Teaching Reform of C Language Course Based on the Cultivation of Computational Thinking Ability

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Abstract. Computational thinking is the important content and research direction of university curriculum construction and teaching reform at home and abroad. Taking the C language course for non-computer majors as an example, this paper analyzes the importance of Computational Thinking in the cultivation of innovative talents, discusses how to cultivate Computational Thinking Ability in the teaching process, and puts forward the teaching reform of C language course based on the cultivation of Computational Thinking ability.

1. Introduction

With the rapid development of science and technology, scientific knowledge is constantly innovating, advanced technology, advanced methods, advanced tools need innovative thinking.

At present, many colleges and universities still adopt the traditional teaching method in computer basic teaching. The teaching of computer basic still stays at the level of tool application. It mainly teaches students how to use some tool software. In the teaching process, there is no deep reflection of the cultivation of Computational Thinking and ability, but it is implied in the teaching process. The use of computational thinking is not compatible with the rapid development of computer technology. We should change the traditional teaching mode, change the original teaching mode of computer tool application into the teaching mode based on the cultivation of Computational Thinking ability, cultivate students' Computational Thinking Ability in the whole teaching process, and then extend to every course in the university.

2. The Connotation of Computational Thinking

In March 2006, Professor Jeannette M. Wing, chairman of the Department of Computer Science at Carnegie Mellon University, published and defined Computational Thinking in ACM.

Professor Zhou Yizhen holds that computational thinking is the use of basic concepts of computer science to solve problems, design systems and understand human behavior, which includes a series of thinking activities covering the breadth of computer science. Computational thinking represents a universal knowledge and a universal skill that everyone, not only computer scientists, should be enthusiastic about learning and using. Through analysis, we can find its profound connotation:

2.1 Computational Thinking is one of the Most Basic Modes of Thinking

Computational thinking is an important part of human scientific thinking activities. Computational thinking will become the basic component and basic skill of human learning and applying knowledge like mathematics and physics. It will infiltrate into each of our lives. We use heuristic reasoning to seek the solution of the problem as a way to understand the world and to apply knowledge. An important basic tool for understanding the world. Basic computer teaching should be close to real life, so in the process of teaching, we unconsciously use computational thinking to solve problems, and train students to use computational thinking to solve problems in real life.
2.2 The Cultivation of Computational Thinking Ability is an Important Part of General Education in Universities

Computational thinking should be integrated into every major, not only the computer major, so that students just enter the university to contact calculation methods and models, arouse students’ interest in the field of computer science exploration, learning as an interest in learning. Every major and field need to find and solve problems. Computational thinking is used to train students to understand and solve real problems.

2.3 Problem Solving Ability

Computational thinking is the use of basic concepts of computer science to solve problems, design systems and understand human behavior, is the application of computer technology in the specific reality. For example, we can now use the website to buy train tickets; hospital registration window can use the hospital system to achieve registration and payment, these are computational thinking to solve the problem.

3. The Relationship Between Computational Thinking and Different Disciplines

Computational thinking is not only the way of thinking in computer science, but also the way of thinking in other disciplines. In mathematics, we should use mathematical induction, integral and other ways of thinking; in chemistry, we should use chemical equations, molecular formulas and other ways of thinking; in physics, we should use Newton's law and other ways of thinking. Computational thinking is closely related to every subject and has a profound impact on this field. The purpose of student education is not only to train students to use what they have learned to solve problems, but also to train students to have a problem-solving way of thinking.

C language programming is not only the basic computer courses for non-computer majors, but also the professional courses for computer majors. This course mainly cultivates the students’ ability to solve problems by using computer technology and methods, cultivates the students' logical thinking ability and programming ability, and plays a very good role in assisting students to learn other professional courses.

4. The Traditional Teaching Mode of C Language

In the traditional C language teaching process, teachers mainly focus on grammar and knowledge points, and then explain examples for grammar and knowledge points.

4.1 Simple as a Tool

Student's understanding is to learn C language, after the use of C language to write programs, did not realize that learning C language is mainly to train students to use computer technology and methods to solve problems. Teacher's understanding is that students learn C language, after the use of C language programming, not to train students to learn a language will be self-learning other computer language ability.

4.2 Single Assessment Method

After learning the C language, students generally use the final exam to assess, the final exam to take the form of examination papers. As long as students master grammar and knowledge points can achieve good results, many students have achieved high marks, but the ability to solve problems is poor, computer programming is still unable to start.

