On-line and Off-line Courses in Embedded Systems Courses

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Abstract. Online and offline (O2O) interactive teaching method is a new modern teaching method. Compared with traditional teaching methods, it has many advantages, such as online teaching, abundant teaching resources, diverse methods and high learning efficiency. Aiming at the traditional teaching mode of embedded system course, this paper designs online and offline teaching models from the aspects of teaching content, teaching methods and teaching evaluation. This paper puts forward a teaching method aiming at cultivating students' practical and innovative abilities. This paper discusses the application of online and offline (O2O) interactive teaching method in Embedded Course Teaching in Colleges and universities from the aspects of online network resource design and offline classroom theory teaching, and gives the teaching effect analysis of Hybrid Teaching mode.

Introduction
Modern higher education puts forward the task and goal of educational informatization: to strengthen the integration of curriculum education and information technology, and to cultivate innovative talents. Therefore, it is a challenge for us to study and explore the teaching content, teaching methods, teaching means and information technology in-depth integration methods and integration rules. The embedded system course is a basic course and application course for computer, intelligent science, electronic information and other specialties. We have applied the integration practice of this course and information technology. According to the platform of "excellent college" of Wuhan Institute of Technology, the research and discussion of online and offline teaching of Embedded System Course Based on Internet cloud is realized and the effect is good. The following aspects are introduced.

On-line and Off-line Teaching Mode Design
At present, there are two main ways to design online and offline modes in Colleges and universities: the first is to put all kinds of resources of courses online on the network platform, mainly based on simple knowledge points. Each chapter is composed of several short videos and so on. Students study independently, and complete online homework according to the requirements of courses. Teachers test online and answer questions accordingly. This model has a good effect on theoretical course learning, but it has a general effect on practical courses. The second mode is to make all the knowledge points of the course into online videos. The students learn systematically online. The off-line teachers teach the theory quickly according to the students’ online learning situation. They mainly talk about the difficulties of students' online learning, and then do a lot of practical operation. This model is quite suitable for courses with tight combination of theory and practice. Embedded system course belongs to this kind.

On-line and Off-line Teaching Model Design of Embedded System Course
The author tries to construct a hybrid teaching mode of online and offline embedded system courses from the aspects of teaching content, teaching methods, teaching practice and teaching evaluation.
Content of Courses

Because there are many majors involved in the course of learning embedded system and the students' foundation is quite different, the design of the course content should meet the learning requirements of the students of this major on the one hand, and the content depth of the students of other majors on the other hand. In terms of teaching content, the design of hierarchical, progressive and multi-selective content is suitable for students at all levels of diverse learning needs. We design the teaching content in Figure 1 based on many years' experience in curriculum and project design. Embedded system hardware basic part describes the basic knowledge of ARM9 SC2440: including timer, interrupt, AD, DA, SPI, PWM, IIC, LCD and other basic knowledge. Each knowledge point applies ADS software integrated development platform to design corresponding project topics for unit consolidation. The software system of embedded system describes the application of ucOS and Linux operating system. The knowledge points include task management, communication between tasks, time management, operation system transplantation and so on.

Teaching Method

In the online and offline hybrid Embedded Course Teaching mode, different teaching methods are adopted according to different teaching content requirements. For the embedded theory part, such as ARM hardware interrupt, timer, register, addressing mode, etc., students learn online, online discussion, online question answering and so on; for the practical teaching content of AD/DA (analog digital conversion), PWM (pulse width modulation), etc., under the laboratory environment, 1 (teacher) to 6 (student) teaching mode, advance. For the teaching content of embedded operating system, such as task creation, task communication, task management, etc., online small video multi-knowledge point self-learning, online unified course in-depth explanation and course experiment are adopted; for embedded operating system porting teaching content, online students are allowed to learn relevant resources and conduct basic courses online. Transplant operation, answer questions and correct them offline.

