Research and Practice on Course Design of Medical Physiology and Engineering under the Background of Cultivating Innovative Talents

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Abstract. This paper takes the medical electronics foundation course of medical imaging as an example, Through the introduction of four typical circuit design requirements and design methods, discusses the purpose and significance of increasing the course design of medical physiological engineering courses under the background of cultivating innovative talents. The method of curriculum design in medical courses, the main problems to be solved and the specific design scheme and results. According to the task and design index requirements of the selected topic, students determine the requirements of the overall design scheme, and draw the system block diagram of the overall scheme (pre-design stage); Analysis, input design, compilation and simulation of the underlying unit circuit; Draw the schematic diagram of the top circuit with the correctly compiled module of the bottom unit, and carry out compilation, debugging and simulation test. Write design report. Through course design, students can learn to search information, compare schemes, calculate circuit parameters, design circuit schematic diagram, make printing board, weld and debug components, test circuit performance, so as to improve students' ability to analyze and solve practical problems. After the completion of the overall design, select the right device, apply the design scheme, complete the circuit board production, one step in place. At the same time, virtual and real contrast.

1. Introduction

1.1 Concept
Practicum: Curriculum design (See figure 1) refers to the comprehensive practical teaching link of a certain course in a university. It is a systematic activity with purpose, plan and structure, including teaching plan, teaching content and teaching link.
This concept of curriculum breaks through the limitation of curriculum in classroom teaching and extends its scope to the education environment of the whole school. It breaks through the limitation of only paying attention to the accumulation of knowledge and experience in the past, and takes many factors such as accumulation, transfer and promoting the development of students as indicators. [1]

1.2 Course design features
The curriculum structure is determined by learners' needs and interests. The emphasis is on problem solving.

1.3 Curriculum present situation
The current situation is: biomedical and science and technology classes of the intersection of courses. Such as "medical electronics", "medical imaging physics", "medical imaging equipment", "principles of medical imaging", "medical imaging technology"[2]... Not many people are involved. There are even fewer courses designed specifically for medical students' ability cultivation. Therefore, we want to increase the link of course design for medical students' science and engineering courses. While stimulating students' interest in learning, it mainly reflects the unique role of science and engineering thinking in the cultivation of medical students' comprehensive ability.

2. Purpose and Sense

2.1 The demand of talents training in the social environment of mass entrepreneurship and innovation

The need of cultivating innovative talents in the background

→ innovative talent (Ability to learn, analyze, innovate, practice and express…….)

→ Strong logical thinking ability (Science and engineering hinking)

→ The weakness of medical students (It is characterized by memory and summary)

To change the weak

(Strengthening competency through the few science and engineering courses offered)

Cultivate innovative ability → In the course, the course design links with independent topic selection, independent design, independent programming and independent debugging are added.[3]

2.2 Improve students' interest in learning
Medical students are difficult to learn science and engineering courses, and often fail to understand and pass the phenomenon.
Curriculum design links can be determined by the needs and interests of learners to design content, focus on the solution of problems, improve interest while cultivating ability.

2.3 Curriculum reform and curriculum construction needs
What we offer is the interdisciplinary course of medicine and science and technology, it is professional basic course! (required)

Course design is very common in science and engineering courses, while in interdisciplinary subjects, "medical electronics foundation" as an example, the use is not much![4]

The project experience can be extended to principles of microcomputer and interface technology and medical imaging physics.

2.4 To meet the employment needs of students
In the current IT - DT transformation era, big data transmission information is imperative! As a medical student who is going to be qualified as a doctor, he/she should have a professional foundation in science and engineering. [5] Simple programming training and the use of computer application software make up for the shortage of medical students in this respect and can broaden the employment channels of medical students.

2.5 Create a flexible and interactive learning platform and atmosphere for teachers and students
Through the public number, in the "medical electronics foundation" course design interactive platform to release a variety of teaching resources, so that students and teachers, students and students form a mutual assistance, progress, mutual motivation teaching mode!

3. Main Contents and Key Problems to be Solved

3.1 Based on the discipline emphasis of electronic technology in medical field, students' innovative ability is cultivated. Take Kirchhoff's law as an example, see Figure 2.

