Research and Practice of Single-chip Microcomputer Course Teaching in Applied Universities

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Key words: SCM; applied universities; curriculum reform

Abstract. Application-oriented universities aim at cultivating applied advanced students and attaching importance to the cultivation of students' practical ability. According to the present problems of course teaching for the principle and application of the single chip microcomputer, including that the students don't like learning actively, lack of practical ability and the unreasonable curriculum assessments, the research and practice are carried out in this paper, by adjusting the content of courses, flexible teaching methods and reforming the curriculum assessment, and ultimately achieved the purpose of improving the of teaching quality and enhancing the practical ability of students.

1. Introduction

In recent years, with the changes of our economic system, in order to meet the needs of the society, some local colleges and universities are transformed into applied universities. The characteristics of applied universities lies in the "application" and "local", The teaching mode should be guided by the social industry, the professional demand as the core, the students not only have the profound theoretical basis, but also have strong practical ability and innovation ability, it required students better serve the local regional economic development after graduation[1].The single chip microcomputer principle and application course as an electrical, electronic information and other professional basic courses, has a strong practical and application. With the rapid development of electronic technology, all kinds of products based on SCM are widely used in consumer electronics, medical equipment, national defense and military and industrial production and the other fields, and the social demand for talents in SCM exploited is increasing[2].Under the new situation of the applied universities' transition, training technical talents both theory and practice with innovative spirit, the teaching mode should be constantly reform to adapt to the development of social industry.

2. Situation Analysis

In recent years, many applied universities in the teaching reform has done many research works, and also achieved good teaching results, but the students' practical ability has not been greatly improved, it mainly lies in the following two aspects:

(1) Cultivating students' initiative study. In the traditional teaching process, teachers and students are the relationship between "teaching" and "learning". Teachers focus on the teaching of classroom teaching, homework and answer questions, but less attention to the students' interesting In the course and active study[1].Students are the principal part of study, so teachers should not only teach the basic knowledge of SCM, but also give full play to the enthusiasm of the students, by focusing on the students' interest to guide the students to active learning and practice to turn theories into their own knowledge and ability. From the students' thought "want me to learn" into "I want to learn", the teacher not only is to change the teaching idea, but also attach to higher requirements in the teaching methods and the overall control ability.

(2) A good course assessment method is necessary. At present，the SCM course assessment is based on the final exam results, Which The final exam results accounted for 70%，usual attendance accounted for 10% and the experimental results accounted for 20%. there are some problems in the process of student experiment: some students are lack of interesting on the experiment topic; some

students directly copy the other students' program to complete the experiment, but they have not master course content at all. There is a high proportion of objective topics in the final examination, and the less of students' practical ability proportion. Students focus on rote knowledge points, and the actual ability of students in program is poor, which shows the curriculum assessment of the distribution of knowledge need to be more rational.

3. Research and Practice of Teaching Mode

In view of the above problems, this course group has carried out reform and research from the aspects including teaching content, teaching methods and practice teaching to cultivate applied technical talents.

3.1. Adjusting the Teaching Content. The SCM course includes 52 hours of theoretical lectures and 12 hours of experiment, while another 1 week curriculum design. In the teaching time, both to complete the theoretical content of SCM, teaching content should be close to the development of technology, but also to enhance the practical ability of students, which requires careful selection of teaching content.

In the selection of teaching materials, not limited to fixed materials, every year teaching content changes according to the trend of technological development, including delete the outdated content or add appropriate topics and examples, which is professional, targeted Strong, close to the practical application, combined with theoretical content and knowledge expansion. The course contents general include the following: Overview, SCM hardware knowledge, SCM I/O interface, C language programming, interrupt system, timer / counter, serial communication, A/D and D/A, SCM expansion and SCM practical project development. The SCM I/O interface contains I/O working principle and programming applications, buttons, LED, digital tube, DC motor, etc. Serial communication content mainly includes the serial technology protocol and related application chip, such as I2C, SPI, 1-WIRE and USB, etc. Typical serial chips include such as AT2402, DS1302, DS18B20, ISD4000 series chip, etc [3].

