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Research on Case Teaching Mode of Programming Course Based on Interdisciplinarity

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***Abstract*—Under the background of new engineering, it is a new challenge to the basic computer programming course in Colleges and universities. How to integrate it with the specialty and better serve the specialty is the direction and focus of the reform. Starting with chemistry and electronics, the study aims at carry out the reform in teaching mode, by using reasonably MOOC and other teaching means to realize the integrated teaching of online and offline and group discussion. At the same time, reasonable cases relating to specialty are designed to fully arouse students' interest in learning. The feasibility has been fully verified in three semesters' comparative teaching. This mode can be applied to different majors, so that the Interdisciplinarity not only expands the width, but also excavates the depth.**

Keywords—Interdisciplinarity; offline; panel discussion

I. INTRODUCTION

Big data, cloud computing, Cyberspace Security and other emerging technologies mark the arrival of the era of intelligence. Higher requirements are put forward for college students' abilities. They not only need the proficiency in basic computer operation, but also the ability of programming in order to better meet the professional needs in future study and work. In the process of new engineering construction, how to integrate computer programming course with specialty at the beginning of college and improve the teaching quality of this course is conducive to teaching reform, educational innovation and the cultivation of innovative talents [1].

The ultimate goal of programming teaching is to cultivate Computational Thinking and improve programming ability. How to improve students' basic grammar norms to master programming skills and ultimately to cultivate their computational thinking ability is the key to solve the problem.

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Reform of Teaching Model

C language programming is a professional basic course closely related to theory and engineering practice. The goal of training is to master basic grammar rules and algorithm ideas, to solve practical problems by using C language programming, and to lay a good foundation for the practice of follow-up courses.

"Overemphasizing grammar, but ignoring students' ability" is a common problem in current programming courses. Although this teaching mode is beneficial to the systematic and complete knowledge, it ignores the students' ability of programming and creative thinking, especially the complexity and flexibility of C language grammar. Various grammatical details make students hesitate and can't make students aware of them. It is difficult to achieve good teaching effect by establishing a real programming idea, so that students' enthusiasm for language learning is not high. Stanford University 2025 Plan puts forward the concept of axis reversal, which turns "knowledge first" into "ability first", and ability becomes the basis of undergraduate study. Nowadays, many educators have put forward the idea of "emphasizing procedure and ignoring grammar" and the principle of "strengthening algorithm and weakening language". The focus of teaching is shifted to the cultivation of programming ability, but the grammar and algorithm ideas of C language complement each other. Without the support of basic grammar, it is difficult to concretize programming ideas. The realization of the algorithm needs specific sentences. How to attend to one thing without losing sight of another in limited school hours? The online and offline teaching mode which is based on task-driven group discussion provides us with a solution.

For on-line teaching, the teachers can extract relevant knowledge points by analyzing coherence of lessons to design the task and content, and make them into video and release it on the network. Students can preview knowledge points and study the teaching videos by themselves before class. If the students have any problems, they can consult relevant materials

and ask questions by leaving messages online. Teachers and students can communicate with each other online. This way can help to cultivate students' autonomous learning ability and facilitate the discussion-based teaching. As for the simple basic grammar students can preview before class. Through the tests, the teacher can evaluate whether the students have met the target requirements. If there is any question, the question can be brought to the off-line classroom. It is an effective way to transform "task-driven" teaching into "problem-driven" teaching.

For offline teaching, the concept of "student-centered, teacher-assisted" enables students to be the main body of the classroom and teachers play a guiding role. Teachers use heuristic questioning to make up the on-line teaching and learning. Teachers can divide students into different groups and divide the tasks to design the comprehensive case of interoperability. After defining the learning objectives, students can consolidate their knowledge and better cultivate their knowledge and their ability to calculate and think through group discussion.

By combining on-line and off-line modes, students publish case reports. Teachers keep track of the progress of each case, extract and discuss students' problems to help the students digest the difficult points, and teachers can design test questions according to the teaching content and students' learning progress to conduct follow-up evaluations.

