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# Case-Driven Teaching Reform and Practice on Course of Introduction to Computer Science and Technology for Main Courses Integration

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**Abstract:** Aiming at the problems such as scattered and complicated knowledge points, as well as abstract and tedious contents in the teaching of Introduction to Computer Science and Technology, this paper adopts a case-driven approach to integrate and elaborate the contents of main courses and clarify their internal logical couplings. Accordingly, a case-driven teaching method oriented to main courses integration is proposed. Years of teaching practice show that this method can not only improve students' deep understanding of the professional curriculum system, but also effectively cultivate their systematic thinking ability, which plays a positive role in promoting the study of subsequent professional courses.

**Keywords:** Introduction to Computer Science and Technology; Case-driven; Main courses; Systematic thinking.

## 1. Introduction

In 2025, China promulgated the " Outline of the Plan for Building China into a Leading Country in Education (2024–2035) ", which clearly proposed to build a self-strengthening and excellent higher education system[1]. For majors of computer science and technology (CST), cultivating students' ability of systematic thinking is a core goal, and it is also an inevitable way to break the bottleneck technology[2]. The course of " Introduction to Computer Science and Technology" (ICST) is the first professional foundation course designed for undergraduate students majored in CST [3]. Its purpose is to introduce the overall situation of the discipline and construct a framework of professional basic knowledge, providing students with a panoramic view and system foundation for their subsequent study of professional courses. However, how to select and organize teaching content has always been a difficult issue in course teaching.

Generally, the course contents of ICST have been roughly divided into three organizational methods[4]. (1)Introducing the operation of common softwares, such as office softwares, operating systems, and so on. This method was a popular organization in the early textbooks of ICST. (2) Preliminary introduction to the main computer courses. This method is the mainstream way of organizing teaching content in current ICST teaching. Some scholars[5-6] have also introduced cutting-edge knowledge of quantum computing and other disciplines into ICST, enriching the teaching content. However, how to organize the knowledge of main courses has always been a teaching difficulty, because if it is only a general "preview" of scattered knowledge points in ICST, abstract and boring content will not only confuse students, but also easily dampen their learning interest. (3) Introducing computational thinking. This method mainly focuses on teaching computational thinking, and in recent years, some universities have adopted this model [7-8]. However, how to build a professional curriculum system framework is still a problem that needs to be solved.

In the long-term teaching practice, we have extracted a case-driven teaching method for the integration of main courses in ICST. This method relies on specific cases to provide a clear and concise introduction to the core courses of CST majors. It connects the internal logical couplings of the main computer courses, thus highlighting the collaborative working mechanism of computer hardware and software, and cultivating students' systematic thinking ability.

## 2. Teching Contents of ICST Course

ICST briefly introduces the main courses of CST major under a content intercoupling framework. Specifically, on the basis of introducing the curriculum system, this course introduces the following knowledges, including data representation (DR), storage (DS), and computation (DC), C language programming (CL), computer composition principles (CCP), data structures and algorithms (DSA), operating systems (OS), computer networks (CN), and artificial intelligence (AI). The content organization is progressive, closely connected, and logically coherent. On the basis of the computer conceptions, DR, DS, and DC are the foundation for a deeper understanding of CL and CCP. Computer hardware (described in CCP) is the physical carrier for OS, while advanced programming languages (for example CL) and DSA are essential knowledge for implementing OS. CN realizes computer interconnection and many functions have been integrated into OS, while the implementation of AI is based on existing computer systems, which involve all the courses' contents mentioned above.

## 3. Case-driven Intercoupling Teaching of Professional Courses

As shown in Figure 1, the ICST course firstly presents basic concepts, such as DR, DS, and DC, then it introduces the basic syntax of CL. Afterwards, by analyzing the execution process of machine level instructions corresponding to the sequence, selection, and loop structure of CL programs on computer hardware (CPU and memory), the composition and working principle of computer hardware are introduced, and the relationship between CL, CCP, and compiler is integrated. Next, ICST gives the basic concepts of DSA. Based on this, it explains the process of OS from startup to execution, connects the basic functions of OS and their collaboration

with computer hardware, and analyzes the DSAs used in them. Then, the course takes visiting a certain website as an example to introduce the working process of CN, and then combines the main functions of the OSI reference model to connect networks. At the same time, it introduces the relationship between CN and OS, as well as commonly used DSAs in CN. Finally, AI is currently a research hotspot in information technology, which revolves around the development and deployment of computer systems that can mimic and implement human cognitive and decision-making abilities. Therefore, the ICST course will introduce the basic concepts and application scenarios of AI.

