Discussion on the Work Process Oriented of Teaching for the Course of Micro Controller Unit in Medical Imaging Engineering Major

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Abstract. This paper states the ideals and methods of teaching reform to the course of Micro Controller Unit in Medical Imaging Engineering Major. On the basis of explaining the disadvantages of the existing teaching situation, new ideas of teaching reform are explored combining with work process oriented. The work process oriented teaching explores the effectively improve the enthusiasm of students, fully mobilize the students’ initiative and creativity, exercise the spirit of student teamwork.

Introduction

Micro Controller Unit (MCU) are widely used in signal acquisition, data processing and display of medical device products with its intelligent potential, strong interface driving ability, easy expansion and low power consumption, and its technology is changing with each passing day [1]. In recent years, MCU application technology talent demand. At home and abroad in the MCU technology updates at the same time, all kinds of universities are also accelerating the development of MCU course and teaching reform. As a university student in Shanghai University of Medicine & Health Sciences with medical imaging engineering major, a large part of the graduation will be engaged in the production, installation and maintenance of medical imaging equipment. Therefore, the knowledge of MCU just like analog electronic technology and digital electronic technology as they must master the knowledge and skills [2].

Today, with the development of modern biomedical engineering technology, medical imaging engineering in the field of high-tech industry has mushroomed vigorous development [3]. Engaged in medical imaging equipment production and research of enterprises need both medical imaging engineering professional quality, but also has the development and application talent of MCU [4]. However, in medical universities, the teaching of MCU in medical imaging engineering major is still using the traditional textbooks suitable for electronic information or mechanical and electrical major. The drawbacks of this way of training caused the students to graduate on the one hand cannot find the ideal job, on the other hand the enterprise cannot recruit the real needs of talent. Based on the principle of teaching must be oriented to the user market, as the teaching of MCU in medical imaging engineering major must teaching reform.

Present Situation

The course of MCU in medical imaging engineering major emphasis on the theory, the selection is a lack of application. Training courses used in the experimental instruments are fixed, the students on the machine experiment is just using a few lines only. Software part of the debugging is also very
simple, cannot fully understand the MCU design and development process [5]. So that students finish this course, they do not know how to system design, do not know how to chip selection, but they do not know how to carry out hardware and software integrated debugging. This teaching structure, so that students generally feel that the application of MCU technology is difficult to learn, the lack of enthusiasm for learning. The reasons for these problems include the following aspects.

Teaching textbooks and medical imaging engineering major education does not match. Now most of the MCU course textbooks are for students of ordinary university but not for medical university, which is characterized by the internal structure of the MCU, working principle and timing process, such as in-depth and detailed introduction, but the use of MCU system design, especially medical imaging products design is less. These elements are essential for researchers engaged in chip structure and MCU technology research, but for most of the application of MCU control system development staff is the cart before the horse. Especially for the students in Shanghai University of Medicine & Health Sciences with medical imaging engineering major, due to digital circuits, analog circuit knowledge and logic analysis ability is poor, the use of this teaching textbooks, not only difficult to produce interest in learning, and it is easy to produce the thought of boredom.

The activity of students in the training program has not been paid attention to and played. The current MCU experimental teaching, is to verify the contents of the theory of MCU for the purpose of the arrangement, is a verification experiment, rather than the use of MCU functional organization development training. Students in accordance with the MCU hardware structure, instruction and software programming verification, application examples to verify the order of the completion of the training content of the course. In the teaching experiment, teachers to teach knowledge for the purpose of teaching in accordance with the order of instruction, experimental courses as the knowledge in classroom to arrange and form a teacher-based and knowledge-based traditional teaching mode, resulting in students in operating opportunities is less, brain thinking chance is more less. This phenomenon led to the theoretical knowledge of students without engineering students solid, hands-on ability cannot be accepted by the employer. This not only makes students lack of interest in learning, depressing students' creativity and initiative, and fundamentally unable to meet the requirements of applied talents education.

**Method of Teaching Reform**

Work process oriented applications talents education is an important direction for the development of international education curriculum in recent years [6]. The so-called work process, refers to the enterprise in order to complete a task and get the results of the work carried out a complete working procedures. Learning areas, learning situation, and the development of learning tasks are from the occupation and the industry work process. At present, based on the work process system development application type talent education course mainstream thought is the study domain curriculum pattern. The selection of the course content will be guided by the work process. The first step in the reform is to work with well-known medical device companies(example: Siemens Healthineers [7]) to analyze the work process of the course of MCU, to clarify the work of the MCU application technology in the field of work tasks and then order, a clear MCU application technology courses professional ability goals. Through the in-depth exchanges with the enterprise, to establish the application for MCU product maintenance, production and research and development positions, analysis of MCU product development process, pushing the corresponding professional job capacity. At the same time, based on corporate culture, decomposition of the post should have basic professionalism. On this basis, the establishment of a MCU application technology using a training task and a number of sub-tasks combined model, that is, at the beginning of the course to study the end of the task to achieve the task ----Computed Tomography (CT) Simulation Control System. The task production is shown in Figure 1.

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Figure 1. Computed tomography (CT) simulation control system.

