

Teaching Reform of Python Programming Course in Artificial Intelligence Major

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Abstract: In view of some common problems in the teaching of Python programming course in artificial intelligence major, the teaching reform ideas are put forward in the aspects of teaching objectives, teaching content, teaching methods and assessment mechanism. Through the integration of Artificial Intelligence (AI) professional knowledge for differentiated teaching design, students' enthusiasm for learning is fully stimulated, students' interest in programming is cultivated, and students' ability to solve practical application problems in the professional field is also improved.

Keywords: Artificial Intelligence, Teaching reform, Python programming course.

1. Introduction

In recent years, AI, as the core driving force of the new round of scientific and technological revolution, is profoundly affecting and changing human life. In the next few decades, the development of AI specialty will directly determine a country's military and scientific and technological status in the world, and thus have a significant impact on political, economic, cultural and other aspects. In 2017, China's State Council issued the Development Plan for the New Generation of Artificial Intelligence, which clearly pointed out that artificial intelligence has become a new focus of international competition and a strategic technology [1] leading the future. In this context, the AI-related talent cultivation has also begun to be highly valued by the governments of all countries. In 2018, the Ministry of Education formulated the Action Plan for Artificial Intelligence Innovation in Colleges and Universities [2], supporting institutions to improve the talent cultivation system and promoting the construction of first-level disciplines in the field of artificial intelligence.

The cultivation of AI professional talents is inseparable from the cultivation of programming ability. Among them, the programming course based on Python language is one of the core contents of the construction of AI professional course. As the most widely used programming language in the AI field, Python is known for the simplicity and readability of its programming style. Programming in Python allows developers to focus on the business itself without struggling with complex syntax details. This not only lowers the threshold of program development, but also improves the efficiency of application development, providing a strong support for the rapid development of the field of AI. Therefore, in the Python programming course, students should not only master the basic grammar knowledge, but also effectively improve their ability to solve practical problems, especially those in the field of AI. This requires focusing on the organic combination of Python programming and AI professional background in the teaching design and teaching process.

2. Teaching status of Python Programming Course

At present, AI majors in many Chinese universities offer

Python programming courses in the second semester of the first undergraduate year, while introduction to AI courses are usually offered in the first semester. This means that when students learn Python programming courses, they already have a preliminary understanding of the field of AI. This makes it possible to combine Python programming and AI expertise. This is also an important entry point for the teaching reform and research of this paper. In addition, the following problems are also common in the current teaching of Python programming course:

(1) The teaching goal is single. Without considering the individual differences of students, "teaching students in accordance with their aptitude" cannot be achieved. This is contrary to the OBE concept [3], and does not take students as the main body for teaching.

(2) The teaching content is single. The theoretical teaching of Python programming is usually just a simple list of grammar knowledge points, and the coding practice is mainly based on replication experiment. This single setting of teaching content is often divorced from the practical application scenario, resulting in students can not really master the ability to solve practical problems, and also easy to lose the enthusiasm for programming courses.

(3) The teaching method is single. The teaching process adopts the traditional indoctrination method, with the teacher as the main body to control the rhythm of the classroom. This leads to the lack of benign interaction between teachers and students, which is not only difficult to stimulate the students' enthusiasm for learning, but also difficult to adjust the teaching methods in time according to the students' knowledge mastery.

(4) The assessment mechanism is single. The traditional closed-book examination method is mainly used to conduct a single evaluation, and it does not pay attention to the multifaceted guidance of the learning process. This is easy to make students only learn to cope with the exam, which is difficult to cultivate students' practical ability and innovative thinking.

In view of the above common problems in Python programming course teaching, this paper puts forward specific ideas of course reform. By optimizing the course teaching objectives, reforming the course teaching content, comprehensively using a variety of teaching methods, and running the multi-dimensional assessment and evaluation

mechanism through the whole teaching process, in order to cultivate higher quality "new engineering" talents for China.

