

# *Research and Practice on the Mixed Teaching of Mcu Course in Electronic Information Course System*

Ting Jia<sup>a,\*</sup>, Jianfeng Lu<sup>b</sup>, Ying Liu<sup>c</sup>

Shenyang Institute of Technology, Fushun, 113122, China  
<sup>a</sup>272932534@qq.com, <sup>b</sup>1610918303@qq.com, <sup>c</sup>29255473@qq.com  
*\*Corresponding author*

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**Abstract:** This paper mainly analyzes the current situation of STM32 MCU Course, and describes the online and offline integration of MCU courses in the electronic information course system and integration into the application of school enterprise cooperation achievements and the mixed teaching research and practice of ideological and political courses. The course content design takes subprojects as its unit, and the teaching process centers on three main links: project analysis, project design and project implementation. The student-centered teaching concept is implemented throughout the course. On the basis of subproject design, considering the progressive difficulty of content, selecting projects are all practical cases closely related to daily life.

## 1. Introduction

As a public basic course for the majors of electronic information, communication engineering, automation, electrical appliances and automation, the course of SCM interface and technology covers the public knowledge points of all disciplines, focuses on the close combination of hardware design and software design, and integrates ICT related technologies of Huawei school enterprise cooperation, which can lay a good foundation for students.

To carry out the construction of new engineering disciplines, we need to do the following: First, based on the current situation and trend of economic development, meet the needs of economic development, and establish a number of new engineering disciplines; Second, explore the educational model suitable for the development of new engineering courses, and reform the traditional teaching; Third, cultivate new engineering talents with innovative ability, practical ability and competitiveness. With the rapid development of "Internet+" technology, it is an urgent educational reform measure to build a smart education model of "Internet+education" and infiltrate the mixed learning model into the curriculum teaching of various disciplines and majors.

As an important professional basic course for electronic information related majors, the course of single-chip microcomputer and interface technology is the core course for training electronic engineers[1]. The teaching effect of this course will directly affect the quality of electronic engineers, especially their innovation ability. In the modern economic society, the development of the country and the revitalization of the nation can not be separated from the support of the

economic foundation, and the innovation ability, as the first driving force for development, is directly related to the future destiny of the country.

## 2. Existing Problems

Current teaching situation of the course "Interface and Technology of Single Chip Microcomputer":

(1) The teaching reform is just a simple integration of curriculum content: most of the teaching reform of this kind of curriculum is due to the huge institutional system and difficult reform. The teaching mode that has been formed for several decades often lacks the courage and determination of reform for both teachers and school leaders. The curriculum teaching reform only focuses on cutting down the content of courses, reducing theoretical class hours, and freeing up a semester or even two for students to enter enterprises and other employers[2]. The theory and practice of such curriculum teaching reform are still out of touch, and no agreement has been found.

(2) Teaching reform is simple and hierarchical teaching: in this kind of curriculum teaching reform, many colleges and universities understand project teaching reform as elite teaching. Cultivate a small number of students to take the postgraduate entrance examination, or guide a small number of students to participate in various competitions. This way does not consider the majority of students, which can be regarded as incomplete teaching reform.

(3) The teaching content is mainly based on theory and lacks practice: it can be seen from the construction of many national and provincial high-quality courses that many course contents are mainly based on theory and do not attach importance to practice. For example, the practice class hours are insufficient, and the contents are just "plug and pull" confirmatory experiments. Students feel that theory is disconnected from application, and they feel that theory is boring and practice is lacking.

In view of these problems, we can adopt the online and offline mixed teaching mode, and carry out teaching reform and exploration on the course of SCM from the aspects of teaching methods and teaching forms. The online and offline hybrid teaching mode can combine the advantages of online teaching and classroom teaching. The traditional classroom teaching is dominated by teacher teaching, while the online teaching emphasizes students' independent learning and thinking. Therefore, the hybrid teaching method not only shows the leading role of teachers, but also highlights the dominant position of students, realizes the complementarity between classroom teaching and online learning, and can effectively improve students' learning initiative and enthusiasm, Guide students' extracurricular learning activities and greatly improve the teaching effect of the curriculum.