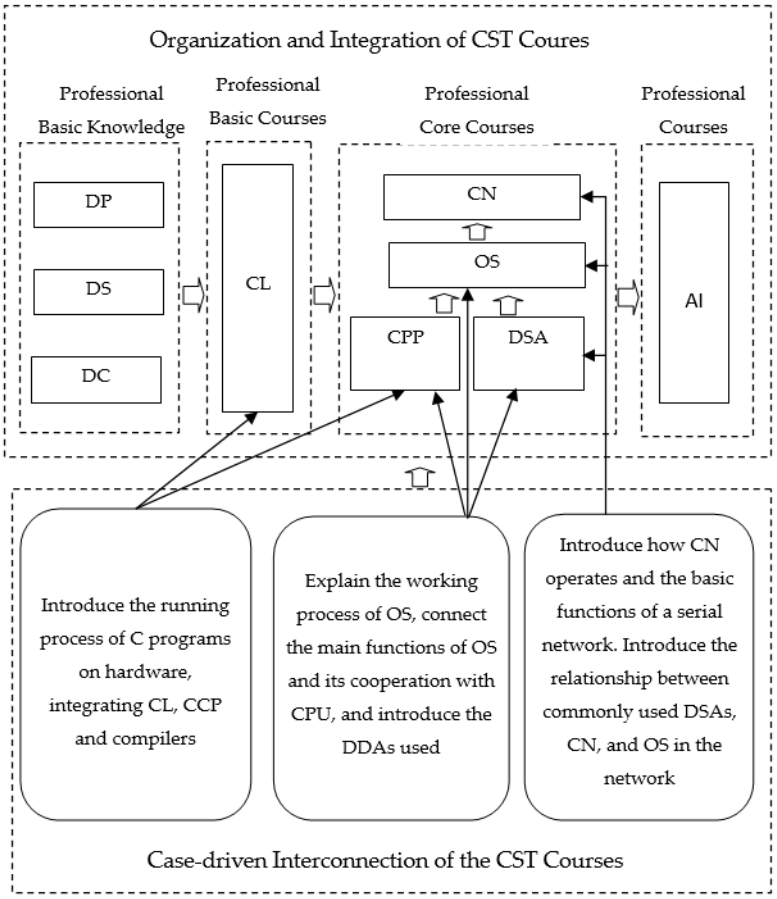



**Figure 1.** Case-driven intercoupling teaching of professional courses

## 4. Teaching Case Presentation

Taking the following C language program as an example, we illustrate its execution process on the prototype computer[9].

