Research on the Training System of Software Technology Professionals Based on Computational Thinking

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Abstract. Computational thinking is the key content of current research in the field of education. Integrating computational thinking into the software professional training system and improving students' ability has become a hot topic in the field of education. The article first analyzes the advantages of computational thinking in the cultivation of students' abilities; then, through the setting of the curriculum system, the research on the talent training mode is carried out; finally, the framework model of school-enterprise cooperation is established.

Introduction

In March 2006, Professor Zhou Yizhen from American computer scientist and Carnegie Mellon University published a related article on computational thinking in the magazine "Communications of the ACM", the authoritative journal of American computers. The specific concept of Computational Thinking). Professor Zhou Yizhen believes that computational thinking is a series of thinking activities that cover the breadth of computer science, such as problem solving, system design, and human behavior understanding, using the basic concepts of computer science. The computational thinking mentioned here is actually not a computer program design and software program, but a way of thinking that comprehensively uses the basic concepts of computers to solve problems and understand human behavior [1].

There are many programming courses in the software technology major. Computer programming courses have a wide range of knowledge, grammatical rules, flexible use, abstract and difficult to understand, and the programming ideas and basics of computer programming languages. The method has a certain relationship with computational thinking, especially the analysis and understanding of the problem, the design of the algorithm framework, and the writing of the code are very prominent. The cultivation process of software technology professionals should be based on “computational thinking”. The main purpose is to cultivate students' logical thinking ability to solve and analyze problems. After students acquire the ability of computational thinking, they can not only complete other computer fields independently. Learning the programming language course, you can also independently learn the relevant courses in the computer field, and also learn the knowledge content of other professional fields. Therefore, it is necessary to introduce computational thinking in the design process of software talent training [2].

Curriculum

In order to better cultivate the computational thinking ability of software technology students, we have established three major curriculum systems: quality education curriculum system, competence training curriculum system and thinking development curriculum system.

Quality Education Curriculum System. The quality education curriculum system consists of ideological and political, physical and foreign language courses prescribed by the major countries. At the same time, the basic backbone courses of software technology with computational thinking are integrated into the curriculum system. The specific curriculum system consists of ideological and political theory and university sports. , public foreign languages, advanced mathematics, computer foundation, employment education and guidance, data structure, C language programming foundation, Oracle, professional English, operating system and other courses.

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Capacity Development Curriculum. In the capacity development curriculum system, it mainly includes language programming courses such as Visual Basic programming, XML foundation, ASP.NET, computer network technology foundation, software engineering, unified modeling language UML, Python programming, Java programming, etc. Through the study of these courses, the use of students to computer programming can be from shallow to deep, from a single process-oriented language to object-oriented programming language, from a single simple program to the development of large database programs, through The step-by-step learning process teaches students not only the single code writing problem, but also the specific solutions and ideas that only solve the problem, thus improving the thinking ability of the student programming.

Thinking development curriculum system. Through the time of the theoretical course, students will master the basic principles of each course and the methods of analyzing and solving problems, but the students did not apply these contents in the specific practice process. We will practice in the thinking expansion curriculum system. The relatively strong curriculum sets up a separate and practical training session. Through the centralized operation in the laboratory, the students can practice the hands-on operation ability, thereby improving the students' hands-on operation ability and expanding the students' thinking. Professional post-skills comprehensive internship, graduation design and other links, let students recognize the work process of the enterprise, and lay the foundation for the students' future posts [3].

Talent Training Measures

Implement "two continuous, three combined". "Two continuous" refers to the continuous three-year continuous practice of practical teaching, and the professional basic skills are continuously continuous for three years. "Three combinations" refers to the combination of theory and practice, the combination of lessons and practice, and the combination of school and corporate positions. In order to ensure the "two continuous" and "three-in-one" implementation in place, truly achieve the purpose of cultivating and cultivating students' thinking and training, combined with the "IT Club" established by our school and the spontaneous programming activities of students, constantly guiding students' thinking ability training .

Adhere To The Combination Of "engineering and learning" And Differential Education. Carry out training measures based on the combination of engineering and learning, and combine the difference education to develop software technology professionals.

(1) Using the Institute of Computer Application of our school, students are allowed to participate in scientific research projects hosted by teachers, and to develop analytical skills, problem-solving skills, resilience and teamwork skills.

(2) Student participates in the management of the laboratory. Through the work of the laboratory, the ability of some students can be first enhanced, and then they can be used to encourage, guide and motivate other students to participate actively to improve their abilities. Excellent students It can promote students with poor learning ability and carry out differential education through mutual learning of students.

(3) Closely integrate the activities of the “IT Club” of our school, and gradually carry out scientific and technological lectures, discipline competitions and other capacity improvement activities to promote students' interest in learning and improve students' professional learning enthusiasm.

