Research on Teaching Methods to Improve the Teaching Effect of Data Structure Course for Electronic Information Specialty

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Abstract: The course of data structure has many contents, few class hours, more abstractness and high practical requirements. In addition, different colleges and universities have different professional teaching directions and teaching methods. In teaching practice, the author studied the educational methods of using practice to promote learning through teaching design, integrating correct world outlook, views on life and values education into the curriculum in all aspects, further strengthening communication between teachers and students. We must strengthen teacher training and change the curriculum assessment mode in improving teaching effectiveness. Teaching practice has shown that there have been beneficial changes in student learning enthusiasm, interest, academic performance, and other aspects before and after the implementation of the discussed methods.

Keywords: Data Structure; Electronic Information Specialty; Methods for Improving Teaching Effectiveness; Curriculum Assessment Mode

1. Introduction

Guided by the concepts of New Engineering, Engineering Education Certification, and OBE education, talent cultivation in universities places greater emphasis on its applicability, development, and innovation [1]. The course of Data Structure is a professional foundational course that cultivates students to apply the knowledge and methods they have learned to solve learning, programming competitions, scientific research, and practical engineering problems. However, different universities and majors have different development directions, and the teaching content, teaching methods, teaching models, and evaluation mechanisms of the same course are different, resulting in uneven teaching effectiveness. For example, Yancheng Institute of Technology uses the big language model proposed by Baidu - ERNIE Bot to help teachers teach in class and students learn after class [2]. Fuzhou University of Technology advocates a new teaching model that integrates teaching, learning, and doing to improve the teaching quality of courses and cultivate students' comprehensive qualities [3]. The author is engaged in the education and teaching of the Data Structure course. During the research, it was found that electronic information majors require both hardware and software skills. Due to the different focuses of each school, some students have weak program language foundations, resulting in difficulties in learning data structure theory and poor practical abilities. The course materials have multiple categories and varying levels of difficulty, and the teaching content is boring and cannot be combined with competitions and real-life cases. Therefore, exploring an effective teaching method to enhance the teaching effectiveness of the course has become one of the urgent research directions. The author explores several methods to improve teaching effectiveness based on their own educational and teaching experience.

2. Select Content to Promote Learning and Improve Teaching Effectiveness Through Practical Application

Firstly, refining the curriculum objectives based on the talent cultivation goals of the school's own major, and selecting textbooks based on the analysis of the curriculum objectives and learning situation. At the same time, resources such as course related competition topics, engineering practical application cases, scientific research projects will be utilized to establish digital, practical, scalable, and sustainable online/offline course content based on the information technology teaching platform. The course content will

keep up with industry development needs, make the competition useful, and make learning interesting. If students achieve certain results in competitions or research projects, they are allowed to exchange credits for relevant courses and receive extra points for courses. Add competition topics such as Computer System Ability Challenge and Blue Bridge Cup Programming Group - C/C++ as teaching and practical cases in teaching. Teachers actively apply for research projects such as The Application of Dijkstra Algorithm in Robot Path Planning, leading students to explore the application of the content in Data Structures in practical scenarios and achieving mutual benefit between teaching and research. By doing so, students can feel the usefulness of this course and effectively implement the teaching effect of using to promote learning and stimulate interest.

In terms of teaching implementation, three teaching stages are adopted. It's pre class, in class, and post class, as shown in Figure 1. Combining blended teaching methods such as offline teaching, online quizzes, and discussions, new knowledge points are explained to enhance student classroom participation. Through activities such as online practice questions, online tutoring, and online teaching data analysis after class, classroom teaching is extended beyond the classroom, breaking the limitations of learning time and space, and solving the problem of short learning hours. So, learning effectiveness is further enhanced.