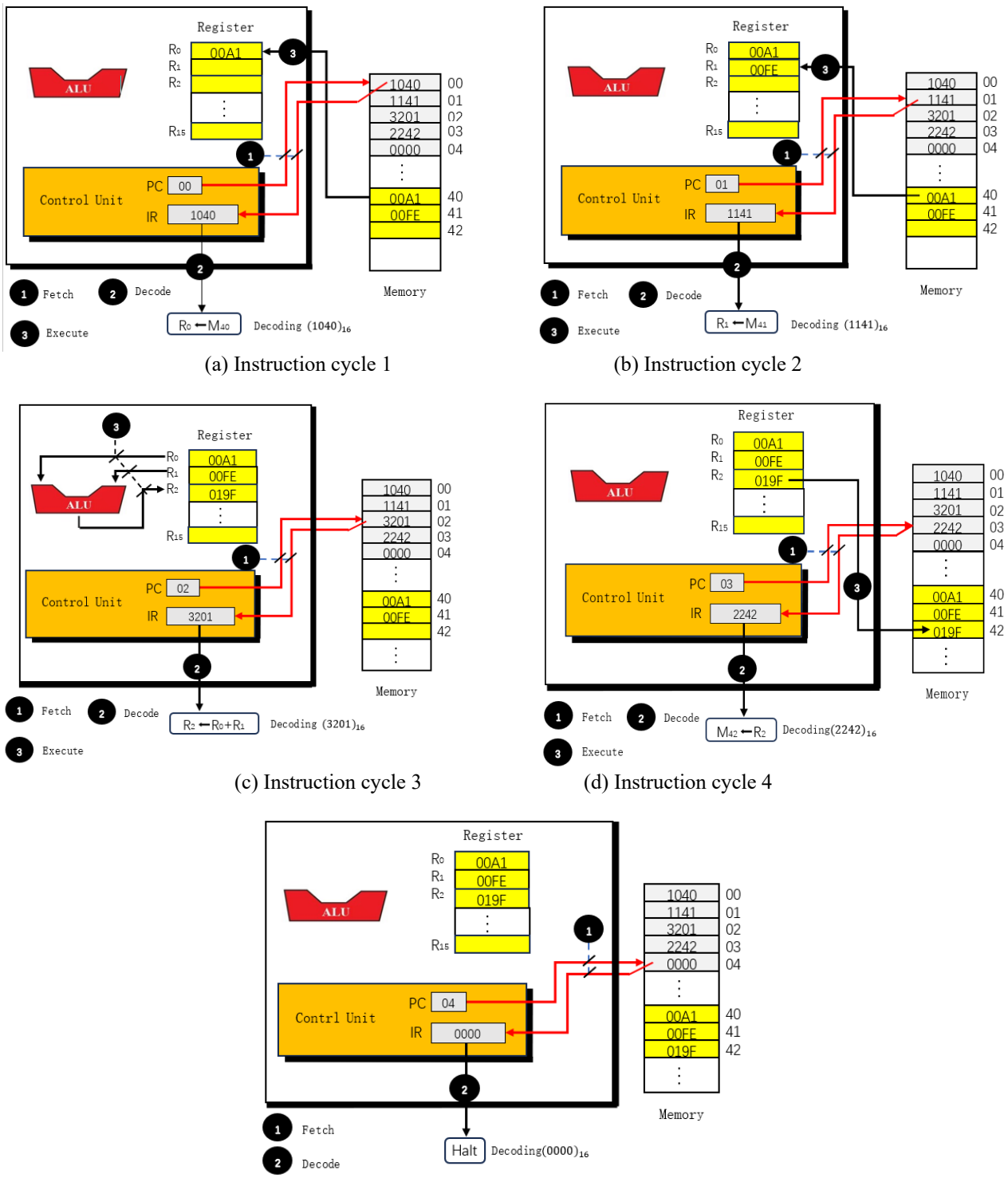
```
void main ()
{
    int a, b, c;
    a=161;
    b=254;
    c=a+b;
}
```

The function of this program is to calculate the sum of variables a (value 177) and b (value 242) and assign it to variable c. Variables represent a storage unit with specific properties, so the values of variables a and b are stored in the memory of a prototype computer. Assuming that the above C program has been compiled into the machine level instructions corresponding to Table 1, since the prototype computer's memory units $(40)_{16}$ to $(FD)_{16}$ are used to store data, it is assumed that the value of variable a is stored in memory unit $(40)_{16}$, the value of variable b is stored in memory unit $(41)_{16}$, and the sum of a and b is stored in memory unit $(42)_{16}$.

**Table 1.** Machine level instructions corresponding to C language programs

| No. | Instruction codes | Meanings of instruction codes |
|---|---|---|
| 1 | $(1040)_{16}$ | Retrieve value from memory unit $M_{40}$ and send it to register $R_0$, abbreviated as $R_0 \leftarrow M_{40}$ |
| 2 | $(1141)_{16}$ | Retrieve value from memory unit $M_{41}$ and send it to register $R_1$, abbreviated as $R_1 \leftarrow M_{41}$ |
| 3 | $(3201)_{16}$ | Sum the values of $R_0$ and $R_1$ and store them in register $R_2$, abbreviated as $R_2 \leftarrow R_1+R_0$ |
| 4 | $(2422)_{16}$ | Write the value of $R_2$ back to memory unit $M_{42}$, abbreviated as $M_{42} \leftarrow R_2$ |
| 5 | $(0000)_{16}$ | Program ends, HALT instruction |

The execution process of the above 5 machine instructions in CPU and memory is shown in Figure 2.




