

# Research on Teaching Reform of C Language Course under the Engineering Education Certification

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## Abstract

In the background of engineering education certification, aiming at the problems of C language curriculum, following the principle of results-oriented, this paper puts forward the research of C language curriculum teaching reform based on OBE concept. In view of the deficiency of C language curriculum under the traditional education method, reform measures are put forward in three aspects of teaching mode, ideological and political elements and assessment, and the reform results are described. It aims to further optimize C language course teaching and improve teaching quality through the teaching research of C language course.

## Keywords

Engineering Education Certification, C Language, OBE

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## 1. Introduction

Engineering education certification is an international quality assurance system for engineering education and an important basis for international mutual recognition of engineering education and engineer qualification (Wang, 2019). In China, C language is not only a compulsory course for computer majors, but also a public course for non-computer majors in science and engineering in many universities. However, the current teaching method cannot adapt to the social development and the actual needs of students, teaching quality cannot be guaranteed. Therefore, how to reform C language curriculum to enable students to master the grammar of C language, and enable them to have better programming ability, so as to solve a variety of learning and life problems, which has become the focus of current C language curriculum research. Based on the engineering

education certification of software Engineering major in Yancheng Normal University, this paper discusses the teaching reform of C language course.

## 2. The Status of C Language Course under the Traditional Education Method

C language teaching under the traditional education method has certain characteristics. First, the teaching mode is single (Guo et al., 2021). The whole C language course consists of theory and experiment. In the theoretical class, the teacher uses the method of filling the classroom according to the teaching plan (Lin, 2022). Although this teaching method can teach students the most knowledge in the least amount of time, and finally achieve “efficient” knowledge transfer, it is not conducive to the development of students’ thinking and ability improvement. However, can experimental classes really exercise students’ programming ability and develop their programming thinking? The answer is no. Because we find that students often finish the experiment report mechanically according to the teacher’s task, and lack of independent thinking. Meanwhile, the traditional teaching mode lacks interaction between teachers and students (Wang, 2022). This interaction is different from the traditional classroom question and answer mechanism, but the in-depth communication between teachers and students.

In addition to the single teaching mode, the traditional teaching mode makes students lack the ideological cognition of C language course. Teachers are only responsible for teaching knowledge, but do not tell students the significance of learning knowledge, which leads to the lack of recognition of this course by students. Moreover, the course is a little difficult for students, and students are easy to give up. This is also a common phenomenon in colleges and universities.

The unitary examination method is also a deficiency of the traditional teaching method. In the past, our assessment model was a combination of usual scores and final exam scores. Regular grades usually consist of attendance and class performance. The final exam is usually a selection, judgment, fill-in-the-blanks, programming, etc. This assessment method has many disadvantages. First of all, attendance should not be considered as a part of the usual score. If students do not adapt to their teachers’ teaching methods, they can choose other teachers’ classes or even find resources from the rich network. Secondly, for C programming courses, it is unwise for the final exam paper to include judgment and selection of these types of questions, because they cannot test students’ overall programming ability.

## 3. The Direction of Teaching Reform Based on OBE Concept

### 3.1. Introduction to the OBE Concept

Outcome Based Education (OBE) was proposed by William G. Spady in 1981. The research logic has gone through the exploration of the educational concept principle to engineering certification (Shen & Steven, 2016). In the process

compared with the traditional education concept, OBE is not teacher-centered or driven by knowledge content, but student-centered and focuses on students' learning results (Chen & Guo, 2021). In June 2013, China was admitted as a signatory of the Washington Agreement (Li, 2014).

Ren et al. (2022) proposed the integration of OBE concept with ideology and politics and its application in C language course teaching, which can take diversified forms in actual teaching, such as courseware explanation and case practice. In addition, it also proposes to analyze the fields that students are interested in by issuing discussion topics, so as to open up ideas for adding ideological and political elements, so as to make corresponding correct guidance. Huang et al. (2020) put forward the C language programming course as an example, and carried out practice and research from the aspects of curriculum training objectives, student-centered teaching, strengthening practical teaching, integrating curriculum ideology and politics, and reforming assessment methods. Finally, it is proved that the teaching quality and learning effect have been further improved after the introduction of OBE concept. Zhou et al. (2021) put forward the innovative idea of "Student-centered, hierarchical teaching" based on OBE concept combined with specialty, and expounded the practice system of innovative teaching of C language course from aspects of learning situation analysis, teaching innovation ideas and ideas, and teaching innovation effects.

### **3.2. Teaching Mode Reform**

Based on the concept of OBE, we have made the following reforms to the teaching mode. First of all, online and offline hybrid teaching is adopted. Before class, the teacher records about 10 minutes of micro-class video and exercises to the software "cloud class", students watch the micro-class video, preview the course content independently, and finally complete the exercises. Teachers check the cloud class exercises to understand the knowledge of students. In class, the teacher should only focus on the weak points of the students. As students fully study independently before class and come to class with questions, the interaction between teachers and students asking questions in class is more meaningful than just a formality.

Secondly, we adopt the tutorial system and the way of "promoting teaching through competition". Our school assigns each new student a tutor who will accompany them throughout their college life. In the second semester of the freshman year, students' tutors will lead students to form teams to participate in "Internet +", "Blue Bridge Cup", "Software Cup" and other programming competitions to train students' programming ability and promote knowledge understanding through competitions.

