Embedded Software Development Talent Training Oriented by Innovation and Entrepreneurship

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ABSTRACT

In the current socialdevelopment, it is an important and difficult problem to improve the innovation and entrepreneurship ability of college students in current education. Higher educationfocuses on improving students' professional skills,ignoringcultivating students' innovation and entrepreneurship abilities. There is a phenomenon of "mismatch" betweenprofessional education and innovation entrepreneurship education.

In this paper, taking embedded software development direction as an example, the necessity of integrating professional education with innovation and entrepreneurship education is analyzed, and the effective ways to realize the integration of the two kinds of education are discussed. In the traditional courses of the embedded software, some universities pay more attention to theory than to practice. So these college graduates don’t have strong software technology innovation ability, design ability, and the development potential. In order to meet the purpose of training excellent engineers in colleges and universities, the embedded software education should be reformed and improved. Taking innovation and entrepreneurship as the orientation, systematic reform of embedded software-related courses is carried out. Taking the school-enterprise cooperative enterprises as the carrier, innovation and entrepreneurship education base is established. At the same time, embedded software competitions are promoted. The college Entrepreneurship Center help students stimulate entrepreneurial dream. So high-quality professional engineers are cultivated to meet the urgent needs of the society for innovative and entrepreneurial talents.

KEYWORDS

Embedded Software, Innovation and Entrepreneurship, Teaching Reform, C++ Programming

INTRODUCTION

At present, innovation and entrepreneurship education has become an important direction for higher education. Although general courses of innovation and entrepreneurship have been set up in many universities at this stage, the current teaching methods usually adopt elective courses, workshops or online education. The teaching content is relatively outdated and the teaching method is relatively simple. This makes the expansion of college students' own innovation and entrepreneurship capabilities limited. In theory, innovation and

entrepreneurship education should been organically integrated with professional curriculum education. This integration will be a necessary prerequisite to carry out teaching reform in colleges at present.

Based on the OBE(Outcome Based Education) education model, this article will take the direction of embedded software development as an example to discuss the reform of relevant professional courses and the implementation of the innovation and entrepreneurship training system, so as to better grasp the specific methods of innovation and entrepreneurship from the perspective of students.

INNOVATION AND ENTREPRENEURSHIP EDUCATION IN THE EMBEDDED SOFTWARE

In the traditional embedded software education, the phenomenon of taking less care of practice than theory in some colleges is prominent. It leads to more teaching hours, and weak engineering design ability for students. As the result of these disadvantages, the graduates are limited in theoretical knowledge, weak in technical innovation ability, design ability, and subsequent development potential.

In order to meet the purpose of universities as the cradle of engineer training, this paper proposes a practical teaching system of innovation and entrepreneurship education for embedded software courses, as is shown in Figure 1. The project-driven model is carried out in the reform. Enterprises in school-enterprise cooperation is taken as the carrier, through the establishment of innovation and entrepreneurship education base. At the same time, students are motivated by competition to realize the deep integration of theoretical study and practical research, simulation training and actual competition. With the help of the University Student Entrepreneurship Center(SOVO), clubs, etc., by students' entrepreneurial dreams are stimulated, and personal innovation and entrepreneurial ideas are developed. Furthermore, job adaptability and professional practical skills are improved. To sum up, students’ innovative and entrepreneurial qualities are effectively cultivated, so that they can better adapt to social needs when they go to work in the future.