II. CASE SELECTION BASED ON DISCIPLINE INTERSECTION

As a general course for freshmen, "Computer Program Design" is for students of different majors in the university. Because of the different requirements for program design in different disciplines and majors, some majors pay attention to scientific computing, some majors pay attention to data processing, and some majors pay attention to communication and control. If we simply locate the programming course in the general course, we cannot meet the various needs[2] In the face of different professional needs, if we adopt the same plan, the same case and the same basic examples, such as finding prime numbers, cumulative summation, factorial, equation, Fibolacci sequence, bubble sort and other simple mathematical problems, and the basic programming knowledge, we cannot meet the students' needs, and we cannot associate our teaching with students' professional requirements As a result, the students might feel that learning is useless, they have no motivation to learn, which will lead many students to think that non-computer professional programming courses are useless, the purpose of learning is only to study for an examination or a certificate. The students' self-learning ability is poor, and the teaching effect is hard to improve. We need to design relevant cases, assignments and comprehensive training topics according to various professional needs. Effective combination of general education with professional needs can realize the sublimation from the teaching of programming knowledge to the training of programming ability.

A. *Case Analysis of Interdisciplinary Combination with Chemistry Major*

The author investigates and studies the follow-up professional needs of chemistry majors. According to the reasonable design cases, for example, quantitative analysis of chemical equilibrium is the core of analytical chemistry, which involves more complex mathematical processing. Programming can achieve precise analysis. In analytical chemistry, generally, the equation is not too complicated, and most of them are to solve the concentration, such as the common problem of finding pH. Students can use relating engineering software such as MATLAB. If the reader has already learned a high-level language, it will take him or her only a week or less to completely understand it and use it skillfully. In the studying for the Master's degree, analytical chemistry and computer are more and more closely linked. Some studies often use computer modeling to simulate complex molecules and complex reactions. At this time, engineering software is not competent; students need to design their own programs, so to train students' programming ability lays a solid foundation for their subsequent professional upgrading.

For freshmen who do not have in-depth study in professional courses, the selection of cases should not only consider the combination with specialty, but also not rely too much on professional knowledge. Some independent and less complex problems for solving equations can be appropriately selected. For example, the "dichotomy" method is used to solve the equation. Other algorithms for finding roots of equations include fixed point iteration (Picard iteration), tangent method (Newton-Raphson iteration), secant iteration and so on. Compared with various iteration methods, the dichotomy method does not need to establish iteration formulas, to consider the initial value of iteration, nor to consider the convergence of iteration, so it is easy to use, especially for non-computer professional users [3].

Case: The solution of equation $2X^3+3X^2-17X-30=0$ in the interval [1,10] is obtained by dichotomy. The concentration of hydrogen ion and PH are calculated by Newton method in the solution of Ac with concentration of 1.0×10^{-5} mol/L (or 1.0×10^{-6}mol/L). It is known that $Ka=1.80*10^{-5}$, $Kw=1.0*10^{-14}$, and $\varepsilon=1.0*10^{-6}$.

The C language program is as follows:

```
#include<stdio.h>
 void main()
 {
    double  a,b,c,m,n,y;
    scanf("%lf%lf",&a, &b);/*  Pay attention to
f(a)>0,f(b<0)*/
   for(;a-b<=0.01;)
    {m=2*pow(a,3)+3*pow(a,2)-17*a-30;
    n=2*pow(b,3)+3*pow(b,2)-17*b-30;
    c=(a+b)/2;
    y= 2*pow(c,3)+3*pow(c,2)-17*c-30;
    if(y>0)
      a=c;
    else
      b=c;}
   printf("%ld",c);
 }
```

Case design is from simplicity to complexity to optimization. It gradually introduces various grammatical elements of C language and elaborates the concepts of C language from a professional point of view through the continuous changes of practical applications and the continuous expansion of case functions. This can better strengthen students' understanding and application of knowledge; especially improve students' understanding and using of the knowledge, which is conducive to the cultivation of practical engineering ability.

B. Case Study of Interdisciplinary Combination with Embedded and Single Chip Computer Systems

C Language Programming is the first program design course for freshmen in general courses. Many students majoring in embedded and single-chip computer systems have not yet learned more relevant professional knowledge. How to make the teaching of C language more close to specialty and let students, who know nothing about Hardware, understand the importance and be interested in C language in further professional study. So simple and easy cases of hardware system structure should be selected [4]. Vivid classroom teaching can also increase students' confidence in programming and their desire for professional knowledge. At the same time, it can also help students learn more about the future and lay a solid foundation for professional programming.