![Kirchhoff voltage law simulation](image)

Figure 2. virtual simulation of kirchhoff's law

The curriculum design is based on the characteristics that the curriculum structure is determined by the
needs and interests of learners. According to the knowledge imparting should be practical, practical, practical teaching objectives; In line with the student-oriented, employment-oriented, ability training as the goal of the curriculum design concept; Choose the main content of the course design.

3.1.1 Circuit fundamentals - kirchhoff's law. Design task: design a dc path to verify kirchhoff's law.

3.1.2 Biomedical amplifier circuit - filter simulation circuit design. Design task: design a pass filter circuit.

3.1.3 Application of combinatorial logic circuit -- design of emergency indicator light in hospital nursing station. Design task: design a four-ward distress system.

3.1.4 Application of sequential logic circuit -- four-channel color lamp design. Design task: design a four-way colored lamp.

3.2 The virtual and real combination of circuit design contrast
This course is designed mainly with the help of EDA (computer-aided design and analysis of electronic circuits).[6] Design software——Multisim 14.

The design of circuit with Multisim can simulate and analyze the actual circuit work truly, highlight the student-centered open mode, stimulate students' bold imagination and try various design schemes and adopt different integrated components, which is helpful for cultivating students' innovative consciousness.

After the completion of the overall design, select the appropriate device, apply the design scheme, complete the circuit board production, one step in place. At the same time, real and virtual comparison was made. Take the design of the emergency light at the hospital care station as an example, see Figure 3.

![Design of ward call system](image)

**Figure 3.** design of emergency indicator light in hospital nursing station
3.3 Convenient interactive mobile terminal publishing

All the course design will eventually be established in their own public account "medical electronics basic course design"
- Platform real-time release. The content is as follows:
  - Open courses: Including courseware download and microlecture display.
  - Practice platform: Including software download and simulation experiment.
  - PBL interaction: It includes four design topics and students' communication of design schemes.

4. Implement Measures and Results

Teaching mode: verification, improvement and comprehensiveness.

4.1 Circuit Foundation-Kirchhoff's Law

Design Task: Design a DC path to verify Kirchhoff's law.
- Requirements: All circuits are made up of linear components, at least double power circuits. The measured circuit values of the current meter and voltmeter are compared with the theoretical results.

4.2 Biomedical Amplifier Circuit -- Design of Filter Simulation Circuit

Design Task: Design a band pass filter circuit.
- Requirements: The signal passes through the frequency range F between 100Hz and 5KHz, the pass band gain is about 6dB, and the drag band decay rate is about -40 dB / tenfold frequency.

4.3 Application of Combined Logic Circuit -- Design of Hospital Nursing Station Call for Help Lamp

Design Task: Design a four-room SOS system.
- Requirements: The four ward levels are one, two, three, and four, and priority coding is performed. When the first ward calls for help, the other ward signs are not on, and the other requirements are the same. When the four wards called for help at the same time, the number one light was on.

4.4 Application of Sequential Logic Circuit -- Design of Four-way Light

Design Task: Design a four-way light.
- Requirements: Complete the light four times to the left, four times to the right, bright one second, destroy one second, light one second, destroy one second of a cycle.

5. Conclusion

Students determine the overall design plan requirements according to the tasks and design specifications of the selected topic, and draw up a system diagram of the overall plant(pre-design stage); Analyze the bottom unit circuit and design the input, compile and simulate it; Make use of the correct bottom unit circuit module, draw the top layer circuit diagram, carry on the compilation debugging and simulation test; Preparation of design reports.

Through the course design, students can learn to find data, compare schemes, calculate circuit parameters, design circuit schematics, make printing plates, weld and debug components, and test circuit performance, thus improving students' ability to analyze and solve practical problems.

Relying on the project: Research Topics of Education and Teaching Reform in Beihua University: Research and practice on course design of medical physiology and engineering under the background of cultivating innovative talents—take basic medical electronics as an example.

Research Topics of Education and Teaching Reform in Beihua University: The research and practice of "virtual Simulation online and offline" two-in-one practical education mode of medical workers' integration in new subjects.

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