Interface and Technology of MCU is a compulsory professional basic course for electronic information engineering and communication engineering majors, which plays an important role in the teaching system of electronic information engineering and communication engineering majors. The characteristics of this course are: many concepts, many knowledge points, large amount of code, large capacity and relatively abstract and boring, and high basic requirements for program design and circuit design. In order to better achieve the teaching objectives of this course and adapt to the "new engineering" education advocated by the Ministry of Education, we should cultivate high-quality applied talents with independent thinking ability, independent learning ability and innovation and entrepreneurship awareness[3]. Therefore, in the teaching of single chip microcomputer, we have actively explored and practiced in the aspects of teaching content, teaching methods, experimental teaching, and teaching resource construction. Under the background of the new engineering major, it is inevitable to reform the teaching of MCU course.

### 3. Implementation Process

Reform of teaching content: based on excellent teaching materials, always adhere to the whole SCM system as the background, and teach each chapter as a link of the SCM system to achieve a specific function, reflecting the process teaching mode of the SCM. Each sub project can cover all the knowledge points of this unit, and can also comprehensively apply the knowledge and skills of SCM learned before. After the completion of all subprojects, students can independently design and complete a single chip project design according to their own interests. In addition, during the final practical training on the application of single chip technology, students will also use a more comprehensive training project to strengthen the centralized training of single chip development skills[4]. By combining the contents of Huawei ICT Competition to develop an expanded comprehensive experimental design, students need not only to complete the output control and input detection of the microcontroller, but also to combine the sensor technology with the input detection of the microcontroller during the entire project development process. Students who can spare no effort can also contact ICT related technologies in the laboratory and use them to realize various functions of the monolithic monitoring system. Organization and implementation: students practice in groups, and students in each group manage experimental equipment and materials by themselves. Teachers use video recording to manage, and cooperate to complete the development and production of the system. In the whole process, students' sense of teamwork and cooperation ability should be trained. The teaching syllabus is formulated with OBE as the guidance, and there are many contents in the course of SCM. Therefore, in the actual teaching process, it should be appropriately deleted. For some content that is too complex, time-consuming and difficult for students to master in mathematical derivation, we will not talk about it or briefly talk about it on the basis of not affecting the understanding of the subsequent content, but focus on mastering the basic principles, ideas and methods, which can not only ensure the integrity of the content in the textbook, but also appropriately reduce the difficulty of the course and save classroom time. It is necessary to introduce new theories and technologies in the course of teaching. On the one hand, it can enable students to understand the latest development and application of technology, and expand their knowledge; On the other hand, it can also attract students' attention, stimulate students' interest in learning and explore new knowledge[5].

Reform of teaching means and teaching methods: the idea for the construction of the course "Interface and Technology of Single Chip Microcomputer" based on the online and offline mixed teaching mode: first, a relatively fixed teaching team should be formed, and the team members need to carry out a reasonable division of labor; Secondly, it is necessary to define the teaching objectives and embody the individualized teaching requirements; Third, we need to determine the specific teaching content, while ensuring the depth and breadth of the content; Secondly, it is necessary to clearly distinguish online and offline teaching content and related resources, and online resources need to be sorted out; Finally, teachers should design diversified assessment methods and means.

The construction of online and offline hybrid teaching of SCM courses is divided into three aspects: online teaching, offline teaching, and the reform of hybrid teaching assessment system. Online teaching: teachers provide learning resources on the network platform, and students independently complete the learning of online resources in extracurricular time; Offline teaching: teachers organize the reform of teaching methods in classroom teaching activities; Mixed teaching assessment system reform: assessment methods for students' learning.

"Online teaching" construction: In online teaching activities, teachers are responsible for building network resources, making electronic courseware, teaching videos and other resources, and designing preview assignments, review assignments and related test questions. Students need to

conduct online learning before class, independently preview relevant electronic resources, complete preview assignments, and feed back problems encountered in the preview process, so that teachers can reasonably arrange the teaching content and teaching methods of offline learning. The specific construction of online teaching is mainly divided into the following two aspects: the decomposition of teaching content and the construction of online learning resources.

Construction of "offline teaching": in the online offline hybrid teaching mode, offline teaching mainly refers to classroom teaching activities and processes. Teachers promote students' understanding and mastery of knowledge through face-to-face centralized teaching and question answering. The offline teaching of SCM course mainly includes four aspects: (1) the teaching of basic knowledge of the course. (2) Operation explanation. (3) Introduction to the practical application of the theoretical knowledge of the course. (4) Classroom organization and question answering.

In the teaching of basic knowledge of the course, teachers should, according to the syllabus and teaching objectives of the course, combine the decomposition of the teaching content in the construction of "online teaching", make electronic courseware for classroom teaching, design blackboard writing, focus on explaining the key and difficult content in a targeted way according to the specific situation of students' mastery of the course content during online learning, and guide students to understand and master relevant knowledge points, Help students establish the logical connection between different knowledge points, so as to achieve the goal of comprehending.