3. Course Reform of Python Programming Course

3.1. Differentiated design of teaching objectives

Based on the AI major orientation of local application-oriented universities, the teaching objectives of Python programming courses are differentiated in design, so that students can choose different course objectives for learning according to their actual situation. This reform plan divides the course objectives into three levels from easy to difficult: master basic grammar knowledge and complete replication experiment (Objective A); possess programming ability to solve the application problems of integrating professional knowledge in the field of AI (Objective B); participate in enterprise application development or professional field related competitions to solve more systematic practical application problems (Objective C).

(1) Objective A is the most basic goal of classroom teaching, which requires students to master the basic grammar knowledge of Python language, and to be able to complete the basic replication experiments. The teaching objectives of traditional Python programming courses mostly stay at this level.

(2) Objective B is a further sublimation of Target A. Its biggest feature is the organic integration of python programming and professional knowledge of AI. This integration is reasonable, because, as an object-oriented programming course, its semesters are usually offered in the second undergraduate semester and beyond. At this time, the students have already learned the course of Introduction to AI, and have had a certain understanding of the basic knowledge in the field of AI. Through this integration, it can not only help students to apply what they have learned in programming learning, stimulate their interest in programming, but also let students have a further understanding of the professional knowledge of AI.

(3) Objective C is the highest goal of classroom teaching. It mainly selects some students with strong learning ability, to follow teachers to participate in enterprise-level application development, or participate in related competitions in the professional field. In general, enterprise projects or competition projects are more systematic. Through this higher level of program development guidance, more application-oriented talents for the actual needs of enterprises are cultivated.

Through the above differentiated design of teaching objective, it can not only meet the learning requirements of students at different levels, but also help teachers to "teach students in accordance with their aptitude". Around this differentiated design of teaching objective, the teaching content should also be differentiated designed.

3.2. Reform of teaching content

The teaching content of the Python programming course is divided into theoretical part and practical part. According to the differentiated teaching objectives, the teaching content is also divided into three parts: Content A, Content B and Content C.

(1) Content A. Its theoretical part focuses on the knowledge transmission of basic theories. In teaching design, the key

points and difficulties should be clear. Also, students should be guided to understand the object-oriented programming idea, rather than just stay at the level of grammatical details. For some less commonly used features in Python programming, it can be appropriately streamlined in the teaching process, so as to reduce the learning burden of students. The design of the practical part should select practical cases based on the theoretical part, and focus on replication experiment, so as to consolidate students' theoretical foundation and cultivate students' practical ability.

(2) Content B. This part is the key and difficult point of the course reform, which also determines the success or failure of the course reform. Its design principle is to find the meeting point of programming knowledge and AI professional knowledge, so that students can easily solve the representative application problems in the field of AI based on the programming knowledge they have learned. Specifically, the teaching implement can be divided into two stages:

(a) In the first stage, the basic programming knowledge, such as Python grammar basis, variable type, control process, class and object, is used to solve the intelligent application problems, such as knowledge representation, reasoning, search and path planning. Typical teaching cases include identification of animals based on generation rules, eight digital problem, shortest path planning and so on.

(b) In the second stage, high-order grammar knowledge, such as high-dimensional data representation, data analysis, data processing and data visualization based on Python programming can be used to solve the typical machine learning related problems. Specifically, it includes supervised learning problems such as classification and regression, and unsupervised learning problems such as cluster analysis and data dimension reduction. Typical teaching cases include housing price prediction, handwritten number recognition, animal and plant species cluster analysis and so on.

In the design of the above teaching content, the programming part should be the main, and the AI application part should be the auxiliary. Do not put the cart before the horse, increase the difficulty of AI knowledge, so as to increase the learning burden of students. The selection of AI application cases should be small and fine, do not be large and complete. Students should not spend too much time to understand the AI professional knowledge, so as to put more energy on the improvement of practical coding ability.

(3) Content C. This part is mainly used to solve the problem of large-scale systematic application with a certain practical application background, which may change according to the specific application needs provided by enterprises or the college students' competition questions. Therefore, the design of this teaching content presents the characteristics of dynamic updating. Its learning process is also more challenging. Generally speaking, enterprise projects are contacted and selected by teachers with the help of their own resources, and relevant competitions are selected by teachers according to students' wishes. Students' learning of this part is mainly completed after class, and specific technical difficulties are discussed under the guidance of teachers. Through the learning of this content, the communication skills of students can be improved, and the independent learning ability and innovation ability can be cultivated as well.

