

# Research on practice teaching system of embedded system based on the cultivation of innovative and entrepreneurial ability

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**Abstract:** Effectively carrying out practice teaching based on the cultivation of innovative and entrepreneurial ability is helpful to concretize abstract theoretical knowledge, and is also of great value to stimulate students' interest in learning and improve their comprehensive ability. At present, the practice teaching of embedded system is closely related to the development of many emerging industries. Therefore, in order to ensure the teaching effect of embedded system, it is necessary to strengthen the analysis of the practice teaching system of embedded system based on the cultivation of innovative and entrepreneurial ability.

**Key words:** cultivation of innovative and entrepreneurial ability; embedded system; teaching points; practice teaching system

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## 1 Introduction

At the present stage, in order to narrow the gap with western developed countries in innovative and entrepreneurial ability, the state has issued relevant policies to innovate entrepreneurship education and teaching, which plays an important role in cultivating students' innovative and entrepreneurial ability. The practice teaching of embedded system is closely related to the development of many emerging industries. Therefore, the practice teaching of embedded system must be effectively carried out in combination with the actual talent demand and teaching objectives, so as to improve students' innovative and entrepreneurial ability.

## 2 Overview of the cultivation of innovative and entrepreneurial ability and embedded system

### 2.1 Overview of the cultivation of innovative and entrepreneurial ability

#### 2.1.1 Innovation and entrepreneurship

Innovation and entrepreneurship are characterized by high risk and high return [1], mainly innovation-related entrepreneurial activities (such as technological innovation, product innovation and service innovation, etc.). Among them, innovation has the characteristics of originality and pioneering, and the purpose of entrepreneurship is to obtain benefits in

practice.

### 2.1.2 The cultivation of innovative and entrepreneurial ability

The purpose of cultivating innovative and entrepreneurial ability is to enhance the probability of success in innovation and entrepreneurship, and to provide knowledge and practical ability for innovation and entrepreneurship. The cultivation of innovative and entrepreneurial ability includes the cultivation of innovation and entrepreneurship in consciousness, spirit, theoretical knowledge reserve and practical ability. Moreover, the effective cultivation of innovative and entrepreneurial ability is helpful to tap students' potential [2], stimulate their innovative thinking and entrepreneurial passion, and promote social and economic development.

### 2.2 Overview of embedded system

Embedded system involves many technologies, such as information technology, communication technology, integrated circuit design technology, sensor technology and so on. Embedded system itself has no development ability. Its realization is generally based on computer technology, combined with the needs of users, through computer platform and the use of "software and hardware collaborative design". Its characteristics are obvious [3], such as real-time and specificity, and it also has the characteristics of low power consumption, high reliability, small size and tailoring.

## **3 Analysis of the teaching points of embedded system**

Embedded system is a course integrating information technology, communication technology, integrated circuit design technology, sensor technology, etc., which involves the collection, integration and analysis of main information, as well as the design, development, application and integration of electronic equipment and information systems. The main teaching points are as follows:

### 3.1 Carry out embedded system teaching in combination with social needs

Due to the increasingly extensive application and rapid development of embedded technology, it is necessary to combine the development of the times and social needs when teaching it. For example, in the teaching of embedded system, we should strengthen cooperation with relevant enterprises and combine the actual projects of enterprises [4], so as to help students understand the present situation and development direction of embedded technology and improve their practical ability.

### 3.2 Cultivate the ability of innovation and entrepreneurship to carry out embedded system teaching

Embedded system is closely related to the development of many emerging industries. Therefore, in order to ensure the teaching effect of embedded system and improve students' comprehensive ability, it is necessary to cultivate students' innovative and entrepreneurial ability in the actual teaching of embedded system. Through the new teaching concept of "taking students as the main body, teachers as the leading factor and projects as the carrier", we can stimulate students' initiative and enhance their innovative thinking ability, so as to enhance their innovative and entrepreneurial ability.