According to the completion of students' exercises after class, we will focus on explaining the solutions to typical exercises in class, cultivate students' ability to analyze and solve problems, and eliminate students' fear of difficulties.

To mobilize students' enthusiasm for learning, teachers need to introduce the practical application cases of SCM to students, strengthen the integration of theory with practice, and expand students' technical vision.

Under the background of new engineering, we are good at organizing classes with modern teaching tools, trying to reform the teaching methods in rainy class, discussing in groups, stimulating students' learning initiative, and answering everyone's questions.

Microcontroller course is a core course for electronics majors, which is highly practical and also a professional course for all majors. The teaching process is all carried out in the laboratory, and the software and hardware simulation is the main part of the teaching process. During the teaching process, students can simulate at any time, which helps students master the basic control design methods; In the training link, the comprehensive project is used to convert the hardware and software simulated in the classroom into real objects, which fully realizes the teaching method of integrating theory with practice. We should attach importance to the application of modern educational concepts in teaching, such as heuristic learning, inquiry learning and cooperative learning; Be able to design teaching methods and teaching evaluation according to course content and student characteristics. According to the OBE concept, we should reverse design the teaching content and teaching methods according to the teaching objectives, change the traditional pure theory teaching mode in the teaching process, explain the knowledge points in combination with the project cases, design corresponding comprehensive cases in each chapter, draw out the corresponding knowledge points in the form of proposing the project case requirements, and master the abstract theory of the microcontroller control system during the completion of the project, Integrate the abstract concepts to be taught into the solution process of the designed comprehensive project case, and cooperate with the experimental box to observe the actual phenomenon of the project case. Through this project driven method, with new teaching methods such as teaching interaction and flipped classroom, we can stimulate students' interest and motivation in learning, establish students' enthusiasm for independent learning, and improve and improve the teaching

effect. In order to improve the learning effect and practical application ability of students on the course of SCM, and meet the needs of contemporary society, hybrid learning is introduced into this course.

Mixed learning adopts many learning methods, such as students' autonomous learning, group discussion, paper PPT report and defense, which require students to participate, think and explore more independently, so as to cultivate students' ability to find, analyze and solve problems.

Through combing and summarizing the process of mixed learning and teaching activities, combined with the analysis of the teaching content, teaching methods and teaching means of the SCM course, it is summarized that the methods used in mixed learning are mainly embodied in: teaching method, case method, discussion method, demonstration method, practice method and experiment method. The "teaching method" is different from the traditional "teaching method" of teachers. It is not only the "teaching" of teachers, but also the "teaching" of students. The "case method" is mainly reflected in the design of teaching content. Through the "case method", the difficult points and key points in the course are clearly described, which is convenient for students to receive. The "discussion method" includes the discussion between students and teachers on the Internet, the discussion in student groups, and the discussion in class. The "demonstration method" and "experimental method" are the methods of animation demonstration and experimental training demonstration to show the learning achievements from both theory and practice. The "practice method" is mainly embodied in that students carry out corresponding self-test exercises after learning a knowledge point to deepen their understanding and mastery of the knowledge point. The teaching content of SCM can be divided into knowledge type and ability type. Therefore, it is very important to adopt the best type of interactive teaching activities to improve the teaching effect. For the "face-to-face" classroom teaching interaction design, the content of each link before, during and after the interaction should be different according to the different types of teaching activities.

Feasibility analysis of project implementation:

(1) Excellent team members:

The members of the research team are composed of teachers who have many years of teaching experience and practical experience in SCM courses, education experts who have worked for many years in education leadership positions, instructors who have rich experience in electronic design competitions, engineers who have obtained multiple patents from enterprises, and front-line teachers.

(2) The teaching concept of embedded technology is clear:

The team members can participate in the training of embedded technology teaching methods organized outside or inside the school, have been engaged in teaching for many years, have clear reform objectives of this topic, and have the ideological basis to complete the teaching reform of this course.

(3) Rich theoretical and experimental teaching resources:

The university library covers an area of 39200 square meters and has a collection of 1.3676 million books, including 843400 paper books and 524200 electronic books. 11020 electronic books. The library has two database resources, Wanfang and CNKI. It can meet the needs of theoretical and practical teaching.

