Research and Construction of C Language Programming Experiment Course Based on Problem and Outcome Oriented

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Abstract: With the continuous improvement and optimization of the industrial structure, the demand of the society for skilled talents is increasing. The Ministry of Education has issued a series of policies and regulations related to higher education to promote the reform and development of college teaching. As one of the computer application technologies, C language programming not only tests students' computer language design ability, but also pays attention to training students' practical operation ability and computer comprehensive quality, which brings certain challenges to college curriculum teaching. The outcome based(OB) teaching concept starts from the learning results and pays attention to the results. The problem based (PB) teaching mode is problem oriented and focuses on the specific problem situation and integrates the problem situation into the specific teaching content, so as to cultivate students' ability to solve practical problems. Based on this, this paper analyzes the teaching strategy of C language programming experiment course based on problems and outcomes, in order to provide reference for educators.

Keywords: problem oriented; Outcome oriented; C language programming; reform in education

Introduction

With the continuous promotion of educational reform, more and more educational concepts have been applied to college curriculum teaching. OB is an open, research-based and exploratory learning method that focuses on problems in a meaningful problem environment and solves real problems through cooperation. The PB theory requires highlighting the student center, output orientation and continuous improvement, and paying more attention to the final learning achievements of students. This concept is becoming the guiding theory of talent training in China's universities. PBL teaching mode based on OBE concept is applied to the teaching of C language programming course in colleges and universities, which plays a positive role in promoting students' interest in subjects and cultivating their comprehensive quality.

1. The Teaching Situation of the Course C Language Programming in Colleges and Universities

C Language Programming is a course offered for students majoring in computer science at the basic learning stage. Through the course learning, students should not only master the basic knowledge of C language and basic methods of programming, master relevant algorithms, excellent programming styles, simple data structures, etc., but also form good comprehensive qualities, including patriotism, team spirit, etc. Under the background of engineering education certification, curriculum teaching should focus on cultivating students' basic engineering knowledge, computer professional knowledge, etc., so that students can understand the teaching model of specific objects, choose research paths according to the characteristics of objects, and understand the commonly used technologies in the system design and development of computer professional fields, which puts forward higher requirements for college curriculum teaching. In the course reform work, our school made an in-depth analysis of the current situation of the course teaching, obtained the number of students in each academic year in recent years (see Figure 1). Through the statistics of the number of students in each academic year from 2014 to 2022, it was found that the number of students in almost every academic year was about 500. The corresponding scores of each academic year were obtained (see Table 1). Through the analysis of the corresponding score data of each academic year, it was found that the proportion of 90-100 points increased year by year from 8.95% in 2013 to 38.28% in 2022, nearly four times higher. It is found that the proportion of students with scores below 40 points has also decreased year by year from 1.84% in 2013 to 0.16% in 2019, that is, to 10% in 2013. Through data analysis, it can be found that the teaching of C language programming in our school has achieved initial results, but there are still deficiencies in training students' programming and ability. The reason lies in the deficiency of traditional teaching mode.
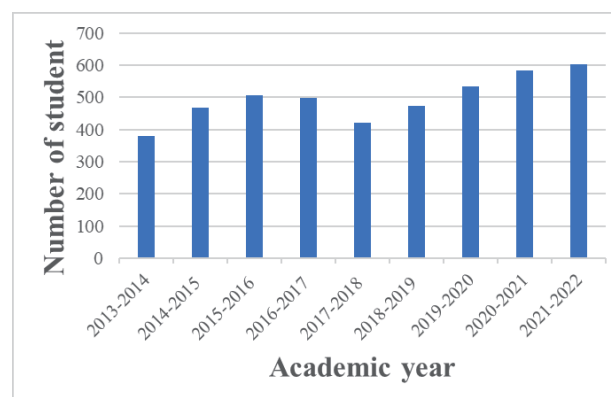