### 3.3 Carry out embedded system teaching in combination with competition

The teaching content of embedded system mainly includes basic theoretical knowledge and its application. Therefore, in order to ensure the practical application of the embedded system knowledge [5], it must be demonstrated through relevant practice. Actively participating in relevant competitions can evaluate whether students master the embedded system knowledge, such as participating in the "Blue Bridge Cup" and other competitions.

## **4 Research on practice teaching system of embedded system based on the cultivation of innovative and entrepreneurial ability**

### 4.1 Clear teaching objectives

A clear teaching goal is helpful to realize the practical teaching purpose of embedded system based on the cultivation

of innovative and entrepreneurial ability. The practice teaching objectives of embedded system based on the cultivation of innovative and entrepreneurial ability generally include basic theoretical knowledge, practical application and innovation and entrepreneurship training. Specifically, the basic theoretical knowledge is the first teaching goal. Students need to be familiar with the working principle and operation of embedded system, so as to ensure that students can master the basic theoretical knowledge of embedded system. The practical application is the second teaching goal. It is necessary to design the embedded system course reasonably [6], and divide it into several groups according to the characteristics of students' specialties and interests, and work together to write the design report and complete the defense. And organize students to actively participate in national or provincial embedded design competitions, so as to enhance students' practical ability. The third teaching goal is the innovation and entrepreneurship training. The practice teaching goal of embedded system based on the cultivation of innovative and entrepreneurial ability is to improve students' innovation ability and enhance their entrepreneurial consciousness. For example, students are encouraged or required to actively apply for scientific research projects or innovation and entrepreneurship competitions, so as to improve their comprehensive ability (e.g., improving students' hardware and circuit design level, etc.).

#### 4.2 Optimize teaching methods

The practice teaching of embedded system based on the cultivation of innovative and entrepreneurial ability must follow the new teaching concept of "taking students as the main body and teachers as the leading factor", combine with modern information technology, and adopt a combination of theory and practice and mixed teaching methods (online and offline), aiming at enhancing students' practical operation ability and strengthening the cultivation of innovative and entrepreneurial ability. At present, there are many specific practice teaching methods for embedded system based on the cultivation of innovative and entrepreneurial ability, such as the integration of production and teaching, the integration of theory and practice teaching, the promotion of learning through competition and the implementation of diversified assessment. It is embodied in the following aspects:

##### 4.2.1 Optimizing the integrated teaching method of production and education

Embedded system is one of the main course contents of electrical information specialty. Therefore, in order to improve the practical teaching effect of embedded system based on the cultivation of innovative and entrepreneurial ability, we must strengthen cooperation with enterprises in combination with teaching objectives and teaching practice, design teaching plans and assessment methods together with cooperative enterprises, and then implement the teaching plan. For example, a cooperative electronic enterprise provides a project, and through the integration of production and teaching between school and enterprise, combined with the specific requirements and teaching objectives of the project, the scheme design and test adjustment are carried out reasonably, aiming at effectively cultivating students' innovative and entrepreneurial ability.

##### 4.2.2 Optimizing the teaching method that combine theory and practice

This teaching method is usually carried out in the laboratory in combination with related projects, and the combination of explanation and practical training is used to promote students' understanding and mastery of knowledge. When using this teaching method in the practice teaching of embedded system based on the cultivation of innovative and entrepreneurial ability [7], it is necessary to uphold the teaching concept of "taking students as the main body, teachers as the leading factor, projects as the carrier and CDIO concept as the guidance", so as to effectively cultivate students' innovative and entrepreneurial ability.

##### 4.2.3 Optimizing the teaching method of promoting learning by competition

In the practice teaching of embedded system based on the cultivation of innovative and entrepreneurial ability,

hierarchical competition must run through all teaching stages. For example, in the learning stage of basic theoretical knowledge, students can be encouraged to participate in competitions organized by the school (such as embedded design competition); In the stage of using embedded system knowledge, students are required to actively participate in regional or national competitions (such as "Blue Bridge Cup"), aiming at enhancing students' practical ability and stimulating students' innovative ability.