4.3 Single Teaching Means

Traditional teaching, classroom is teacher-centered, teachers in the classroom, students listen to the class, students are passive listening, many students feel that the course is boring, gradually lost interest. In the teaching process, the teacher mainly talks about grammar and knowledge points, and then explains the corresponding examples, students are not active learning.
4.4 Students' Enthusiasm for Learning is not High

Because in the teaching process, students have been in passive learning, no active thinking, students will feel that the curriculum is boring, teachers in the classroom full of indoctrination, students' learning enthusiasm is not high, in the teaching process did not pay attention to the cultivation of students' learning enthusiasm.

4.5 Neglect the Cultivation of Computational Thinking

Teachers in the process of teaching implied the idea of computational thinking, but did not pay attention to the cultivation of students' thinking ability, we teach students not only to let students use knowledge to solve problems, more importantly, to cultivate students' thinking ability to solve problems.

5. Teaching Reform of C Language Course Based on the Cultivation of Computational Thinking Ability

5.1 Reform of Teaching Contents

Introducing computational thinking into the classroom is no longer to instill grammar and knowledge from the beginning to the end, but to attach importance to the cultivation of students' practical ability, focusing on the ability to solve problems. In the classroom, the core is to solve problems. Teachers guide students to solve problems, construct mathematical models, write algorithms and implement programming. Changing the traditional teaching mode separated from theory and experiment. The traditional teaching mode is to explain grammar and knowledge points in the large class, arrange the practical operation in the experimental class, and separate the theoretical class from the experimental class. After introducing computational thinking, the teaching should be mainly arranged in the laboratory, focusing on cultivating students' ability to analyze problems, solve problems and write programs, to understand grammar and knowledge points in the process of practice, and to cultivate students' thinking ability.

5.2 Reform of Classroom Teaching Mode

In the traditional teaching mode, the teacher is the main body of the whole class. The whole class is mainly explained by the teacher. The teacher mainly instills grammar and knowledge into the students. The students are passive listeners, not active learners. After introducing computational thinking, we can adopt a variety of teaching methods, the main purpose is to let students become the main body of learning, not passive learning. Specifically, the following teaching methods can be adopted:

5.2.1 Blended Teaching

Blended teaching is a mixture of online learning and face-to-face teaching. The so-called blended learning is to combine the advantages of traditional learning methods with the advantages of network learning. In other words, it is necessary to give full play to the leading role of teachers in guiding, inspiring and monitoring the teaching process, but also fully reflect the initiative, enthusiasm and creativity of students as the main body of the learning process. The consensus of international educational technology circles is that the best learning effect can be achieved only by combining traditional learning with network learning and making them complementary. Students change from passive learning to active learning, mainly to cultivate students' active learning.

The flowchart of blended course design is shown in Table 1.

5.2.2 Case Teaching

In traditional teaching methods, teachers first explain grammar and knowledge points, then explain the corresponding examples, then let students do exercises in books, the whole teaching process, students are passive acceptance of learning. The case teaching method does not explain the theoretical knowledge in the classroom, but first introduces a real life case to the students, this case contains the knowledge points to be explained in this lesson, let the students understand some
Theoretical knowledge from this case, then the content of the teacher will not be so empty and boring, because the students have already life cases in mind, combined with cases to explain for students to understand. In the course of class, the teacher, guided by the teacher, takes the actual examples in real life as the object of analysis according to the teaching purpose of the syllabus. The teacher introduces the cases into the teaching process purposefully, systematically and systematically, and guides the students to think, analyze and solve the problems so as to help them solve the problems. Case teaching method is to train students to learn to think, cultivate students' ability to analyze and solve problems, mobilize students' enthusiasm and initiative in learning, cultivate students' interest in learning, and cultivate students' active learning. Changing the traditional teaching method and introducing case teaching method into classroom teaching are as follows:

- Case introduction: introduce a case close to real life.
- Case analysis: analysis of specific cases according to actual needs.
- Teaching according to cases: combining cases with specific teaching.
- Case specific implementation: combined with cases to explain the specific operation steps.

5.2.3 Flip Classroom Teaching

Flip classroom teaching mode refers to the students complete knowledge learning after class, and the classroom has become a place for interaction between teachers and students and between students and students, including answering questions, the use of knowledge, so as to achieve better teaching results. Teachers no longer occupy the classroom time to teach knowledge, which requires students to learn independently before class. Students can learn by watching online videos, watching micro-classes, reading e-books. Students can also discuss with other students through the network, and can consult the information themselves when needed. Teachers can also have more time to communicate with students. After class, students can learn abundant knowledge and abundant online learning resources through the network. Students and teachers can also interact with each other through the Internet to solve the difficulties encountered by students in the process of learning.