All the training sessions of this course revolve around the tasks. Specifically summarized as the following items [8]:

- Task 1: Design, installation and commissioning of data acquisition MCU control system
- Task 2: Design and debugging of data conversion in MCU control system
- Task 3: Design and debugging of data transmission in MCU control system
- Task 4: Design, installation and commissioning of keyboard scanning, decoding MCU control system
- Task 5: Design, installation and commissioning of MCU control system
- Task 6: Design and debugging of digital tube, LCD display control system

Based on the above six projects teaching, students can not only learn MCU and commonly used sensor knowledge, but also familiar with a product development process, and the knowledge to form a complete system. Be task as the carrier to organize the training, the application of the field of work in the training process.

The complete production process of CT Simulation Control System includes six tasks: task clarity, organization plan, plan decision, implementation, inspection and acceptance, evaluation summary. Only to participate in the complete work-process, students can gradually form the application of the needs of social sense of belonging, sense of responsibility, professional creativity. For the six tasks, students should complete the following tasks:

I) Clear training requirements, understand the software, hardware respectively to achieve the standard. The task is mainly to let each student clear the purpose of training, and ultimately to complete the product features. This task is the basis of the entire training project, students only in full understanding of the premise of training requirement, it is possible to make a reasonable design to ensure that follow-up training in the right direction.

II) The working groups conduct intra-group division of labor and collect information. This work for the first time involved in product production of medical imaging engineering major students in terms of some difficulties, especially at the beginning they do not know where to start. Can be used to student-led, teachers outside the guidance of the way, both to give full play to students' subjective initiative, but also to ensure the smooth development of training.

III) Work group to discuss, select a reasonable CT Simulation Control System design. The use of group learning method, the working group were put forward to complete the task design, each group selected a student came to the stage to put forward the implementation of this group of programs, teachers and students to discuss after the discussion, more optimized, the final selection of a reasonable, scientific program to implement. In this session, the teacher should be appropriate to the students to design the program analysis, pointed out a reasonable place and affirmed, euphemistically unreasonable and need to amend the place, so as not to combat student enthusiasm.

IV) For component procurement, circuit board production, program preparation. At this stage, students in accordance with the work plan, independent of the selected components procurement, complete data collection, data conversion, data transmission, data display, keyboard and microcontroller control and other tasks. Teacher in the implementation of the task of the tour guide,
give the necessary knowledge to add; in the implementation process for each step of the student self-examination, timely correction, and work records.

V) Debug the circuit, download the program. After the project is completed, check for the initial task requirement, check the completion of the project, if not the case, for analysis and modification. This process is more difficultly, comprehensive ability requirements are higher, for students with poor ability, teachers can step by step to guide how to debug the circuit board and procedures, cannot be arranged. Students commissioned on the work-process and the results of the summary.

VI) Summary of assessment. The evaluation is divided into three aspects: self-evaluation, group evaluation and teacher evaluation. The self-evaluation stage of the group was first communicated by the members of the working group. The advantages and shortcomings of the training team were summarized. The improvement plan was put forward for the shortcomings. The results of the other working groups were evaluated by the working group. And the recommendations; teacher evaluation is the evaluation of student reports and results, pointing out the advantages of each working group and its members and make recommendations for improvement. Finally, the students fill out the evaluation form and the optimization plan according to the suggestions of other working groups and teachers' evaluation, and collate all the information and file the project.

Results

The work process oriented training arrangements ask for teachers and students of the higher requirements, teachers need to stimulate students’ interest in learning, to guide students to complete the task, to develop students to think, analyze and solve problems; students need to seriously think, actively, in the prescribed time to complete the task. Thus to teaching, learning, training integrated. So that students experience the success of the task to complete the fun, understand the importance of teamwork.

CT Simulation Control System production tasks, the use of “workshop teaching” organization, sub-classes for a number of “working group”, and select a “supervisor”, other students as “staff”, experience the work environment and work process, not only to the professional ability of the training objectives, but also strengthen the students' learning methods and social skills.

The basic characteristics of “workshop teaching” are: the main body of the study is the working group, each working group to complete a number of learning tasks according to the work-process, each member of the working group in the working group to assume part of the sub-tasks, members of the group as required independent or collaborate to complete their own sub-tasks, the work of each task is to work groups as the object to state the actual completion of the situation. Each group of members and teachers score each other according to the statement and the actual completion of the situation, evaluation, pointed out to complete the better and need to improve the place, and students together to write feedback report. Through this organization under the guidance of teachers to work in the form of organization, so that students take the initiative to participate in the entire process of training tasks, students will learn how to obtain knowledge and information, teamwork, communication and other basic knowledge, exercise the ability to express language.

Summary

The course of MCU in medical imaging engineering major to work process oriented, to CT simulation control system as the carrier, effectively improve the enthusiasm of students, fully mobilize the students’ initiative and creativity, exercise the spirit of student teamwork. Through this training project, can be fully taught and practical work needs not out of line. So that students in the university mastered the required knowledge of actual work, cultivate the students’ practical ability and practical skills to meet the industry demand of applied talents for medical imaging engineering.
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References