Figure 1 Number of students in each school year

Table 1 Summary of Student Scores

Academic year	90-100 points		80-89 points		70-79 points		60-69 points		40-59 points		Below 40 points	
	Number of students	Proportion	Number of students	Proportion	Number of students	Proportion	Number of students	Proportion	Number of students	Proportion	Number of students	Proportion
2013-2014	34	8.95	118	31.05	141	37.11	60	15.79	20	5.26	7	1.84
2014-2015	99	21.11	185	39.45	122	26.01	45	9.59	17	3.62	1	0.21
2015-2016	116	22.88	213	42.01	131	25.84	33	6.51	13	2.56	1	0.20
2016-2017	128	25.70	155	31.12	108	21.69	63	12.65	40	8.03	4	0.80
2017-2018	119	28.27	155	36.82	96	22.80	36	8.55	13	3.09	2	0.48
2018-2019	173	36.50	168	35.44	96	20.25	29	6.12	7	1.48	1	0.21
2019-2020	197	36.83	186	34.71	114	21.31	29	5.43	8	1.53	1	0.19
2020-2021	217	37.15	197	33.68	132	22.65	28	4.88	8	1.39	1	0.25
2021-2022	231	38.28	207	34.36	118	19.54	35	5.79	11	1.87	1	0.16

2. Research and Construction of C Language Programming Experiment Course Based on Problem and Result oriented

2.1 The Front end Analysis of C Language Program Teaching Based on Problem and Result oriented

The problem oriented and result oriented C language programming experiment course should pay attention to the development of students' abilities. Before the course is launched, teachers should strengthen the analysis of teaching objects and teaching contents, and determine the teaching activities after learning through the analysis of the teaching front end. Teachers can start with the following aspects: first, the analysis of teaching objects. The analysis of students' learning is the key to ensure the success of teaching. This teaching mode advocates students as the main body of learning activities. Teachers should focus on analyzing students' physical and mental characteristics, and guide students to form new knowledge and experience on the basis of their original knowledge and experience. In this regard, teachers should start from two aspects: students' general characteristics and ability status. On the one hand, they should analyze the general characteristics of college students, such as age characteristics, personality differences and learning motivation.

The teaching objects of C Language Programming in colleges and universities are freshmen or sophomores of information technology and computer majors. They are in the stage of youth development. Abstract logical thinking occupies the main position, and their thinking is more active. They are interested in new things. This shows that teachers can use students' curiosity to carry out teaching and guide students to learn independently. On the other hand, we should analyze the current situation of students' abilities. Most college students are exposed to C language knowledge for the first time. They have a solid foundation in mathematics, physics and other disciplines, but their ability in computer programming is relatively weak. Secondly, we should analyze the teaching content. C language is an intermediate language between high-level and low-level, with rich data types, and is the current process programming language. The course of C Language Programming mainly teaches the basic knowledge of application engineering and computer expertise to deduce and analyze the system model, explain the solution method of the specific object mathematical model, and carry out the system development work in the computer professional field with the help of information technology tools and development tools.

2.2 The Design of C Language Program Teaching Goal Based on Problem and Result oriented

The design of teaching objectives is the direction of the whole teaching activity, which runs through the whole teaching implementation process, and can play the role of guiding teaching and learning to guide teachers' teaching and students' learning. In this regard, teachers should integrate the entire teaching content to reasonably set up curriculum teaching, guide students to effectively exercise procedural skills on the basis of mastering theoretical knowledge. For example, for students in the early training stage, teachers should pay attention to the training of students' basic skills, and can set the following goals: master the basic knowledge of C language and the methods of program writing, debugging and running, and be familiar with the basic data types and sequential program structure. For students in the mid-term training stage, teachers should pay attention to the consolidation of students' existing knowledge. On this basis, teachers can deepen the course knowledge, and set the following goals: be able to skillfully use structures such as branches and loops to complete the program framework design, and learn to code according to the program framework. For students in the later training stage, teachers should pay attention to the practical application training of students, so that students can master the course knowledge in repeated experiments, and set the following goals: master the basic knowledge and application of arrays and functions. The setting of teaching objectives can promote students to master corresponding knowledge and skills at different stages, gradually improve the difficulty of objectives and promote the development of students' abilities, so as to cultivate students' problem-solving methods and autonomous learning ability. In addition to knowledge and skill goals, teachers should also set corresponding emotional attitude goals, promote students to form a rigorous and serious attitude of inquiry through experimental skills training, and form computer thinking through the process of using programming knowledge to solve practical problems, so as to promote students' all-round development.