Programming language using assembly language or C language, and different schools and teachers have different understanding, so exist the different teaching focus. Finally, I choose the C language as a programming language, and assembly language is only occasionally interspersed with the introduction of the teaching process. Although in the SCM course and follow-up courses will be related to the assembly language, such as DSP principles and applications, embedded development and application [4]. The reason is to take into account the actual development of students in most of the time is to use C language as a programming language, only in the bottom of the driver or used as boot code. Although the c language program exists the defaults such as indirect hardware control and relatively low efficiency, but in the long run, its good capability and portability, especially in the complex operation, floating point operation, etc., As a high-level language C language, its simple and compact, flexible grammar mechanism, the writing of complex program is much easier.

3.2. Diversifying Teaching Methods and Means. To make the students feel interesting in the course, improve the students' practical abilities, show the charming of SCM course and change students' active learning attitude, which requires teacher should have good teaching methods and means to guide students effectively.

3.2.1. Cultivating Students' Interesting. First, to arouse students' interest in learning in the first lesson of the course is very important. I use the single-chip development board with LCD12864 to display "welcome to the world of single-chip" with different background music, which make students interested in single-chip courses significantly and active classroom atmosphere. Then through pictures or videos to demonstrate the typical application of embedded devices, such as smart bracelet, four rotor aircraft, smart home and etc., also show the various competitions winning achievements in recent years. It will give students a deep impression and that, as long as their own efforts to learn, set a goal, also can obtain the above achievements and awards, naturally the students make obvious interest in learning, and the effect is better.

3.2.2. Project-based Teaching Mode. The traditional SCM course teaching is to introduce the principles firstly and then examples of applications. The first half of the teaching stage is boring,

which makes some students less interested in it, and the effect of learning is poor. The research group uses project-based teaching, the first application and then explain the principle, and the learning effect is obvious. In the teaching stage, we first establish the vivid practice project, attracting the interest of students, and then lead the students to explore the reasons. To explain the knowledge and principle of SCM thought the practical project step by step, which is helpful for students to master SCM. This project-based teaching is to practice as the carrier, and gradually in-depth explain the micro-controller internal resources and C language, with explaining the actual project development process commonly used in circuit design and programming skills etc[2]. Because of the design ideas and programming skills combined with the actual project development, so that students can quickly put into the actual development when they master it. For example, in the stage of "the I/O interface", we first demonstrate the forward and reverse flow of lights, and then use the key to control the forward and reverse lights and flashing states. When the student's attention is attracted, they began to consider how to achieve the function, and then the teachers step by step explain the I/O micro-controller resources, driving methods, precautions, etc. In this process, the circuit design can be extended by connecting to the courses of analog circuits and digital circuit they have learned. From a single LED drive circuit to master the drive mode including sink current and pull current, the selection of current limited resistor, the setting and application of the resistor pack in the eight LED driver circuit, also the circuit setting of the buzzer due to its insufficient drive current use the transistor to amplify or other drive chip. In the whole teaching stage, from the hardware to the software, to teach students the hardware working principle and ideas, to connect the technical problems difficult to understand or theoretical knowledge with practical life as far as possible, to help students understand the micro-controller principle with more realistic styles. In the subsequent electronic design and development process, The students search the relevant information actively, and will not be confused, then the difficulty of completing the circuit design will be significantly reduced.

3.2.3. Abundant Teaching Methods.
The teaching mode that using PPT and blackboard by teacher and passively accepted for students is not appropriate in modern technology social. We should make full use of a variety of teaching methods to improve students' learning initiative and initiative, and thus improve the quality of teaching.

Combined with compiler software Keil and simulation software Proteus, the teaching effect of present programming and debugging simulation is more obvious than that of demonstrated directly by the power-point. Proteus as an excellent simulation software, shows the function and effect of programming directly, enhances students' awareness of single-chip computer course, and stimulates students interest in learning. The software is not limited by the hardware chip, and it is very helpful for students to learn micro-controller by being designed or debugged in their spare time. In the course of teaching, I would rather spend more time to write program at present, and debug simulation results in Proteus. Students in the process of the teachers' manual programming, can , realize the ideas and skills of programming. Sometimes the teacher have some problems in programming, and let students to help the teacher to find it, which is helpful for students to pay attention to their related knowledge, rather than demonstrated simply by PPT for students to learn. passively. At the end of teaching, students generally show that the learning effect is better, and the enthusiasm and initiative of learning are better than those of other courses.

