Research and Practice of Student-Oriented Teaching Reform of the Course "Principles and Applications of Single-Chip Microcomputer"

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Abstract. The course of "Principle and Application of Single Chip Microcomputer" is a very important professional foundation or core course for engineering majors in colleges and universities. It has the characteristics of high practical and theoretical requirements, multiple and complex knowledge points. The article takes the realization of moral cultivation and the cultivation of application-oriented talents as the primary task of education and teaching. Through analyzing the problems existing in the current teaching practice of this course, it carries out reform research from the selection of teaching materials, the revision of teaching syllabus, the teaching mode of theory and practice courses, the organic integration of curriculum ideology and politics, and the assessment method of the course. In the process of reform, we should be student-oriented, pay attention to students' political literacy and professional knowledge and skills, break the traditional curriculum teaching methods, use modern teaching methods and methods reasonably, and integrate the ideological and political elements of the curriculum into the teaching naturally, so as to provide reference for colleges and universities to cultivate high-quality application-oriented talents with strong innovation and practical application ability, national feelings and noble qualities.

Keywords: Applied talents · Curriculum ideological and political · reform in education

1 Introduction

The course "Principles and Applications of Single-chip Microcomputer" is very comprehensive, practical and theoretical, and plays a very important role in the students' subsequent professional courses, graduation design, discipline competition and graduation practice. At the same time, the course includes learning methods and attitudes, academic ethics, professional ethics, scientific thinking and dialectics, life values, patriotism and other ideological and political elements The skillful introduction of ideological and political education in the teaching of curriculum design is an important means to cultivate students' correct values, enhance professional quality and sense of responsibility,

and have feelings of home and country. The curriculum teaching not only undertakes the task of imparting professional knowledge and skills, but also should play the corresponding educational function and implement the important task of establishing morality and cultivating people. Based on this, the article, combining the current situation of curriculum teaching, carries out teaching reform research with the primary task of achieving moral cultivation and cultivating application-oriented talents, and provides a reference for colleges and universities to cultivate high-quality application-oriented talents with strong innovation and practical application ability, national feelings and noble qualities.

2   Analysis of Teaching Status

The course teaching generally includes theory teaching and practice teaching, practice teaching is divided into experiment teaching and curriculum design teaching two parts. There are many problems in the teaching of the current course, and the results are not satisfactory [1–5].

2.1   Limited Class Hours but Many Teaching Contents

The theoretical teaching content of this course is very much, and each teaching content also includes a lot of knowledge points. For example, serial communication includes the basis of communication, the structure and configuration method of serial port-related registers, the four working modes and related applications of serial ports, and the method of multi-computer communication. The content of experiment teaching mainly includes drawing, designing, editing and debugging the software and hardware system of single chip computer by using relevant software. The teaching content of the course design is mainly to complete the design and implementation of the specific SCM application system in a team, such as the design and implementation of the intersection traffic light control system. The course generally has 5 credits, including 3.5 credits (56 class hours) for theory and experiment, and 1 credit (18 class hours) for course design. This course is comprehensive, with many teaching contents and abstract knowledge points. It requires a lot of theoretical knowledge and practical training support, so that students can have strong innovative and practical application ability. It is difficult to guarantee the teaching effect only by using limited teaching hours.

2.2   The Teaching Method is Single and the Theory is Divorced from Practice

The theoretical teaching is generally completed in the multimedia classroom. Teachers generally complete the teaching in the way of multimedia courseware + blackboard writing. Teachers generally make teaching plans according to the selected teaching materials. In class, they generally explain the knowledge points according to the order of chapters of the selected teaching materials. Because there are many teaching knowledge points and the class time is limited, there is very little time left for interaction with students. Generally, the teaching process is that the teacher takes the initiative to speak and the students are attracted, which leads to the students' failure to participate in the class. The students' consolidation of knowledge points is generally completed through homework

after class. The teacher judges the students' mastery of knowledge points by correcting homework. The students' completion of homework after class lacks process supervision, and there is generally plagiarism, so it can not really reflect the students' mastery of knowledge points.

Experimental teaching is generally completed in a fixed laboratory. Due to the limitations of experimental equipment, location, class hours and other factors, experimental projects lack innovation, and there are many basic experiments. In the teaching process, the teacher first explains the matters needing attention in the experimental process, then the students complete the connection of the system circuit and the editing and input of the program according to the experimental steps in the guide book, and finally debug and observe the experimental results. Course design teaching is generally arranged to be completed within one week, and students are usually required to complete the design of a comprehensive project. The designed topics are generally selected by students from the ones prepared by teachers in advance, while the ones prepared by teachers are generally those accumulated in previous years, which lack innovation and can not stimulate students' interest in exploration and learning.