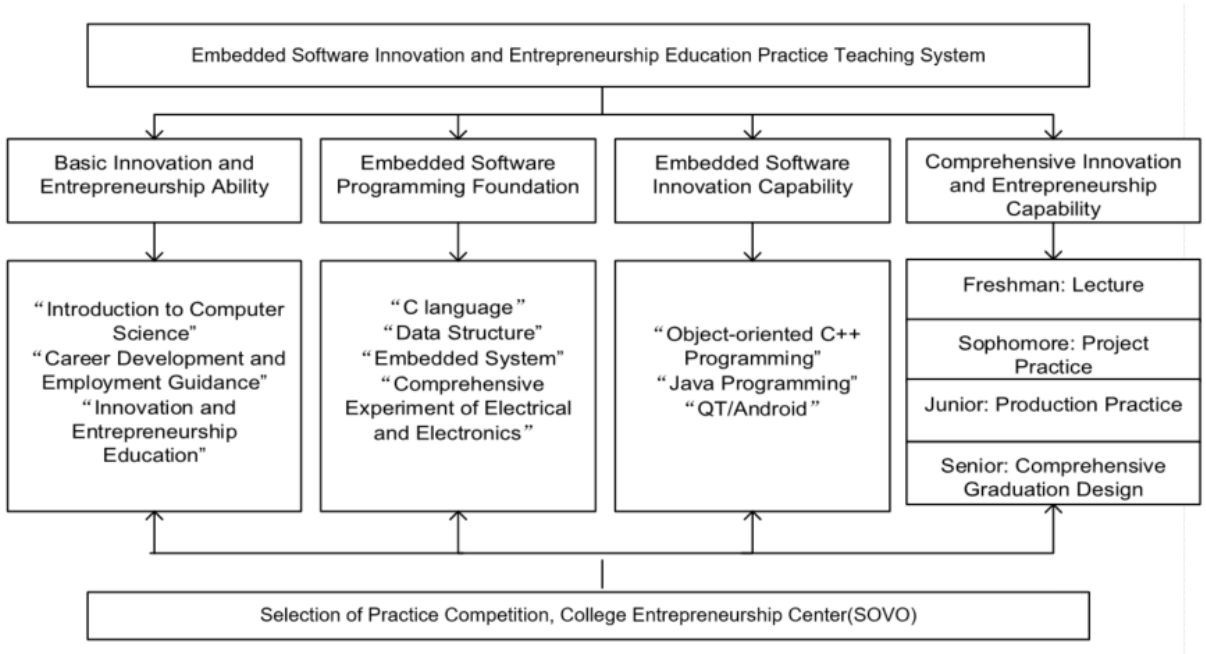

Fig. 1 Embedded Software Innovation and Entrepreneuship Education Practice Teaching System

Take the Innovation and Entrepreneurship as the Guidance, Carry on the System Reform to the Embedded Software Related Curriculum

The model of double-innovation education focuses on imparting knowledge about innovation and entrepreneurship and cultivating students' skills and awareness in innovation and entrepreneurship. To achieve this goal, it is necessary to implement teaching reform by setting up educational courses with characteristics of entrepreneurship and innovation. The curriculum system of embedded software is involved in computing, software, electronics, communication and other majors in colleges and universities. Through the integration of the curriculum system, the curriculum design is shown in Figure 1. It is mainly divided into two directions: professional teaching and innovation and entrepreneurship education. The software professional courses mainly include basic programming courses based on C language and data structure, object-oriented programming courses based on C++ and Java, and interface development courses such as QT and Android. Innovation and entrepreneurship education courses include innovation and entrepreneurship education, career development and employment guidance courses. Specific curriculum teaching reform ideas starts from the OBE education model, and the teaching of programming courses are extended in a project-oriented way. By dismantling the project tasks and combing with the specific requirements for talents' job ability, the relevant curriculum contents will be reformed.

In the above reform courses of embedded development direction, taking "C + + programming" as the representative, this paper expounds the specific reform ideas of this type of courses. From the current teaching situation of this course, even if some students have a good foundation of C language, it is difficult for them to apply the object-oriented design idea. They can only use C + + syntax to write process-oriented programs. Their understanding of the use of "C + + Programming" is still not enough, which is different from the original intention of the course. The core concept of CDIO Engineering Education emphasizes "learning by doing",

"project-driven" to learn and understand knowledge. In order to make CDIO teaching mode fully reflect in the teaching of "C + + Programming", the teaching concept of "project decomposition and task driven" should be fully embodied in the whole teaching process.