### **3.3. Integrate Ideological and Political Elements**

The textbook we use is "C Programming (fifth Edition)" by Tan Hao-keung. Ideological and political elements are integrated into each chapter. In the first class, for example, by huawei meng wanzhou event, to the students to clarify the

plight of China's high-tech industry, due to the relatively backward technology, automatic driving, car network, sensor and other core system chip rely heavily on overseas, now foreign chip industry monopoly, lead to many vendors in China, especially the automobile manufacturers have to production, or even shut down. In a similar way, students are encouraged to study hard, improve their vocational skills and make contributions to the country and the people. When introducing the knowledge of variables, we should guide students to pay attention to the naming of variables and methods, and add annotations reasonably, which are the basic qualities of software developers. Guide students to improve their professional ethics and develop good professional quality.

### **3.4. Evaluation Reform**

We are constantly improving the way we assess students so that the results reflect their true abilities. The current assessment model is still a combination of ordinary scores and test scores. Ordinary grades are made up of class performance and homework scores, which are used instead of attendance. In today's information society, there are many course resources on the Internet. We allow students to choose their own courses and study at any time and place. The number of times students attend the teacher's class will not be considered as part of the score. The examination paper also from the original multiple choice, fill in the blank, judge, programming questions to complete programming questions. A final paper consists of 10 programming questions, each graded step by step.

## **4. The Effect and Consideration of Teaching Reform Based on OBE**

### **4.1. Teaching Mode Reform**

The mixed teaching mode of online and offline greatly promotes students' learning enthusiasm and improves students' learning initiative. Because the learning method of using micro-lesson video before class makes preview more efficient, exercises before class fully expose students' knowledge mastery. Thus, in class, teachers will strengthen teaching efforts on key and difficult points according to students' knowledge, and finish teaching work with emphasis. In this teaching mode, the content of class explanation is determined by students, while in the traditional teaching mode, teachers cannot master students' preview and all knowledge points are explained in class. Therefore, the reformed teaching mode is more efficient and accurate.

Implementation of tutor system for undergraduate students in the university four years have guide, advantage is good for the development of the students, encounter problems will find his mentor, and teachers will lead students to participate in various types of games, with the game to promote the teaching, improve the students' learning enthusiasm and improve teaching quality, enrich students' college life. The weakness of the tutorial system is that it takes up too much time for teachers. There is only one tutor for each student, but there are

nearly 30 students for each teacher, which greatly consumes teachers' energy. How to balance teachers' energy input and students' learning efficiency needs further research.

#### **4.2. Integration of Ideological and Political Elements**

Compared with the traditional teaching methods, the integration of ideological and political elements on the one hand strengthens the patriotic education of students, and makes it clear that teachers are not only teaching courses but also have the responsibility to cultivate students' correct ideas and world views. On the other hand, the ideological and political elements are used to empower the technical courses to stimulate students' sense of identity to the significance of the courses and their sense of mission to learn knowledge, so that they can devote themselves to learning in a fuller state, instead of aimlessly studying to complete tasks.

#### **4.3. Evaluation Reform**

The reform of assessment and evaluation shows certain advantages. For the part of attendance that is excluded from ordinary grades, students first give good feedback, believing that the school provides more choices and freedom.

Secondly, according to the final data, the elimination of attendance rate does not make students slack off in study, thus affecting the overall score of the final course. For the final examination paper only programming problem of the reform of a topic, in the beginning, we believe that the selection, fills up the topic examines is students mastery of small knowledge, and the programming problem can test students' overall programming ideas, in practice, the programmer as long as there is the whole programming ideas, for some small grammar issues encountered in the process, can search to solve directly, Convenient and quick. Therefore, we don't need to ask them to remember some small points too much in their student stage, just examine the overall programming idea is enough. This does promote the overall programming ability of students, but there are some shortcomings. In the interview, we know that a small number of students have a poor grasp of knowledge and do not have the ability to think independently. They are afraid of programming questions and lose the memorizing part of the questions, which leads to a big gap in students' exam scores. Secondly, it is not conducive to the national Computer Level 2 examination, which is one of the most important exams for Chinese college students and even affects the normal graduation of students. In the past, our C language course assessment mode is similar to the computer Level 2 examination mode, which has a high degree of knowledge compatibility and effectively improves the passing rate of the computer Level 2 examination. However, after the reform, the passing rate of the computer level 2 examination has decreased slightly, which is what we do not want to see.

Therefore, what kind of assessment method can effectively assess the ability of

students, and contribute to the normal academic development of students, which remains to be considered and groped.

#### 4.4. Data Support

After the reform, according to the achievement report of C language courses in each semester, compared with the students of Grade 17, the students of Grade 19 have improved 7.8% in problem solving and computational thinking as well as the application ability of computer programming language. Students' ability of problem analysis, simple algorithm design and programming improved by 5.6%; The students' ability of using C language to program design, using integrated development environment, program testing and program debugging skills improved by 4.8%.

#### 5. Conclusion

Based on the engineering education certification of software Engineering major in Yancheng Normal University, this paper proposes reform measures in three aspects: teaching mode, ideological and political elements and assessment, aiming at the deficiency of C language curriculum under the traditional education concept. In general, the C language teaching reform measures based on the OBE concept are conducive to improving students' learning literacy. However, there are still some problems in the practical application process. I will continue to explore and study the C language courses in the future to further promote the teaching effect.

#### Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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