#### 4.2.4 The optimization of diversified teaching evaluation methods

The written test is no longer the only way to evaluate the practice teaching of embedded system based on the cultivation of innovative and entrepreneurial ability. Instead, we should combine the requirements of personnel training, and make an all-round assessment and evaluation with the theories, experiments, curriculum design, competition results, innovation and entrepreneurship project plans of basic knowledge.

#### 4.3 Construct the corresponding guarantee mechanism

In order to ensure the effective development of embedded system practice teaching based on the cultivation of innovative and entrepreneurial ability, it is necessary to build a guarantee mechanism in teaching infrastructure and teaching staff. Specifically, it is as follows:

##### (1) Strengthen the guarantee of teaching infrastructure

The practice teaching of embedded system based on the cultivation of innovative and entrepreneurial ability involves the laboratory of classroom teaching, the training base of practical application and the places needed for innovation and entrepreneurship [8]. Therefore, in order to ensure the effectiveness of its teaching, we must strengthen the construction of teaching infrastructure in combination with actual requirements to ensure that its teaching can achieve the purpose of cultivating students' innovative and entrepreneurial ability.

##### (2) Strengthen the guarantee of teaching staff

In order to meet the requirements of embedded system practice teaching based on the cultivation of innovative and entrepreneurial ability, it is necessary to strengthen the guarantee of teaching staff, so that its practice teaching can be carried out. For example, by strengthening the training of double-position teachers, the technical backbone of cooperative enterprises participating in practical teaching, and the teachers who teach theoretical knowledge in cooperative enterprises in winter and summer vacations and participate in product research and development in the project, the guarantee ability of the teaching staff can be improved.

## 5 Conclusion

To sum up, compared with western developed countries, the teaching work of cultivating innovative and entrepreneurial ability in China is relatively late. Therefore, in order to narrow the gap with western developed countries, the state has issued relevant policies to support innovation and entrepreneurship education and teaching. The practical teaching of embedded system is closely related to the development of many emerging industries. Therefore, in order to ensure its teaching effectiveness, this paper briefly describes the teaching points of embedded system from relevant theories, focusing on the practical teaching system of embedded system based on the cultivation of innovative and entrepreneurial ability, aiming at enhancing students' innovative and entrepreneurial ability.

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### **Conflicts of interest**

The author declares no conflicts of interest regarding the publication of this paper.

### **References**

[1] Xu YH, Zhao JY, Zhang XH, et al. 2016. Reform and practice of experimental teaching of embedded system course. *Computer Knowledge and Technology*, 20: 134-136.

[2] Xu BQ. 2017. Exploration of college students' innovation and entrepreneurship practice based on learning resource cloud platform. *Value Engineering*, 36(35): 219-221.

[3] Li L, Deng HB, Wang Y, et al. 2019. Reform and exploration of embedded system experiment teaching under the new engineering concept. *Experiment Science and Technology*, 5: 81-84+98.

[4]Chen WL, Li W. 2019. Reform and practice of experimental teaching of embedded system application. *Education Modernization*, 59: 43-44+53.

[5] Shen HY, Hao ZH, Miao YH. 2019. Reform and exploration of experimental teaching of the principle and application of embedded system. *Contemporary Education Research and Teaching Practice*, 10: 43-44+53.

[6] Li N. 2019. Analysis on teaching reform of embedded course experimental system. *Computer Products and Circulation*, 2: 204.

[7] Gong YW, Liu QM, Zhou G. 2020. Research on embedded talent training mode of school-enterprise cooperation in computer specialty. *Software Guide*, 3: 272-275.

[8] Liu Y. 2021. A practical approach to the integration of production and education in application-oriented universities. *China Adult Education*, 4:18-20.