(a) Instruction cycle 1

(b) Instruction cycle 2

(c) Instruction cycle 3

(d) Instruction cycle 4

(e) Instruction cycle 5

**Figure 2.** An teaching case integrating C program and computer composition principles

## 5. Teaching Practice Process

In the ICST teaching process, we always aim to build a professional framework of curriculum system, and cultivate systematic thinking ability for the integration of main courses. We adopt a case-driven teaching method to introduce the contents of main courses, and integrate ideological and political elements into the curriculum based on the flipped classroom teaching method [10]. The teaching organization and practical methods of the course are shown in Figure 3.

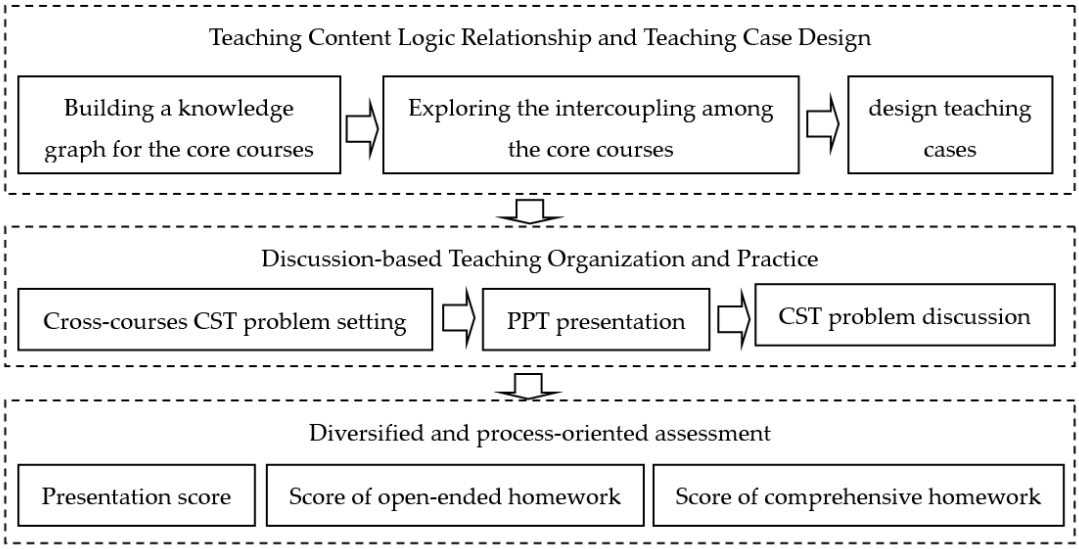



**Figure 3.** Teaching organization and practical methods of the ICST course

Lot of teaching practices have shown that the proposed teaching method can effectively construct a panoramic view of the professional curriculum system for students during their freshman year, and students will delve into subsequent professional courses with questions in mind. This method can not only stimulate students' learning interest, but also help them deepen their understanding of computer systems. The teaching practice process and student feedback show that this method is effective.

# 6. Conclusion

For a long time, how to guide the framework knowledge of CST for freshmen has always been a teaching difficulty in ICST courses. In today's context of connotative development in higher education, the CST major emphasizes the cultivation of systematic abilities. Long term teaching practices have shown that using the ICST course as the "general outline" and systematically introducing the professional curriculum system, it is feasible to integrate case-driven teaching methods for the core courses of CST. This method can not only connect the core contents of a single course based on specific cases, but also connect the internal logical connections of the core courses, thereby enabling students to understand the mechanism of computer hardware and software collaboration, laying a good foundation for the subsequent study of professional courses. In the future, we will further enrich the contents of main courses in the ICST and construct a panoramic view of professional knowledge based on knowledge graphs.

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