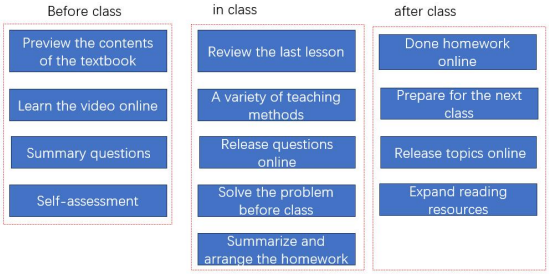

Figure 1. Pre Class, in Class, and after Class Teaching Segments

In practical teaching, the first step is to select topics that are closely related to practical applications, daily life, and competitions [4]. Secondly, setting differentiated questions to form a three-level practical system of basic validation, simple design, and comprehensive design, gradually improving students' practical application abilities. Finally, for differentiated questions, a differentiated practical evaluation method is adopted, such as the basic validation being assessed based on the scores of practical reports and personal reports; Simple design involves group participation and self-evaluation as assessment methods. Through group collaboration, it not only exercises students' communication and expression abilities, but also achieves the teaching goal of strengthening team members and promoting common progress. It also cultivates students' sense of teamwork. Integrated design, also known as extensibility, mainly involves selecting students with strong programming abilities to strengthen their practice and prepare for competitions. Throughout the entire practice process, a "little teacher" responsibility system is implemented, encouraging outstanding students to act as "little teachers". For every time "little teachers" help others solve a problem, they can receive individual reward points for the course. This also alleviates the contradiction of fewer practical teachers and more students, making it difficult for students to answer their questions in a timely manner.

Guide students to participate in programming competitions, apply the programming concepts and methods they have learned to the competition, promote learning through competition, and use good competition cases as practical materials to promote teaching through competition, further improving practical ability and innovation level.

This method was first applied in the 2022 student group of the Department of Electronics at our school and has achieved good results in actual teaching. The enthusiasm and initiative of students in learning have been improved, their practical abilities have been enhanced, and the pass rate of course exams has shown an increase; Secondly, the number of students participating in the "Computer System Ability Challenge" has increased, and some students have won second and third prizes in the provincial competition.

3. Integrating Correct World Outlook, Views on Life and Values Education into the Curriculum to Enhance the Effectiveness of Education

The current requirements for correct world outlook, views on life and values education in the curriculum" have shifted from single course education in the past to various majors,

disciplines, and curriculum systems. Therefore, in the teaching process of this course, correct world outlook, views on life and values in the curriculum should be reasonably added, and this education should be carried out in a subtle and silent way, so that this education in the curriculum can shape the soul of professional courses. There are two specific methods for implementation.

Taking classroom teaching as the main battlefield and using application cases as the starting point, fully tap into the elements of correct world outlook, views on life and values education. For example, when explaining queues in linear structures in the course, analyzing that transaction processing in computers follows the message queue pattern allows students to feel the usefulness of queue data structures while also guiding them to pay attention to order and rules. When explaining the structure of a diagram, one is to reveal the dialectical viewpoint that things are universally connected based on the logical structure characteristics of the diagram, in order to guide students to interact and communicate more in daily learning and life, treat people and things in a peaceful and friendly manner, and help each other. The second is to introduce the great achievements of the country based on the application of the shortest path in practical life such as path planning and map navigation, cultivate students' patriotism and enhance their sense of national pride, stimulate their confidence in applying what they have learned and their sense of responsibility to serve the country [5].

Assisted by online teaching tools such as Xuetong, Classroom Dispatch, and PTA, we continuously carry out correct world outlook, views on life and values education before and after class. Before class, focusing on the knowledge and cases taught in this lesson, and finding relevant background introduction materials or videos to put into the preview module, and annotate and explain the development significance of events, noble character of characters, and cultural connotations of objects in the materials or videos with voice annotations. This not only stimulates students' interest in learning the knowledge of this lesson, but also injects "soul" into the knowledge during material preview. Arm students with knowledge and shape their character with flexibility. After class, assign some cutting-edge reference materials related to the knowledge of this lesson for students to read, further expand their knowledge, experience the latest developments in technology, maintain interest in continuous learning, and consciously cultivate the habit of students actively paying attention to the development of national engineering and technology. In addition, some interdisciplinary or engineering case practical assignments related to the knowledge of this class can be assigned, requiring students to independently search for information, program implementation, analyze results, and write analysis reports. In order to cultivate their self-learning ability, knowledge application ability, problem-solving ability, and written expression ability.

