the future work. At the same time, the code and documents accumulated by students in the project solution process can also be used as materials and knowledge reserves for participating in various discipline competitions, such as "Internet + College students innovation and Entrepreneurship", provincial programming competition, etc.

2.3 Python Language Teaching Content Design

Based on the OBE teaching concept, how to select the project content closely related to each specialty of engineering has become the focus and difficulty of python language teaching content. In the past, computer science majors in the process of learning programming language courses, are in the form of course design to strengthen and consolidate what students have learned. However, the projects selected for these course designs are all specialized fields that are closely integrated with the computer majors, such as the design of application-based applets, software design and the design of some database-related management systems. Engineering majors cover a wide range of professional directions, which requires teachers teaching PYTHON programming language to have a certain degree of understanding of their own professional directions in addition to their professional knowledge of computers.

Take Shaoyang College where the author works as an example, PYTHON programming is offered in the School of Management, the School of Electricity, the School of Mechanical Engineering and the School of Civil Engineering, so the relevant teachers must have a certain degree of professional knowledge of the relevant specialties in the teaching process. The following table is an example

Table 1. Content Design for Teaching Python Language

Faculty	Specialties	Teachers' Professional Knowledge Reserve Teaching	Teaching Learning Focus
Management	Economic management	The organization of social and economic activities and its changing rules.	Data processing and data analysis.
Mechanical	Mechanical Engineering	Machine automation, data processing, optimization and simulation.	Computer-aided design and robot control.
Electrical	Electrical Engineering	Simulation and modeling, scientific computing.	Simulation and modeling, scientific computing.

Civil engineering	Civil engineering	Design and construction of civil engineering related to engineering.	Computer aided design, data processing and analysis.

Table 1 lists the faculties where the majors are located, the professional knowledge of the teachers, and the teaching priorities in python language. The difficulty in the implementation of the whole teaching content lies in the teacher's professional knowledge, and how to solve this difficulty ultimately lies in the project-driven. The reserve of relevant professional knowledge of the teacher does not require complete mastery and absorption, but to understand the new dynamics and new direction of the relevant professional industry. According to the information accessed to select the appropriate project to drive the teaching content. Some teachers who do not master and are not familiar with the relevant professional knowledge can learn from students in the classroom or in the process of practice, this time the teacher can also be a student[7-8].

The learning process of python language of various engineering majors in the reform of teaching content can play a significant effect on the improvement of teachers' professionalism while focusing on students. The whole process of teaching reform is a continuous improvement process for both students and teachers, and at the same time, it has an immeasurable effect on encouraging students to be open to innovation, continuous learning, and enhancing their ability to analyze and solve problems.

3. Conclusions

It is of great practical significance to introduce the teaching concept of OBE into the construction of engineering courses. In the context of today's "artificial intelligence +" and the rapid development of computer technology, how to cultivate qualified engineering talents and improve students 'literacy has become a problem that university educators must face. Guided by the OBE concept and focusing on the needs of engineering students 'learning and employment, continuous curriculum reform will also become the unremitting efforts of university teachers.

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