5.3 Reform of Examination Methods

At present, many colleges and universities in China still adopt the traditional assessment method, that is, the usual results + final examination results to determine. The assessment method is single, focusing on the last final exam, not from the multi-dimensional evaluation of students' curriculum learning; students are not interested in learning, students are about to take the exam when the sudden attack, learning effect is not good; students' hands-on ability is poor.

- Build a multi-dimensional assessment standard suitable for our school students;
- It can objectively evaluate a student's learning state and academic achievement.
- In the whole assessment process, students' learning attitude, learning process and learning results can be fully concerned, and teachers' comprehensive assessment of students can be realized.
- Combine online and offline achievements in a certain proportion.

Curriculum learning evaluation indicators: curriculum assignments, online testing, online learning behavior, offline assessment, online learning behavior from the number of times to enter the curriculum, the number of homework handed in, the number of reading curriculum resources, the number of participation in curriculum questionnaires, the number of learning notes, the number of questions to teachers, online length of time, access to classes and so on. Student total score = course work *30%+ online test *15%+ online learning behavior *15%+ offline assessment *40%, online learning behavior achievement = course entry * 1% + course assignments * 3% + reading course resources * 2% + course questionnaires * 1% + learning notes * 2% + questions to teachers * 2% + online time * 2% + course entry * 2%, homework grade = first assignment * 6% + second assignment * 6% + third assignment * 6% + fourth assignment * 6% + fifth assignment * 6%.
### TABLE I. Blended Curriculum Design Process.

<table>
<thead>
<tr>
<th>Groups participating in learning activities</th>
<th>Before class</th>
<th>In class</th>
<th>After class</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
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<td></td>
<td></td>
<td>Online behavior</td>
</tr>
<tr>
<td>3 Constructing and releasing guidance information</td>
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<td>20 Summative assessment</td>
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<td>4 Building and publishing learning resources</td>
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<td>22 Teaching reflection and teaching record</td>
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<td>5 Publishing learning tasks and activities</td>
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<td>23 Giving expansion questions and answering questions</td>
<td>Offline behavior</td>
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<td>7 Online answer</td>
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<td>Offline behavior</td>
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<td>9 Student learning behavior assessment</td>
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<td>Offline behavior</td>
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<td>10 Adjustment of classroom instruction content</td>
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<td>Offline behavior</td>
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<td>1 Online and offline integrated design</td>
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<td>2 Determination of teaching objectives</td>
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<td>12 Classroom teaching and answering questions</td>
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<td>Offline behavior</td>
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<td>13 Classroom task release</td>
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<td>15 Classroom task guidance</td>
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<td>17 Formative assessment</td>
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<td>18 Assign homework after class</td>
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<td>19 Finish one's homework</td>
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<td>21 Completing learning reflection and learning record</td>
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<td>24 Complete the development problem independently</td>
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<td>Offline behavior</td>
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<tr>
<td>Student</td>
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<td>Offline behavior</td>
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<td>6 Conducting online learning according to the guidance list</td>
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<td>8 Feedback on online learning results</td>
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<td>14 Collaborate in classroom tasks</td>
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<td>16 Submit materialized results</td>
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<td>11 Other preparation before class</td>
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<td>Offline behavior</td>
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<tr>
<td>10 Adjustment of classroom instruction content</td>
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### 6. Conclusion

This paper first introduces the connotation of computational thinking. Through the discussion of the connotation of computational thinking, we can find that it is very important to cultivate students' computational thinking. At present, teachers neglect the cultivation of students' computational
thinking ability in the course of teaching C language, so we should change the boring teaching method of explaining theory in the past. Only by grasping the computational thinking can students truly master the knowledge they have learned. This paper focuses on the teaching reform of C language course based on the cultivation of computational thinking ability. Practice shows that introducing computational thinking into C language course conforms to the law of students' learning cognition, makes students from perceptual knowledge to rational knowledge, which can fully mobilize the enthusiasm of students' interest in learning and motivate students to learn, to improve the students' analytical problem solving capacity issues and improve their practical ability, teaching is no longer confined to books, expanding the horizons of students learning. Computational thinking has provided a clue for the reform of computer-based course in college.

References