The above two methods have fully expanded the spatial and temporal pattern of curriculum correct world outlook, views on life and values education, expanding the education that was originally only in the classroom to a virtual network battlefield. On the other hand, with the development, openness, and sharing of online platforms, the correct world outlook, views on life and values education elements that can be excavated gradually penetrate into various aspects related to the learning, life, and future career of college students, making it easy for students to accept. This truly achieves the goal of educating students silently and effectively improves the effectiveness of education.

4. Enhancing Communication between Teachers and Students to Improve Teaching Effect

Firstly, in the main battlefield of classroom teaching, we need to change the traditional teacher centered cramming teaching method. Teachers should strengthen the learning subject status of college students and make them the center of teaching activities. When selecting teaching content and designing teaching methods, online survey questionnaires can be used to understand learning needs and characteristics, analyze learning situations, accurately connect, and improve the pertinence of teaching activities. Reasonably utilizing teaching modes such as group discussion, flipped classroom, split classroom, and blended online and offline in the classroom to fully mobilize students'

initiative, with students as the main body and teachers as the lead.

Secondly, increase face-to-face open communication activities between teachers and students outside of class, further deepen communication and exchange between teachers and students, achieve teaching goals, and improve teaching effectiveness. Currently, teachers have a heavy workload in teaching and have to undertake research and research projects, which results in them having limited time and energy to interact and communicate with students outside of class. Through teachers taking turns on duty every day, teachers and students can communicate and answer questions in a timely manner, close the relationship between teachers and students, solve problems in teaching, provide reference and lay a foundation for the design of subsequent teaching forms, and providing assistance for further improving teaching effectiveness.

Furthermore, through online teaching platforms, we can expand the time and space for teacher-student communication, adjust the teaching content and methods in a timely manner through online preview situations, and understand the mastery of knowledge through real-time online assignments, thereby adjusting the course progress and teaching direction. Using big data analysis as a carrier to accurately locate the needs of each college student is conducive to achieving personalized teaching. In addition, with the help of online platforms such as "QQ Group WeChat Group" and "Tencent Meeting", some students who are not good at face-to-face communication and expression have a channel to speak out.

Practice has shown that the frequency of teacher-student communication activities has significantly increased through the above three methods, and the coverage of teacher-student communication has significantly increased. Therefore, the course lecturer should fully leverage the role of the organizer and engage in friendly communication through in class interaction, face-to-face communication, and online communication, in order to improve student participation in teaching and promote greater effectiveness in course teaching.

5. Cultivate a Team of Teachers with Professional Qualities

Due to the high turnover of teaching staff in private universities, it is necessary to appoint 1-2 relatively stable course speakers from the date of offering this course. The course team will be formed by the speaker, who will receive irregular school-based training, industry dynamic training, and guidance on enterprise employment. At the same time, the course leader is required to consciously learn interdisciplinary knowledge, improve their knowledge reserves and comprehensive application abilities, and continuously strive to improve the teaching effectiveness of the course. The course team should work together to create the course, and the teaching team should have a reasonable structure in terms of academic background, age, and major, ensuring that the teaching team can achieve the integrity, coordination, unity, and coherence of the course teaching. To avoid the interruption of course content development caused by the departure of some teachers, which in turn affects teaching effectiveness. At the same time, the teaching team members complement each other and can provide suggestions for curriculum construction from different perspectives, which is conducive to promoting curriculum construction [6]. On the other hand, schools should establish a diversified assessment and dynamic adjustment mechanism for course managers to ensure that they have an advantageous position in terms of professional ethics, professional competence, and organizational coordination. The course leader, as the leader, is responsible for the teaching team of the course. The course leader can freely choose members according to the wishes of colleagues, assign roles, divide tasks reasonably, organize regular course discussions, and promote course construction.