Specifically, a number of different projects in the “C++ Programming” for students to choose: for example, from the perspective of management system development, "school personnel management system" project; from the perspective of game development, the second project, "Tetris game development", etc. The project is divided into several sub-tasks in each chapter according to the teaching content, and the final project is gradually completed with small modular goals as accumulation. For example, according to table 1, the project "school personnel management system" is decomposed into several sub-tasks according to the knowledge points, and the sub tasks are correlated with each other by chapters. Taking the actual project as the goal and the subtask as the driving force, the theoretical knowledge of each chapter is introduced through the actual task, and applied to solve practical problems.

Table 1. The Project Decomposed into Subtasks

Teaching Unit	**Knowledge Point**	**The Project Decomposed into Subtasks**
Class and Object	Object-oriented programming methods; connection of class and object; the declaration method; constructor; destructor; copy constructor; the composite class	Design the school's "People" class for personnel management. Abstract the attributes that all roles of people have: "name", "number", "sex", "date of birth", "id", etc., where "date of birth" is declared as an embedded child class of the "date" class. The member functions are added to input and display the personnel information.
Inheritance and Derivation	Concept of inheritance and derivation; three ways of inheritance; derived class constructors; four access rights; the use of virtual base class	In the previous chapters, the encapsulation of the "People" class was implemented. Based on that, the "Student" class and "Teacher" class are derived. The "Student" class adds attribute: "class number"; "Teacher" class adds attributes: "job", "department". Then the "TA" (Assistant Student) class is derived from "Student" class and "Teacher" class. Note the use of virtual base class and overloads the corresponding member function.
Polymorphism	The meaning of polymorphism; using virtual functions to implement polymorphism; pure virtual functions and abstract class; operator overloading method	In the previous chapters, the multi-level inheritance class relationship of personnel management was implemented. (1) How to use the operator to implement the operation of "People" class object? Override the operator "==" for the people class to determine whether the ID properties of the two "People" objects are equal.

		(2) The public function member "display()" is defined in the above classes to display the attribute information. Therefore, the "display()" of the base class is passed to the derived class during the inheritance process, and the derived class itself overloads its own "display()". In that way, how to dynamically bind the required "display()" according to the type of the object when using the object?

The integration of CDIO teaching method and "C + + Programming" course are achieved through practical projects. In the learning process, students are encouraged to make full use of the curriculum knowledge to independently complete the whole project, including requirements analysis, product design, development and system testing, so as to consolidate the curriculum knowledge in the project practice. Through this reform mode, the embedded software courses are not only about the learning of unilateral programming technology, but also about the process of product development.

With the Community as the Carrier，Promote Embedded Software Competition Projects to Stimulate Entrepreneurial Dream.

Practical training of innovation and entrepreneurship is carried out under the guidance of subject competition, in which students' innovation and entrepreneurship ability is enhanced. By carrying out competitions related to embedded software and community training activities, students are encouraged to actively build teams to participate in competitions, so as to realize the deep integration of theoretical learning and practical research, as well as the integration of simulation training and actual competition.

The embedded software competitions that professional students can participate in are shown in Table 2. In this process, schools, enterprises, tutors and students cooperate with each other to promote learning through competitions. Relying on the innovation and entrepreneurship platform, various activities can be carried out including teaching, research, project operation, innovation and entrepreneurship education, and competition team cultivation. The school tutor focuses on the cultivation of students' basic professional knowledge and skills, and the enterprise tutor is responsible for the cultivation of students' comprehensive practical ability and professional quality. The senior students drive the junior students to exert their respective strengths and make collaborative innovation.