Teaching Evaluation

Course assessment is an important link to test students' learning effect. Our course results are divided into three parts: (1) 15% of the normal grades, mainly including attendance and completion of homework on-line; (2) 35% of the robot project scores, mainly including the writing of project papers, the demonstration of project codes and answers to relevant code knowledge points, the
principle and method of project hardware design, and the project defense situation, and finally according to the item. The division of labor and internal coordination of team members are given corresponding scores. (3) 50% of the final closed-book test scores, mainly through the examination papers to test students' grasp of basic knowledge points.

The Development of Online Teaching Resources for Embedded System Courses
According to the characteristics of embedded system course, in order to echo the online and offline teaching mode, the corresponding online teaching resources have been improved and perfected.

Increase the Number of Micro-lesson Videos with More Difficult Knowledge Points
Due to the fragmentation and indeterminacy of students' learning time and the diversification of students' levels, it is necessary to design corresponding micro-lesson videos in difficulty and gradual. For example, in the basic part of embedded system hardware, 6 micro-lesson videos are designed for knowledge points such as registers and addressing modes; in the embedded operating system, 8 micro-lesson videos are designed for task creation, inter-task communication, message management, etc. Students can choose to learn the corresponding videos according to their own foundation and learning progress.

Strengthen the Supervision of Students' learning Process
Teachers answer students' online learning questions and check their online learning knowledge points in a fixed period of time every day. Teachers improve or add or delete the corresponding online teaching resources according to the results of the examination, and design or adjust the corresponding teaching videos according to students' learning feedback. For example, in the course of running embedded system online course, it is difficult for students to learn the hardware part of embedded system by feedback. By communicating with students, it is found that their guiding course is to learn the principle of 8-bit single-chip computer, and that some majors have not even set up circuit theory. Obviously, this part of students will have a hard time learning 32-bit embedded system hardware. Therefore, according to the feedback from students, we added the curriculum resources of connecting the principle of single-chip computer to the principle of 32-bit microprocessor on-line, and designed some teaching resources of circuit theory knowledge points.

Experiments
According to the nature of embedded system course and teaching requirements, we have added 12 experimental hours to the practical teaching of the original 8 experimental hours, reaching 20 experimental hours. According to the hardware part and the operating system part of the embedded system, experiments such as LED, EEPROM, IIC clock, LCD display, task creation, task communication and task priority are added.

Analysis of the Effect of Course Teaching Mode
The teaching mode of embedded system based on online and offline has been carried out for nearly one semester, and the following expected results have been achieved:

The Efficiency and Interest of Students
Because of the fragmentation of time, the repeatability of course learning, and the flexibility of electronic devices, students are interested in learning. The theory and method of embedded system in online learning and experimental verification offline stimulate students' enthusiasm for learning.

The More Convenient Communication between Students and Teachers
On the one hand, students can make teaching evaluation for teachers' answers and online guidance in the course of online learning; on the other hand, teachers can effectively evaluate students' academic performance according to students' online learning and online examination.
The Improved Teachers' teaching Level and Students' Learning Quality

Informationized teaching mode determines that teachers should prepare more and better online teaching resources and design teaching resources rationally; while students leave the traditional projection PPT teaching mode and turn to learning and communication at anytime and anywhere, and submit corresponding online homework in time to induce and stimulate students' autonomous learning, which significantly improves the quality of students' learning.

Conclusion

Aiming at the traditional teaching mode of embedded system course, this paper puts forward the idea of online and offline hybrid teaching mode, designs the teaching mode of online and offline embedded system course from the aspects of teaching content, teaching method and teaching evaluation, and puts forward the teaching method aiming at cultivating students' practical ability and innovation ability. This paper discusses the application of online and offline (O2O) interactive teaching method in Embedded Course Teaching in Colleges and universities from the aspects of online network resource design and offline classroom theory teaching. Through the teaching effect, the students' academic performance and practical ability have been greatly improved. The next step will be to strengthen the teaching mode design, so that more students can benefit.

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Reference