It should be pay attention to the cross-uses of courses in the teaching. For example, in the "single-chip C language programming" content, using the sentence of "for", "while" and "switch" to achieve the same status of the flowing lights respectively. Students in the process of comparing each other, will realize the different uses and programming efficiency .At the chapter of D / A conversion ,the array is usually be used to achieve the sine wave program. Using Matlab program to achieve the sine wave array data, then guide the students to deal with some complex data through Matlab, and then to the micro-controller processing or implementation.

Carry out group discussion teaching. Teachers prepare the discussing content first,and arrange 5-7 students as a group to discuss and complete, in this stage teacher should control progress and the difficulty of the subject and timely summary. For example, in the "electronic watch" discussion,

there are many ways to solve the problem, through the students discuss and improve at present, which not only active classroom atmosphere, but also conducive to students' sense of participation, is of great help in cultivating students' initiative, independence, language expression ability and the logical ability and independent working ability. Teachers can better adjust their teaching progress and promote the improvement of teaching methods by listening to the discussion of students and knowing the shortcomings in their learning. Therefore, to carry out the group discussion teaching plays a vital role in learning initiative for teachers and students, strengthening the interaction between teachers and students, cultivating students' challenging and innovation consciousness,, inspiring students to explore and acquire knowledge creatively, and improving self-learning ability.

3.3. Strengthening Practice. There are 12 hours of classroom experiment and 1 week course design，to improve the students' practical ability in limited time, so it is very important in the experimental selection and arrangement. The total experiment is divided into design experiment and comprehensive experiment. The design experiment is the extraction of a specific section of the content, such as flowing lights, timers, interrupts and so on[2].Comprehensive experiment is to learn the crossing knowledge of the chapter, such as simple electronic calculator. The subject of curriculum design should be diversified, can be part of the contents of the research topic of teachers, or it can be in the research and entrepreneurship projects, etc.. The teacher provides the technical support, the experiment equipment and the open experiment sites, to let the students consult the reference, the design programs, the writing procedure, and finally complete the experiment. In the checking phase, it is usual for students to use PPT to introduce the design process, hardware demonstration and question to carry out project. For individual students with outstanding ability, you can choose the more difficult subject, the source of the problem can generally be obtained from the website, such as 21ic, electronic engineering world and crowd-funding and so on. Teachers should timely give guidance to students design suggests or design direction, Q&A in fixed time, timely tracking of students' design, to avoid the students to complete the course design by copy from the Internet and lead to their lacking of practical ability. Teachers should do a good guiding for students who are very interested in electronic design. It Can be participated in the National College Students Electronic Design Competition, Challenge Cup Innovation Entrepreneurship Competition, etc..so that the students find their own lacking in the process of competition, and through active learning to improve their comprehensive quality, ultimately achieve the purpose of improving students' practical ability.

3.4. Reforming the Curriculum Assessment. In view of the shortcomings of the previous course examination, the research group started to develop the practical ability of the students as the starting point, and reform the curriculum assessments[3]. Examining method: the final exam accounts for 50% , usual grades accounts for 10% and experimental results accounts for 40% in the hundred-mark system. The improving proportion of experimental results require that the experimental teacher should properly assess the students' grade according to the quality of each student' experiments. The final examination papers should pay attention to the type and proportion of the topic, to avoid too much theoretical knowledge, to emphasize more practical ability of the topic, by reducing the proportion of objective, increasing the proportion of subjective to reverse the learning mode of students, to cultivate students' practical ability .

4. Summary

According to the characteristics of Microcomputer Principle and application course, to enhance students' practical ability as the goal, the teaching reform and research are carried out from the aspects of teaching content, teaching methods and means, practical teaching and curriculum assessments. Through nearly three years of teaching feedback, the quality of teaching has been significantly strengthened, the enthusiasm of students and practical ability has been greatly improved. In the future, the research group will continue to explore and learn from each other, to

cultivate students' practical ability and innovation ability, to promote construction of applied technical talents in local colleges and universities, and improve the quality of personnel training [5].

Acknowledgment

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