6. Transform the Course Assessment and Evaluation Mode

The transformation of course assessment and evaluation mode are to change the single course assessment and evaluation method based solely on exam results, highlight the role of diversified subjects such as students, counselors, teachers, families, and employers, and construct a model of collaborative assessment and evaluation with the main lecturer as the main body and diversified subjects as the main body, as shown in Figure 2 [7]. Among them, the evaluation weight of the main lecturer is 70%, the evaluation weight

of interdisciplinary teachers is 10%, the evaluation weight of classmates is 10%, the evaluation weight of counselors is 5%, and other evaluations account for 5%.

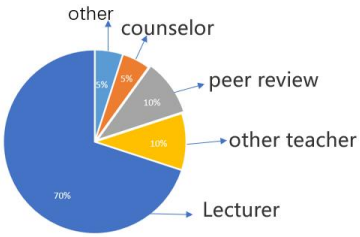

Figure 2. Multiple Assessment and Evaluation Subjects

Secondly, as the main body of assessment and evaluation, the lecturer can develop quantifiable evaluation indicators based on the characteristics of the course's tool and application, combined with its theoretical and experimental teaching hours ratio and content weight. Student evaluation includes classroom performance, final assessment, daily behavior evaluation, and quality evaluation, all of which are completed online. The entire process and comprehensive assessment assess the degree of knowledge, ability, and quality achievement of students, as shown in Figure 3.

Overall, a combination of process assessment and final assessment, both online and offline, is adopted. The process assessment decomposition indicators include attendance, quizzes, group tasks, homework, experiments, competition points in class as well as video task and topic discussions. The indicators involve various aspects of pre class, in class, after class, theory, experiments, and comprehensive application abilities, covering various evaluation dimensions of knowledge, ability, and quality. They are relatively objective and fair, and students indicate that they can generally accept them. Teaching practice has shown that after adopting this evaluation model, students need to participate in all aspects of course teaching. In order to obtain corresponding scores, thereby improving their mastery of course knowledge and comprehensive application ability. On the other hand, due to the evaluation rules being jointly drafted with students in advance, each evaluation indicator is clear and the evaluation data relied on is open and transparent, which enhances the credibility of various assessment indicators, enhances the credibility of teachers to a certain extent, and further improves the teacher-student relationship. This diversified evaluation model ultimately has a good effect of promoting learning and teaching through evaluation.

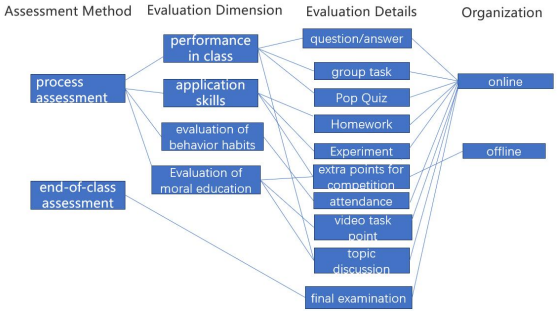

Figure 3. Comprehensive Evaluation Map of Students Throughout the Entire Process

7. Summary

Starting from the existing problems in the current teaching process of the Data Structure course in electronic information related majors, the author explores how to achieve the teaching effect of promoting learning through the selection of teaching resources and the improvement of teaching methods; How to excavate i correct world outlook, views on life and values education elements in the curriculum to enhance the effectiveness of education; On this basis, methods to strengthen communication between teachers and students to assist teaching were also studied, as well as the beneficial impact of improving teacher training and course evaluation methods on improving teaching effectiveness.

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