3.3. Reform of teaching methods

Based on the differentiated design of teaching objectives and teaching content, this paper puts forward the following reform ideas of teaching methods. First of all, in the whole teaching process, the project-driven teaching method is [4] throughout. For example, in order to achieve teaching objective A, replication experimental projects are used to guide students' learning; in order to achieve teaching objective B, application projects based on AI professional knowledge are used to guide students' learning; in order to achieve teaching objective C, students are guided based on enterprise-level application or competition questions. The project design corresponding to different teaching objectives should be from small to large, and the difficulty gradually increases, which is also in line with the law of students' knowledge mastery. Learning through a project-driven way can fully stimulate students' interest in learning and their sense of achievement. Secondly, according to the teaching content of different learning stages, the teaching should also be assisted by different teaching methods. The specific teaching methods adopted are shown as follows:

(1) For teaching content A, problem guidance method is used for auxiliary teaching. When students first contact a lot of grammar knowledge, it is easy to feel boring to program language. Therefore, teachers should avoid using the traditional indoctrination teaching methods, but should set questions timely according to the teaching content, so as to guide students to think about the correlation among grammar knowledge points, and to stimulate students' interest in programming.

(2) For teaching content B, collaborative inquiry teaching method is used for auxiliary teaching. Students' mastery of the AI knowledge is uneven. It is usually difficult to fully master this learning content. Students should be allowed to learn from each other in group cooperation, conduct cooperative exploration, and jointly solve the typical AI application problems.

(3) For teaching content C, the task incentive teaching method is used for auxiliary teaching. This teaching content is not open for all students, but for the outstanding students in the previous teaching process. The teaching content corresponds to the highest-level teaching objective, and the learning difficulty is also the greatest. Teachers should assist students to decompose the tasks of the projects, and encourage students to master the systematic program development method by gradually completing the goal of each small task.

3.4. Reform of the evaluation mechanism

In the course assessment, different teaching evaluation methods should be flexibly adopted according to the respective characteristics of the learning content.

(1) The assessment mechanism of teaching content A emphasizes the cultivation of individual independent learning ability. The theoretical part is assessed through classroom questioning and in-class test. The practical part is assessed through experiment report;

(2) The assessment mechanism of teaching content B focuses on the completion effect of specific application, as well as on the group communication ability and team cooperation ability;

(3) The assessment mechanism of teaching content C should not only take the completion of the project or the award of competition as the main evaluation points, but also

fully consider the interaction between students and teachers and the completion of sub-tasks, so as to ensure the sustainability of students' enthusiasm for learning.

In order to avoid students only learning with the goal of teaching objectives A, the proportion of scores after achieving teaching objectives B and C should be appropriately increased. Through a reasonable proportion setting of assessment items, it is expected that all students can achieve the teaching objective A, most students can achieve the teaching objective B, and a few students can achieve the teaching objective C.

4. Teaching Practice and Effect

Several rounds of teaching practice are performed based on the above design of course reform. The results of the latest questionnaire survey showed that the students' overall satisfaction with the teaching mode reached 96%, which was basically recognized by the students. Students generally believe that by organically combining the programming language with AI professional knowledge, they not only improve the practical programming ability, but also have a further understanding of AI professional knowledge, and obtain the learning effect of "1+1>2".

5. Conclusion

Python programming course is an important professional compulsory course in the curriculum system of AI major. It is also an important tool to solve practical application problems in the field of AI. In view of the common problems in the current teaching of Python programming course, we put forward the course reform ideas from the aspects of teaching objectives, teaching content, teaching methods and assessment mechanism based on the differences of individual students by organically integrating Python programming with the professional knowledge of AI. The teaching practice shows that this teaching mode not only effectively improves the students' practical programming ability, but also plays a good role in cultivating talents who meet the needs of engineering practice.

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