1) Reasonable case selection

For the students majoring in electrical engineering, the focus of C language teaching is the reasonable choice of cases. It should not only be related to the major, but also get rid of the restriction of professional knowledge, so that freshmen with relatively weak hardware foundation can experience the effect of hardware programming and feel the soul and charm of C language better.

Choose a simple and clear prototype case, so that students do not need to do more research on hardware, such as the circuit design of the pipeline LED lamp, as shown in Figure 1. This circuit has only one button switch and many LED lights. It can use multi-branch selection and cyclic structure to realize the cyclic lighting of multi-street lamps. Students can fully understand and practice the branch selection and cyclic structure of C language. At the same time, we can call the delay function to let students improve the concept of function and the idea of structured programming. At the same time, we can use arrays and pointers, which can greatly enhance the recognition and application of arrays and pointers. Teachers can prepare for the experiment in advance, and cooperate with the experiment in case demonstration to make the experiment more vivid and convincing. At the same time, the system can simulate experiments or, if conditions permit, allow students to assemble by themselves, which can improve students' practical ability and at the same time make students feel that learning is useful and the sense of achievement is doubled.

2) The same case study corresponding to different knowledge structures

Although standard C and single chip C51 are very consistent in many aspects, there are still some details to be distinguished [5]. Before explaining the case, special topics are needed, such as the use of header files, the way of input and output, and so on. This case uses switch structure to realize the circular lighting of LED 1 ~ LED 8. The knowledge of circuit design only needs a little dialing. The realization process of C language can be emphasized from different angles [6].

The same program can adopt a variety of programming design schemes, so that students can give full play to their programming imagination, use the knowledge they have learned, and experience the systematicness of C language and the openness of programming. By repeated debugging and improvement, students can deeply understand the idea of program design and at the same time increase the cohesion of the classroom. Discussions between students and teachers, students and students will be more practical and effective. And at the same time, it can fully mobilize students' initiative and creativity in learning, and can allocate multiple learning collaboration. The group can still discuss and study after class.

At present, the feedback survey on the teaching reform of the students majoring in MCU shows that C language teaching has great influence on students' professional learning, this mode can better integrate with professional knowledge, improve students’ learning motivation, and make self-study easy. In the reform of new engineering construction, how C language, as a general course, serves the specialty relating to electrical majors？ We can start with single chip computer programming, which not only does not need too much hardware knowledge, but also embodies the practicability of programming. In case selection, we should choose more "useful" and "interesting" cases to improve students' practical ability and programming ability to lay a good foundation for further specialty.

Under the background of new engineering, the interdisciplinary integration is the foothold of new engineering construction. As a general course, the program design should better integrate with specialty to serve specialty and lay a solid foundation for professional creativity and initiative. The interdisciplinary integration will combine the course construction with other professional courses, give full play to the advantages of general course, and truly improve students' practice and innovation and cooperation. Programming has a strong demand for practicality. The training of programming ability can not only rely on teaching courses, but also on students' gradual training through practice. In order to improve students' engineering practice ability, we have set up a large number of practical links in the course of programming. According to the steps of practical problems to be solved, students are divided into to complete a series of tasks. Students can collect relevant information in combination with their professional knowledge and research interests, and cooperate to complete data analysis and modeling, solve relating tasks, write experimental reports, and complete comprehensive experiments. Teachers give guidance to students in the process, regularly check the progress of students and give quantitative evaluation results to complete the comprehensive experimental teaching process. Through this task, students' enthusiasm can be fully mobilized, students' active thinking can be triggered, and students' programming ability can be cultivated.

III. Conclusion

The real value of knowledge lies in practice, and the fundamental purpose of learning lies in application. In order to accumulate practical experience and enhance application ability, we should take ability training as the orientation, integrate knowledge into practice, and then learn new knowledge to solve problems encountered in practice. Only by constantly finding and solving new problems from the combination of knowledge and practice can students truly master programming technology.

Under the framework of general education, programming teaching should take into account the knowledge structure and ability requirements of students of different majors to construct a new teaching system and mode, design teaching cases systematically and scientifically, implement individualized teaching, cultivate students' computing thinking ability, and provide good information technology support for the study of various majors.

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