2.3 Pay Attention to the Teaching of Professional Knowledge, Ignore the Integration of Ideological and Political Elements, and Teaching and Education Are not Unified

At present, the professional course teachers in colleges and universities have not enough understanding of the importance of integrating ideological and political elements into the curriculum. They only pay attention to the teaching of knowledge points and professional skills in the curriculum, and pay less attention to the cultivation of students' noble moral character, correct value guidance and other qualities, ignoring the integration of ideological and political elements. At the same time, due to the heavy teaching tasks and less class hours of the SCM course, the traditional teaching methods lead to the lack of time for teachers to integrate ideological and political elements in the classroom. Some teachers responded to the call of national colleges and universities to integrate the ideological and political elements into the curriculum, and also tried to integrate the ideological and political elements into the classroom, but the way was wrong, simple and rough. The ideological and political elements were like plasters, unnatural, abrupt and stiff. The teacher seemed very awkward when teaching, and could not get the sympathy of students at all. Instead, it played a negative role and reduced the teaching effect of the classroom.

2.4 The Assessment Method Needs to Be Further Improved

At present, the assessment method of SCM courses mostly adopts the combination of ordinary score (30%) + final paper score (70%). Ordinary score generally includes class attendance, homework, in-class experiment, etc. Teachers calculate the final ordinary score of each part according to the requirements of the course syllabus in a certain proportion. The final paper grade is derived from the final unified written examination. As the final paper scores occupy a large proportion, students only need to memorize the theoretical knowledge before the exam, the exam can be successfully passed. This

way of examination focuses on students' mastery of the theoretical knowledge of the course, but ignores the objective evaluation of students' professional quality, practical application ability, innovation ability and so on. It is easy to make students become high scores but low ability.

3   Teaching Reform Measures

3.1   Based on the Teaching Objectives, Revise the Syllabus, Update the Teaching Content in Time, and Select the Appropriate Teaching Materials

The teaching syllabus is the teaching outline of a course. In order to realize the dual tasks of cultivating virtuous people and cultivating applied talents, curriculum ideology and politics should be naturally introduced in the whole course teaching process. Therefore, the syllabus design of the course should not only reflect what professional knowledge and skills the course cultivates students to acquire, but also reflect the ideological and political content of the course, so as to cultivate students to form correct values. Both teachers' teaching and students' learning are completed based on textbooks. The selection of textbooks will directly affect the teaching effect of a course. Therefore, it is very important to choose a suitable textbook. The single-chip microcomputer course is highly theoretical and practical, aiming at cultivating application-oriented talents. The textbooks selected for the course should not only reflect the current new technology, but also take into account the application of engineering practice. The textbooks should contain some specific cases reflecting engineering application, so as to facilitate the training of students' engineering practice ability.

3.2   Optimize the Curriculum Structure, Adopt the Method of "Project Case Analysis + Analogy Teaching", and Construct a New Model of Curriculum Theory Teaching

