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Research Article

Exploration of Teaching Reform of Data Collection and Web Crawler Course Based on PDCA Cycle

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Abstract

The course of Data Collection and Web Crawler is highly practical and students are generally interested in learning it. However, the traditional teacher-centered teaching model focuses on knowledge transfer, which cannot meet the social demand for big data talents. PDCA (Plan-Do-Check-Act) cycle is the ideological basis of total quality management, which accords with the inherent law of teaching quality management. With "students" as the core and based on PDCA cycle, this paper carries out reform design from four processes of Plan, Do, Check and Act. The four stages of PDCA cycle correspond to the design, implementation, evaluation and reflection of teaching. The "Plan" part includes the design of teaching objectives and the design of teaching content. The teaching objectives are divided into knowledge objectives, ability objectives and quality objectives, while the design of teaching content can be summarized as addition, subtraction, adjustment and integration. The "Do" part mainly adopts a variety of teaching methods, such as the combination of theory and experiment, the combination of online and offline, the combination of group and individual reports. The "Check" part adopts a variety of evaluation methods, including examination, operation and reporting, to comprehensively evaluate students' knowledge, abilities and qualities. The "Act" part is mainly about standardizing successful methods, documenting existing problems to avoid repeat offenses, and transferring unresolved problems to the next cycle. Under the new teaching mode, the teaching is student-centered, giving full play to students' subjective initiative, and improving their ability and quality while mastering knowledge.

Keywords

PDCA Cycle, Data Collection and Web Crawler, Teaching Reform, Big Data

1. Introduction

As one of the sources of data collection, web crawler plays a crucial role in the research and application of data analysis technology. In 2022, the Ministry of Industry and Information Technology issued the "Big Data Industry Talent Post Ability Requirements", pointing out that the ability requirements for big data talents are divided into four aspects: comprehensive ability, professional knowledge, technical skills and engineering practice ability [1]. However, the traditional teaching mode focuses on the teaching of knowledge and does not pay attention to the cultivation of students' ability and quality, and there is still a certain gap with the social demand for big data talents.

The PDCA cycle divides quality management into four stages, namely, Plan, Do, Check and Act, and the four stages are carried out repeatedly to achieve a stepped rise in quality. In recent years, some scholars studied the application of

PDCA cycle theory in college teaching quality [2-4]. Many scholars studied the application of PDCA cycle in curriculum teaching [5-9]. Zhong and Tan proposed that the ideological and political elements based on PDCA cycle should be integrated into the teaching model [10]. Some scholars combined the PDCA cycle with the OBE (Outcomes-based Education) concept [11, 12].

There are relatively few researches on the reform of web crawler teaching. Liu and Xu discussed the application of project-driven teaching in web crawler courses [13]. Fang discussed the mining of ideological and political elements in the web crawler course [14]. Lu and Han studied the ideological and political construction of web crawler course in higher vocational colleges [15]. PDCA cycle is consistent with the inherent law of teaching quality management. Based on PDCA cycle, this paper carries out reform design from the four processes of teaching design, teaching implementation, teaching evaluation and teaching reflection, hoping to achieve continuous improvement of curriculum quality and cultivate students' programming ability, independent learning ability and problem-solving ability.

2. Course Overview and Problems

2.1. Course Overview

Data acquisition and web crawler is the core course of big data major. The course starts in the first semester of the third year, with a total of 68 hours, of which 34 hours are theoretical and 34 hours are computer. Mastering the basic methods and technologies of crawlers can lay a good foundation for courses such as big data analysis and visualization, data mining and machine learning.

2.2. Problems

2.2.1. Too Much Content

The content arrangement of web crawler textbook is relatively comprehensive, if the whole content is explained, on the one hand, the study time is not enough; On the other hand, it is difficult for students to master. Considering the uneven level of knowledge ability of students inside and outside the district, it is necessary to redesign the content of the textbook to ensure that students master the core knowledge system.

2.2.2. Fear of Difficulty

Students are afraid of difficulties. Students do not have a solid grasp of basic knowledge such as English, mathematics and computer, and their thinking ability and programming ability are weak. Especially, students who are not good at English also show fear of programming. Can not program, fear of programming, become a stumbling block for students to learn web crawler. In fact, the Python syntax involved in the initial web crawler is simple, and what students need most is to overcome their fear.

2.2.3. High Ability Requirement

The crawler technology is updated quickly and requires higher self-learning ability of students. However, most students are passive in learning, largely dependent on teachers to meet the needs of classroom learning, lacking independent thinking and exploration spirit. Facing the complex social environment and the competitive employment environment, students' autonomous learning ability needs to be strengthened.

3. Teaching Reform Process

The four stages of PDCA cycle correspond to the design, implementation, evaluation and reflection of teaching.

3.1. Plan

This part includes teaching objective design and teaching content design.

3.1.1. Teaching Objective Design

According to the professional training objective and the characteristics of web crawler course, the teaching goal can be divided into knowledge goal, ability goal and quality goal. Knowledge goal is the foundation, ability goal is the key, quality goal is the soul. On the basis of the basic method and technology of tamping reptiles, through the training of students' thinking ability and innovation ability, students can become professional and technical talents with artisan spirit and responsibility.

3.1.2. Teaching Content Design

Textbook is the main carrier of teaching content and the important foundation of students' learning. The redesign of teaching content can be summarized as "addition, subtraction, adjustment and integration".