This major has a 150 square meter MCU laboratory, which can meet the students' learning needs for software design and hardware design in and out of class. At present, a 150m<sup>2</sup> teaching space in the school is specially opened, and high-frequency experimental instruments and single-chip microcomputer experimental equipment are added, which can realize embedded system development and serve as a development laboratory for students.

(4) Abundant teaching achievements in the course of SCM

The members of this research group have carried out many rounds of teaching reform, published

many papers on the curriculum reform of SCM, and completed the construction of an excellent course of SCM. At present, the SCM course has carried out project teaching relying on typical practical application projects, and will gradually prepare practical teaching guidance books for practice and design projects, which will be used as handouts on campus, published publicly after improvement, and gradually promoted.

#### Features and Innovation of the Project

(1) It is easy to acquire knowledge. In the Internet era, a large part of students' information comes from the network, and mobile phones are an important means for students to obtain network resources. Students use a mobile phone to make real-time query of massive information, so that students' learning of SCM Interface and Technology is no longer limited to classrooms and laboratories; Communication with teachers is no longer limited to face-to-face teaching, so as to achieve two-way interaction between teachers and students at any time and anywhere.

(2) Stimulate students' interest in learning. Through online network video, such a mobile internet platform can achieve the effect that teachers can hear their lessons before they see them; It is easy to realize the ice breaking warm field of the teaching class, enhance the students' acceptance of the curriculum, and accelerate the students' cognition and interest in the curriculum.

(3) Meet individual needs and strengthen interaction. Single Chip Microcomputer Interface and Technology is a course with high requirements for basic knowledge. The basis of C language programming and circuit theory of each student is uneven, so that different problems will be encountered in the learning process. With an interactive mobile teaching platform, teachers can implement one-to-one tutoring and answering, solve different problems encountered by each student in the learning process, and truly achieve a targeted goal.

(4) Integrate curriculum resources and bring forth the new. With the emergence of new technologies, new knowledge will be supplemented at any time, and the mobile Internet platform can be used to update and replace new knowledge at any time. For example, the current intelligent building and smart community technology did not appear in the previous teaching content of the course "MCU Interface and Technology". Teachers can publish announcements and discussions on the latest technology through the rain class for students' reference.

The members of the research team are teachers with rich teaching experience and practical experience. The following table shows the awarding and scientific research ability of the members of the research team, including the summary of a number of teaching achievements, a number of national, provincial and university projects and applications for approved patents. All these indicate that the members of the research group have completed a number of teaching reforms and basic research work for the electronic information engineering specialty, deeply studied the course content system and construction principles and methods, and have carried out many rounds of attempts and exploration for the teaching reform of the microcontroller course. We have made a thorough study of the teaching methods and teaching means of the course, carried out the reform of the course examination methods, etc., and have achieved phased results. At the same time, he also has rich experience in project implementation to ensure that the project comes from reality and has certain progressiveness and practicality.

(1) The teaching reform of SCM has been carried out for five years. From the implementation process to the results, teachers and students are very satisfied. The excellent rate of students' performance is 40%, and the average and passing rate is 55%. The construction of excellent SCM courses has been completed.

(2) The conditions of the single-chip microcomputer laboratory have been continuously increased and improved. The high-frequency electronic technology laboratory has all adopted digital oscilloscopes above 100MHz as observation instruments, and also has advanced experimental equipment such as digital frequency sweeper, spectrum power tester, and distortion

tester, which has laid a good foundation for the construction of the high-frequency electronic technology project teaching experimental base.

The teachers have rich experience in SCM teaching, are familiar with experimental equipment, and have participated in CDIO engineering education training.

Resource guarantee: the researchers themselves and the school library have a certain amount of research materials needed for this project, and the school is able to provide the lack of research materials. In addition, both the researchers themselves and the school have network resources, which can facilitate and quickly carry out data retrieval.

Guarantee of experimental conditions: relevant experimental conditions and equipment are good. There are perfect laboratories and equipment to meet the requirements of teaching and reform.

Policy guarantee: The school has always attached great importance to teaching reform, teaching and research, with preferential policies, guaranteed funds and incentive measures.

Time guarantee: The research personnel are basically professional teachers. In addition to completing normal teaching tasks, the rest of the time can be used to carry out teaching and research work. Therefore, the research time of the subject researchers is fully guaranteed

#### 4. Summary

Mixed learning adopts many learning methods, such as students' autonomous learning, group discussion, paper PPT report and defense, which require students to participate, think and explore more independently, so as to cultivate students' ability to find, analyze and solve problems.

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