Optimize the course structure, with half class hours for theory and experiment respectively. The theoretical teaching adopts the method of "project case analysis + analogy teaching", uses the project case to guide students to learn, and uses the teaching method of introducing people and things similar to or similar to the teaching content when teaching knowledge points. The specific implementation method is to build the case base of the course project according to the teaching focus, and introduce the project case through virtual simulation demonstration in the classroom. For example, when explaining the interrupt system, the project case of interrupt keying color lamp is demonstrated by simulation, as shown in Fig. 1. The theoretical knowledge is integrated into the project case, and the theoretical knowledge related to interrupt is gradually introduced in the process of explaining the case. At the same time, each knowledge point is introduced into the examples in life through analogy teaching method. For example, when introducing the interrupt source, the interrupt source of the single chip computer is introduced by explaining that there is more than one interrupt source in life. Explore theory with life examples, compare the known with the unknown, cultivate students' ability to combine theory with practice and flexibly apply knowledge to solve problems, and improve students' learning
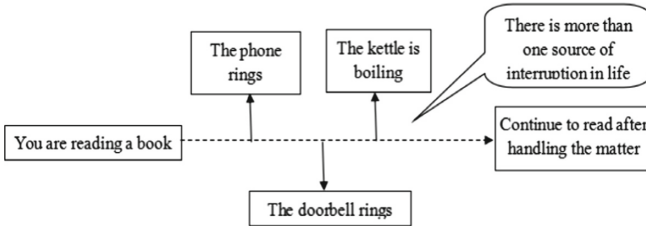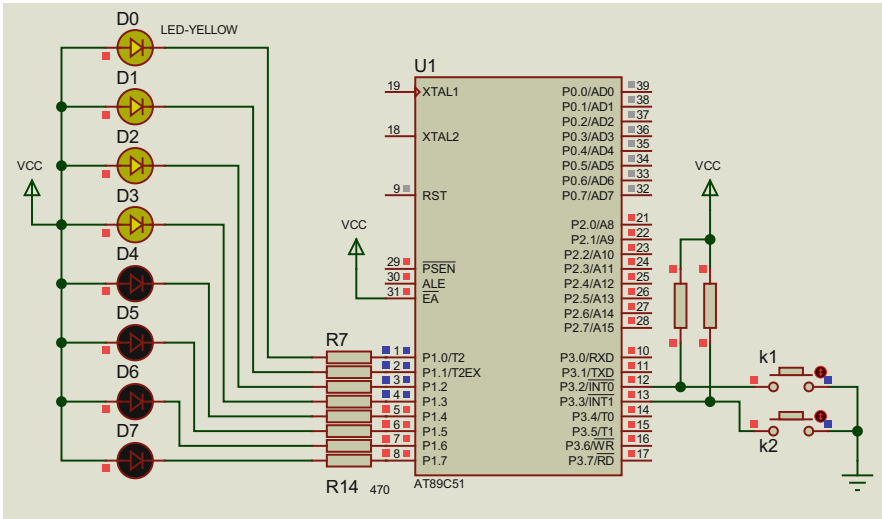
Fig. 1. Implementation of "project case analysis + analogy teaching" method

interest. In order to further improve the classroom teaching effect, the online learning platform is introduced into teaching. Before class, share learning resources to students through the platform for preview; In class, interact with students through the platform and release in-class exercises; After class, homework will be released through the platform to answer students' questions in time.

3.3   The New Model of Curriculum Practice Teaching is Constructed by Practical Stratification and Combination of Virtuality and Reality

For the experiment teaching, the experiment is divided into three levels according to the difficulty of the development and debugging level: basic, improved and comprehensive. The purpose of basic experiment is to make students master the most basic system application and program design methods, which is the content that all students should master. High-type experiments need to integrate the results of basic experiments and develop and design new application systems. The comprehensive experiment is designed for students who have a thorough knowledge of the knowledge points and want to further develop the system practical application, with the purpose of further improving students' practical and innovative abilities. In order to meet the personalized needs of students'

design, improve their innovative design ability, break the limits of experimental conditions, and enhance the flexibility of the experiment, instead of using the experimental box, the "virtual simulation technology + small development board" method is used for experimental teaching. The location of the experiment is changed to the computer room, and each student is configured with a computer and a small physical development board. Before the experiment, the task will be distributed to the students, and the students are required to simulate the experiment effect in advance. Through the simulation, the students can have a certain understanding of the hardware and program design of the experiment in advance. In the experiment, the online debugging will be carried out by combining the small format and virtual simulation technology. As shown in Fig. 2, the practice shows that the experimental method of "virtual simulation technology + small development board" is flexible and can effectively improve the efficiency and quality of the experiment completion, so that students' innovation and practical ability have been fully trained.

For the teaching of curriculum design, firstly update the project subject in time according to the students' interests and the development of current technology, and divide the project subject according to the level of difficulty to allow students with different foundations to choose. Each project subject is designed according to the "basic function + extended function". The basic function is designed by the teacher. The extended function requires students to independently design and propose new functions based on the basic function. This ensures that each project has a certain gradient and level, and teaches students according to their aptitude, so as to cultivate students from multiple aspects. In order to solve the problem of insufficient class hours, the whole course design teaching is carried out in six stages, namely, the proposal of tasks, the comparison and selection of schemes, the design of project hardware and software, the production of physical objects, the acceptance of results, and the students' reply and teacher's comments. The first three stages should be completed by students before the course design week. The teacher should do a good job of process supervision, guide students to learn to consult resources and documents, carry out research on project topics, and provide personalized guidance to ensure that each group of students can successfully complete the tasks of each stage. In the course design week, students need to complete the next three stages of tasks. Students first simulate and then make physical objects, write design reports, and teachers accept specific results, students reply to teachers' comments, and calculate the final score according to the proportion of each task. The teaching process of curriculum design is shown in Fig. 3.