(4) Interconnecting with the enterprise, so that the students' comprehensive post-skills internships are consistent with the needs of the enterprise, and the real questions and teamwork are completed.

Focus On Practice And Improve Hands-on Ability. The software technology major is a special profession, which requires students to have a broad knowledge of the width of the knowledge, but also requires students to have a strong practical ability. During the three-year period, students arrange their study time reasonably, and through various methods, such as in-class experiments, concentrated practice, on-campus training, and off-campus training, cultivate students' interest in learning and improve their hands-on ability. After leaving school, students can quickly adapt to their jobs based on their acquired abilities and skills. According to the self-learning ability that has been obtained, it can adapt to the computer industry that is developing at a high speed [4].

Promote Multi-directional, Wide-caliber Training System. Students can participate in computer self-study, Microsoft certification exams, computer professional and technical qualifications and level exams during their study period. At the same time, the professional thinking ability training system has opened two different restricted course directions: computer program design and computer system analysis. The setting of the direction course refers to the examination course of China Computer Software Professional Technical Qualification and Level Examination [5]. At the same time as the limited course, the instructor will guide the students throughout the course, so that students can expand from two aspects: computer programming, computer system analysis, business management application design, WEB application design, software testing, information processing, etc. . Expand students' knowledge and enhance students' choice and competitiveness in choosing a career.

Practicing Education. In the process of cultivating students' thinking ability, quality education, ability training and thinking development rely on each other and infiltrate each other. In the whole teaching process, the professional basic course teaching is the main line, with optional courses as the auxiliary line, the practice links, graduation Design a comprehensive, step-by-step teaching approach to students. For normal graduates, the whole school will be completed in the first semester and the second semester. The second semester, the fourth semester, the fifth semester, and the basic courses and compulsory courses will be offered. Students can take the exams for some courses of the computer self-study exam and Microsoft certification. Exams, computer grades, etc. In the fourth and fifth semester, professional courses and professional related courses are offered, and a variety of certificate examinations can be taken. In the sixth semester, graduate internship and graduation design began.

Carry Out The Training Mode Of "one specialization, multiple energy, one life and more certificates". Students can strive to obtain computer self-study undergraduate certificate, Adobe Media certificate, SUNMS certificate, NIT national computer application technology certificate test, Microsoft certification test certificate IT professional certificate and other test certificates according to their own abilities and hobbies, China computer software professional technical qualifications and level Exam certificates, etc., the process of obtaining these certificates is a gradual process, which is the process of improving students' thinking ability.

Software Talent Training Mode Based on Computational Thinking

The design of the talent training model mainly reflects the improvement process of computational thinking. When designing the talent training mode, the curriculum will be deeply integrated with the enterprise, and the talent training mode of “work task orientation and capacity improvement” will be implemented.

The school-enterprise combined talent training model of “work task orientation and ability improvement” is a process of cultivating the formation of professional job skills, effectively refining the typical tasks in the enterprise work, and transforming the work tasks into course content. The task of the course is to post-decompose the work tasks, design the teaching objectives, teaching tasks and teaching content according to the job position, so that the students can gradually improve the job ability and cultivate the students' computational thinking ability while completing the design tasks. The target requirements for talent development.

"Task-oriented, thinking-enhanced" Teaching Mode. The school-enterprise cooperation talent training mode of “work task orientation and capacity improvement” divides the process of capacity development into three stages, namely, the capacity accumulation stage, the capability development stage and the comprehensive practice stage. The specific design and arrangement process is shown in Table 1. Shown.

(1) The ability accumulation stage is mainly to train students' individual ability, combined with the school laboratory and the practice base outside the school, through the combination of theory and practice, starting from simple and independent tasks, gradually overcoming complex tasks, thus forming a single occupation. Ability [6]. In the process of cultivating this link, with the task of work as the platform, through the simple steps of reading the program, writing the program, debugging the

program and testing the program, gradually increase the difficulty of the program in the work task, so that the students can form a clearer understanding of the programming process. The understanding, so as to master the essentials of the programming stage, lay the foundation for the integration of professional capabilities.

(2) The ability development stage mainly cultivates students' comprehensive ability. After the students get the single ability improvement, they can simulate some simple tasks in the post, through the simulation task given by the enterprise, and decompose the simulation task, and under the guidance of the teacher, complete some small tasks after decomposition. Form the students' comprehensive professional ability, and at the same time make the students' computational thinking ability gradually improve, and prepare students for the development of real software projects.