(1) Addition. Python is an important tool for crawlers. In the early stage of the computer content arrangement, Python programming exercises are added, focusing on strengthening the exercises of combined data type operation, function definition and call, and file operation, laying the foundation for subsequent web crawling.

(2) Subtraction. Due to the limited theoretical time, taking into account students' acceptance ability, advanced knowledge such as crawler framework and distributed crawler is removed, and the basic methods of crawler are mainly explained.

(3) Adjustment. Adjust the data store to before the dynamic web crawl based on the student's cognitive process. Students can store the captured content in time and get a sense of accomplishment in advance.

(4) Integration. Integrate ideological and political elements to help achieve quality goals. For example, in terms of character retrieval, ancient Chinese poetry is chosen to enhance cultural confidence and national pride. In the aspect of picture climbing, the beautiful scenery of China is chosen to inspire students' feelings of home and country.

3.2. Do

In order to ensure the realization of knowledge objectives, ability objectives and quality objectives, it is necessary to adopt diversified teaching methods.

3.2.1. Combine Theoretical Teaching with Experimental Teaching

Traditional theory teaching and experiment teaching are independent, theory teaching in the ordinary classroom, experiment teaching in the computer room. Theory class teachers talk, students listen. The teacher operates the experiment class and the students watch it. Students' participation degree is low, and their hands-on ability cannot be exercised. Web crawler is practical and can be arranged in a big data professional room. When teachers teach or operate at the same time, students can follow the progress, which helps to improve the efficiency and effect of learning.

3.2.2. Combine Offline Teaching with Online Teaching

Teachers should focus on the goal and choose reasonable methods so that students can grasp the key points and break through the difficulties. In order to take into account the learning needs of students at different levels, teachers should optimize the online teaching design and recommend online video resources such as MOOCs and micro-lessons to students, so that students can get what they need online. Students with strong learning ability can learn advanced knowledge online and cultivate independent learning ability; Students who lack knowledge of knowledge points can supplement their learning online.

3.2.3. Combine Group Reporting with Individual Reporting

At the end of the semester, students will be grouped freely, choose the problems they are interested in, adopt web crawler, work together to solve practical problems, make PPT presentation, and complete crawler reports. The exchange of roles between teachers and students can stimulate students' interest in learning, cultivate students' ability to analyze and solve problems, and exercise their communication and expression skills and teamwork skills.

3.3. Check

The traditional closed book examination focuses on the examination of theoretical knowledge. The assessment of web crawler course should not only pay attention to the understanding of basic principles and methods, but also pay attention to the assessment of practical ability. Therefore, it is necessary to combine the three forms of closed book examination, computer operation and group report, and adopt diversified evaluation methods to conduct a comprehensive evaluation of students.

Closed book examination accounted for 50%, mainly testing students' mastery of web crawler related theories and methods. Computer operation accounted for 30%, mainly testing students' ability to use Python to climb web data, parse web data, and save data. Group reporting accounts for 20%, focusing on testing students' practical application, teamwork and communication skills. The above three assessment methods respectively from the knowledge, ability and quality of the students are comprehensively assessed. According to the detailed assessment results, students can take targeted improvement measures.

3.4. Act

The teacher should summarize each teaching situation in time. On the one hand, the existing problems are summarized and sorted out, recorded and filed, to avoid future repetition; On the other hand, successful methods are standardized to facilitate implementation; For the problems that cannot be solved, the reasons are analyzed and transferred to the next PDCA cycle to solve them, such as revising course content, improving teaching resources, and improving teaching methods.

4. Effect of Reform

As a university for ethnic minorities, the composition of students in each grade is different, so the horizontal comparison of teaching effect is not of reference value. Therefore, only longitudinal comparisons are made here.

4.1. Learning Ability

At the beginning, students were obviously afraid of difficulties in this course. By integrating ideological and political elements and improving teaching methods, students' interest in this course increased significantly in the middle term. Students with strong learning ability can try a variety of methods around web page parsing; Students with weak learning ability came to the classroom early and expressed their learning attitude towards the course with actions. They began to ask bold questions about what they did not understand, and the students all became better themselves.

4.2. Comprehensive Quality

Through the design of different levels of experimental content, improve the assessment method, in the process of

computer, students are no longer idle, but actively strive for their own goals, virtually cultivate the spirit of hard work and excellence. In the group report at the end of the term, the team members performed their respective duties, and exercised their ability to analyze and solve problems, innovate and cooperate with the team. At the same time, students also enjoy the joy of success and the fun of learning.

5. Conclusions

Based on student-centered and PDCA cycle, this paper discusses the teaching reform of data collection and web crawler course. Under the new teaching design, the main role of students has been brought into play, the learning initiative has been enhanced, and the innovative practice ability has been improved. With the progress of society, the renewal of knowledge and the change of students, teachers need to continue to learn new theories, new methods and new ideas, and constantly improve their professional quality and comprehensive quality. PDCA cycle continues, teaching quality improvement continues.

Abbreviations

PDCA   Plan-Do-Check-Act
OBE   Outcomes-Based Education

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Data Availability Statement

No data was used.

Conflicts of Interest

The authors declare no conflicts of interest.

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Biography

Na Wang is a lecturer at Xizang Minzu University, College of Information Engineering. She acquired her PhD in management from Southeast University in 2022, and her Master of Engineering from Xi'an Jiaotong University in 2011.

Research Field

Na Wang: Data collection, data analysis and visualization, data mining, supply chain management, Closed-loop supply chain management