3.4 Fully Excavate the Ideological and Political Elements, Naturally Integrate into the Classroom, and Achieve the Goal of Teaching and Educating People

Through the introduction of modern information teaching means such as "rain class" and "simulation technology" and teaching methods such as "project case teaching + analogy teaching", the ideological and political elements contained in the course are fully explored and naturally integrated into the teaching process, so as to further improve the teaching quality and achieve the goal of unifying teaching and education. Reorganize and integrate the teaching content, find out the ideological and political points related to the teaching content, skillfully integrate the ideological and political points into the
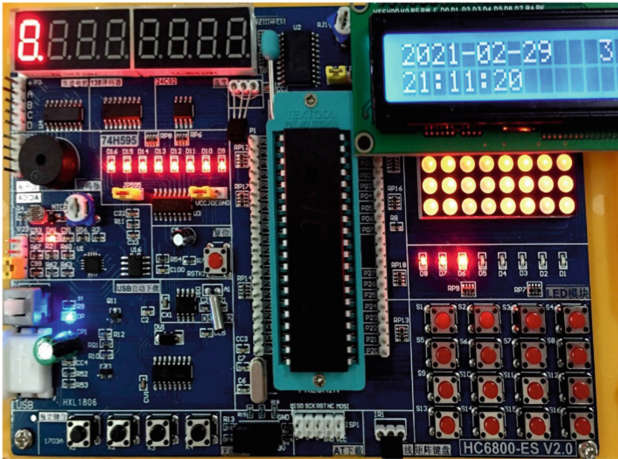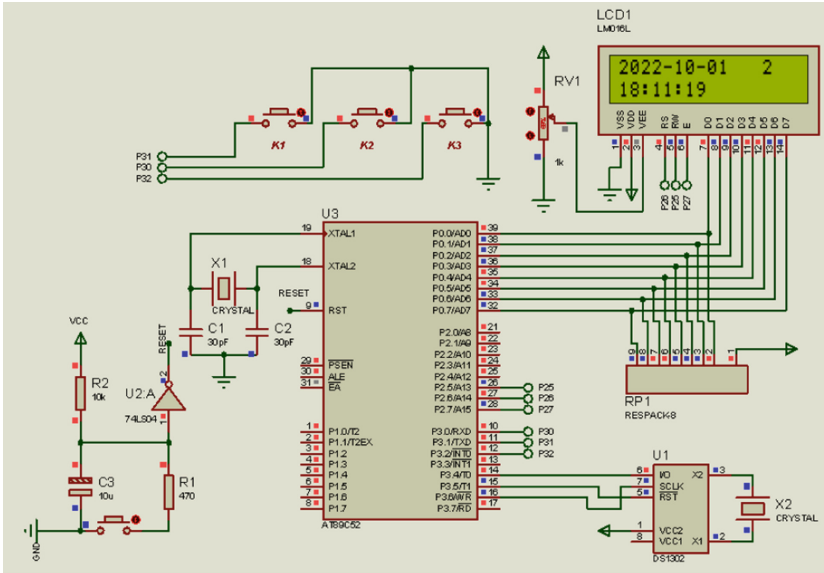
Fig. 2. Experimental method of "Virtual Simulation technology + small development board"

classroom through a variety of teaching methods, and cultivate application-oriented talents with both virtue and ability. For example, when teaching about the interruption of system priorities, the analogical teaching method is integrated into ideological and political points, and the management of priorities in our college life is compared, so that students can reasonably plan their college life according to their own conditions, embrace a better new life, learn professional and technical skills well, and make their own contribution to the development of national science and technology. The content of SCM course contains a lot of ideological and political points. Table 1 shows the ideological and political elements contained in part of the teaching content.
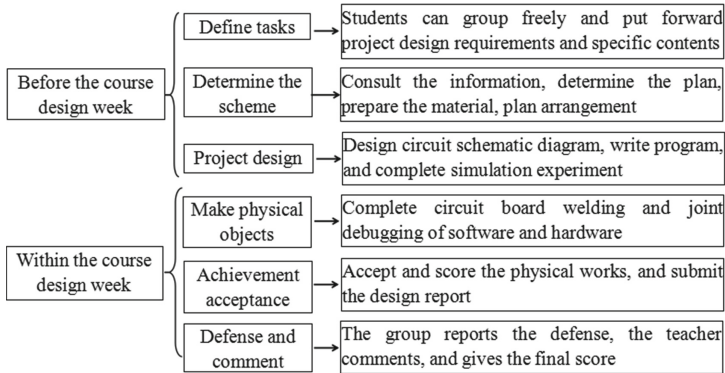
Fig. 3. Implementation method of curriculum design teaching