Table 2 Innovation and Entrepreneurship Project Design at Different Levels

Grade	Level	The Project Carried Out
Freshman	Entry-level	C Programming Competition Electric Iron Contest

Sophomore	Basic	Lanqiao Cup National Software Competition Analog circuit Design Competition "Internet +" College Innovation and Entrepreneurship Competition
Junior	Improved	"Challenge Cup" Undergraduate Business Plan Competition Electronic Design Competition for College Students The Vertical and Horizontal Projects Commissioned by Tutors
Senior	Advanced	Practical Projects of University-Enterprise Cooperative Enterprises

Taking the enterprise demand as the traction, the industry-university cooperation competition projects are deeply developed. In this kind of project, students can learn professional knowledge by doing, so as to achieve the purpose of cultivating students' innovation ability. Meanwhile, students' interest are stimulated in learning by solving practical problems. Based on the actual combat cases of teachers' scientific research, college students' innovation and enterprise actual combat, the comprehensive ability of students can be greatly improved. Through the actual combat of various projects, the practical ability of hands-on is cultivated; through the expansion and extension of project cases, students' creative ability is cultivated; through the development of theme design, the team cooperation ability is cultivated; through the development of creative design, students' innovation and entrepreneurship ability is cultivated.

Regarding University-Enterprise Cooperative as the Carrier, Establish the Innovation and Entrepreneurship Education Base

For double-innovation education, traditional teaching in classroom is certainly important, but its strong practicality puts forward higher requirements for practical teaching. Aiming at the lack of real projects for student innovation and entrepreneurship, Dalian Neusoft University of Information(DNUI) established the University Student Entrepreneurship Center (SOVO) to simulate the process of business operations. In SOVO, students participate in the project team, and the technical team helps each other, encourages each other, and cooperates with each other. Moreover, guidance is provided by instructor and work site is provided for activities.

Simulating the company operation is a good test method for the innovation and entrepreneurship ability of college students. Embedded software application, as a tool, has low investment cost with advanced and practical characteristics. Real enterprise projects are used as the object of double-innovation enlightenment, which not only exercises students' programming ability, but also lays the foundation for students' innovation and entrepreneurship. Each real project is divided into three stages: basic development, comprehensive development, and independent innovation development. Students gradually improve from being able to use, to making good use of, then further to innovative applications step by step. Students have a communication space by opening up an innovation and entrepreneurship corner. Some successful graduates or outsiders of innovation and

entrepreneurship are regularly invited to give lectures and share their entrepreneurial experience. During the training process, students can experience the workplace culture, feel the workplace atmosphere, cultivate a spirit of unity and cooperation, and develop a positive, punctual, rigorous and efficient workplace quality.

At present, DNUI has set up different studios in the field of IT technology, among which the embedded software project groups include “smart city”, “mobile internet”, “service outsourcing”, and “artificial intelligence”. The studios have been used in the innovation and entrepreneurship competitions, undertook horizontal projects and scientific research projects providing a "creative space" incubation base. Innovation and entrepreneurship are combined with theoretical and practical courses, so as to provide guidance and ideas into reality services. Since 2002, more than 280 virtual companies have been established and 85 companies have been registered, with a successful incubation rate of 30%. In a variety of double-innovation discipline competitions, students of Department of Intelligence and Electronic Engineering have won award rate of up to 54% in the past two years, including several national prizes. In terms of horizontal projects, website construction, mobile APP development, game development, and virtual reality roaming systems all have good achievements. In terms of scientific research topics, project applications, patent applications and paper publications reflect the improvement of the quality of innovation and entrepreneurship of students.

CONCLUSION

Taking the direction of embedded software development as an example, this paper analyzes the necessity of integrating professional education with double-innovation education in colleges and universities. Guided by "new ideas, new concepts, new technologies, new methods, new standards, and new systems", the concepts of "student-centered, output-oriented, and continuous improvement" is implemented. And talent training program will be implemented in professional courses, practical competitions, innovation and entrepreneurship education. The embedded software development curriculum group and training system with progressive, organic connection, scientific and reasonable double-innovation education mode is established step by step, so as to promote the cultivation of innovative technical talents and new engineering talents.

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