2.3 The Setting of C Language Program Teaching Strategy Based on Problem and Result oriented

As a basic course, C language program can help students better achieve the teaching objectives by using problem oriented and results oriented teaching methods in teaching. In this regard, teachers can mainly start teaching from the following steps: take the teaching of

"for circular statements" as an example. The first is situation introduction and question posing. Considering the abstract and complicated knowledge points of this course, teachers can help students understand with situational questions, so that students can experience the application of professional knowledge in actual situations, and provide ideas for subsequent knowledge learning and practical exercise. PB emphasizes taking problem situations as the carrier to achieve learning tasks and goals, learning knowledge by letting learners solve problems cooperatively, and forming the ability of autonomous learning. OB emphasizes that the goal of teaching design and implementation is students' learning achievements, and advocates that both teaching goals and implementation plans serve students' learning achievements. At this stage, the teacher presents the problem situation for the students, shows the robot and artificial intelligence and other relevant information with the help of multimedia, attracts the students' attention with the help of the film "History of Boston Power Robot", guides the students to guess what the robot can do, and puts forward the inquiry question of "how to use the for loop sentence to make the robot move forward 10 steps". Teachers should reasonably choose questions based on the course content and teaching objectives, and create a situation closely related to students' daily life and learning, so as to ensure students' deep and active participation.

The second is to explore problems and teach new knowledge. In the work of teaching reform, teachers should play their own guiding role, guide students to complete problem inquiry through independent thinking and communication writing, and obtain new knowledge on the basis of problem inquiry. Teachers organize students to explore the problems, and explain the core knowledge points with the help of real life cases, learned knowledge, etc. After determining the problem, the students will think about the problem in combination with the textbook. The teacher will explain the "semantics and flow chart of the for circular sentence" to the students, and the students will master the key points according to the textbook.

The third stage is group cooperation and problem solving. After the question is raised, the teacher organizes students to communicate and analyze in groups, and the teacher can guide and urge the group to complete. In order to help students think and research, teachers can divide the problems in this environment into several problems, guide students to complete them one by one in the way of game passing. All problems are released in the form of tasks, such as group design algorithm and flow chart, programming according to algorithm and flow chart, and other tasks. They are managed and evaluated by means of games, and score records and incentives are based on game elements such as score levels, It can stimulate students' interest and innovation awareness to the maximum extent, and promote the completion of tasks and the output of learning achievements.

Finally, the results were reported and shared among groups. The teacher organizes groups to report the results in turn, and other groups listen carefully to the results reported by others to learn and think about the solutions of other groups. The teacher watches the solutions of different groups, and puts forward targeted correction suggestions for the group solutions to supplement the missing parts of the students. Under the guidance of teachers, students further optimize their own plans.

3. Conclusion

To sum up, C Language Programming is an important part of the curriculum system of colleges and universities. The problem-based and results oriented teaching model takes collaborative discussion as the main means, emphasizes problem and task orientation, emphasizes student centered, and emphasizes results output, which can stimulate students to think independently, promote students to communicate and help each other, establish team spirit, and effectively improve students' learning efficiency and comprehensive quality. Applying it to practical teaching can effectively improve students' academic performance, promote students' independent learning ability, problem solving ability and other comprehensive qualities.

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