3.5 Pay Attention to Applying What You Have Learned and Scientifically Design Assessment Methods

In the teaching, students are emphasized to apply what they have learned, to be student-oriented, to pay attention to process assessment, and to test the learning effect of students in various forms. The final assessment of the course will separate the course design and integrate the theoretical course with the experimental course. Upon completion of the course, students will obtain the results of two courses at the end of the term, one of which is the result of integrating theory and experiment, and the other is the result of course design. After the integration of theoretical and experimental courses, the score consists of two parts: the written test score at the end of the semester (60%) and the hourly score (40%). The usual score consists of six parts: student attendance, class interaction, network platform learning, in-class practice, homework after class, and experiment. The course design assessment consists of the completion of the tasks before the course design week and the results of the design week (design report, system function realization, defense, team cooperation). In addition to focusing on the mastery of course knowledge and skills, this assessment method also focuses on the effect of students' ideological and political education, which is completed by assessing students' classroom participation, method application, practical ability, team cooperation, etc. This comprehensive assessment method can better reflect the actual learning effect of students, and has the role of cultivating students' comprehensive practical ability and value guidance.

4 Analysis of Reform Results

In order to verify the feasibility and effectiveness of the reform measures, two classes of the same grade were selected, one class adopted the traditional teaching method, the other class adopted the reformed teaching method, and the teachers kept consistent. The final exam scores of the two classes are counted, and the results are shown in Table 2. The results vary greatly under different teaching methods. The average score of the class after the reform is 9.12 higher than that before the reform, and the proportion of excellent,

Table 1. Part of the teaching content contains ideological and political elements

Teaching content	Ideological and political entry point	Ideological and political elements	Blending method
SCM overview, development history, application field, development trend	Chip development trend, ZTE Huawei event, the introduction of domestic chips	Scientific and Scientific and technological innovation, patriotism, social responsibility	Theme discussion, picture display, case inspiration
MCU software development software use	Precautions and errors in the process of software development	Meticulous craftsman spirit	Operation demonstration, operation practice,
MCU internal hardware structure	Pin function, clock circuit and timing	Regular and orderly professional quality	Case inspiration, knowledge correlation
The working principle and application of interrupt system	Interrupt process, interrupt priority	Good quality of organization and planning, pragmatic and craftsman spirit	Case entry, task orientation, analogy teaching, knowledge correlation
The working principle and application of timer	Knowledge of internal timer and time setting	Honesty and punctuality of professional ethics and professional quality	Video display, case inspired, task oriented, knowledge related
The working principle and application of serial communication	Serial port communication mode and protocol Settings	Abide by the agreement, social ethics, team spirit, great power feelings	Case study, knowledge relevance, task orientation

good and medium is significantly increased. The results show that the student-oriented teaching reform and practice of the course "Principles and Applications of Single-chip Computers" is feasible and effective.

Table 2. Student performance statistics before and after the reform

Score	Before reform	After reform
Excellent(100–90)	9.8%	10.9%
good(89–80)	17.6%	47.3%
medium(79–70)	25.2%	27.3%
pass(69–60)	33.7%	12.7%
fail(59–0)	13.7%	1.8%
average score	70.53	79.65

5   Conclusion

In order to achieve the double goals of cultivating talents and cultivating applied talents, this paper analyzes the problems existing in the current curriculum teaching and puts forward corresponding improvement measures. Through two years of practice, good results have been achieved, students' learning attitude and practical application ability have been significantly improved, and students' achievements have been significantly improved. In the past two years, the number of students participating in the project competition related to single-chip microcomputer and the number of winners have increased significantly. This course was rated as the excellent undergraduate course of our university in 2022. The reform and practice of the teaching methods of the courses studied can bring benefits to the course construction and the training of more comprehensive talents with both moral integrity and ability, and can also be applied to the reform and construction of other courses, with a high reference effect.

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