(3) The comprehensive practice stage mainly cultivates students' understanding of software engineering and forms students' software engineering ideas, so that students can effectively develop enterprise projects after having the idea of software engineering. At this stage, students can comprehensively improve their work ability and professional position ability by participating in a complete software engineering project [6]. In the comprehensive practice stage, students first conduct productive internships in the school-enterprise cooperation training base. The instructors divide the students into several project teams according to the size of the company's work tasks, and arrange a project team in each project team. Long, under the unified management of the project leader, assign the corresponding task to the project members. The whole process is carried out under the supervision of the instructor. The identity of the students is changed to the programmers in the project. These students can master according to their own. Knowledge and expertise play the role of different project team members. The software project development team develops a large software project from survey analysis, requirements analysis, summary design, detailed design, software coding, software testing, software operation and maintenance [7]. Through this session, students can get real exercise and have also greatly improved their computational thinking.

Table 1 "Task-oriented, thinking improvement" teaching mode

Stage		Practice Mode	Work Tasks	Project Carrier	Thinking Improvement
Capacity accumulation	First semester	Basic skill training	Independent work task	Writing a single function program	Single professional ability
	Second semester				
Capacity development	Third semester	Multi-post cross training	Compound work task	Developing small software	Comprehensive professional ability
	Fourth semester				
Comprehensive Practice	Fifth semester	Productive internship	Real work task	Developing real projects	Professional ability migration
	Sixth semester	Internships	Corporate work tasks	Developing enterprise projects	Job ability
Talent specification		Competent software development position			

Enterprises Entering The Campus. The strong support condition for the school-enterprise cooperation model of “work task orientation and capacity improvement” is the enterprise, and the requirements for the enterprise are very high [8]. Therefore, it is required to deepen the understanding of the enterprise, carry out in-depth cooperation with the enterprise, introduce the software enterprise into the campus, and establish an internship base together with the enterprise, so that the students can feel that the learning of the school is the working environment of the enterprise, and the students can A better foundation for a competent corporate position [9].

(1) When the software enterprise enters the campus of the science and technology park, the enterprise within the school becomes the base for students to learn and practice, and the entire management process is controlled by the full name of the enterprise.

(2) In the productive internship training, the students use the management method of the enterprise to replace the teacher management and the management of the counselor, so that the identity of the students is truly transformed into “corporate employees”. The change of identity is conducive to the study of students and can stimulate the expansion of students' thinking ability.

(3) The school conducts the teaching management of the students, the enterprises participate in the teaching management of the school, integrate the tasks of the enterprise into the curriculum of the school, and carry out the teaching of the teachers to teach the students.

(4) The content of students in the productive training practice is aimed at the enterprise work tasks, and the work tasks are effectively combined with the teaching links and teaching contents.

(5) Adopting the standards of enterprise management to evaluate the students' practice links, and evaluate the quality standards, benefit evaluation and reliability of software projects designed by students [10].

Summary

Integrating computational thinking into the process of training software professionals, reforming the traditional teaching model, combining the teaching process with the enterprise, can achieve the "postalization" of teaching objectives, the teaching content "work task", the teaching process "enterprise", The teaching evaluation is “engineering”, which enhances students' computing thinking ability, enhances students' employment competitiveness, and promotes the effective improvement of the quality of software technology.

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References

[1] F. Liu. Reform and Practice of Computer Language Course Teaching Model Based on Computational Thinking[J]. Journal of Heilongjiang Institute of Technology, 2016, 16(1):19-21.

[2] F. Liu., W.W. Guo. Research on Teaching Reform of VB Programming Based on Computational Thinking[J]. Journal of Lanzhou University of Arts and Science(Natural Science Edition), 2015, 29(6): 115-118.

[3] F. Liu. Analysis of the Teaching Reform Effect of Visual Basic Programming Based on Computational Thinking[J]. Journal of Lanzhou University of Arts and Science(Natural Science Edition), 2017(4).

[4] W.W. Guo and F. Liu. Application of Computational Thinking-oriented Teaching Model in VB Programming Course[J]. Journal of Wuhan Polytechnic, 2015(4): 55-57.

[5] J.H. Chen. Practical Exploration of Strengthening Computational Thinking Training in Programming Courses[J].Computer Education,2009,(20)):84-85.

[6] F. Liu, W.W. Guo and L. Shan. Development and Practice of Software Technology Professional Course Group Based on Work Process Model[J]. Heilongjiang Education (Higher Education Research and Evaluation), 2014(7): 28-29.

[7] J.M. Wu. Teaching Reform of Programming Courses and Cultivation of Computational Thinking[J]. Computer Education, 2012, (19): 17-23.

[8] R. Jia. The Practice of Computational Thinking in VisuaI Basic Programming Course[J].Computer Knowledge and Technology,2011,(25):62-66.

[9] Y.L. Shang. Research on VB programming course teaching of non-computer major based on computational thinking[J].Science & Technology,2013,(8):262-267.

[10] X.R. Zheng. Research and Practice of the Reform of Higher Vocational Software Curriculum System Based on Work Process[J]. Computer Education,2010,(8).