

# Application of practice driven learning method in the course of electronic circuit CAD

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**Abstract:** This paper analyzes and summarizes the common problems in the teaching implementation of electronic professional courses in higher vocational colleges, and puts forward a practice driven learning teaching method combined with STM32 module development project based on the professional course of electronic circuit CAD in higher vocational education, This method is effective in improving students' autonomous learning consciousness and engineering practice ability in the course teaching.

**Key words:** practice driven electronic circuit CAD STM32 module

## Introduction

“Electronic circuit CAD” is a professional compulsory course for electronic information majors. This course is usually taught by Protel99 or Altium designer, which aims to enable students to design reasonable and complete electrical schematic diagrams and printed circuit boards (PCBs) according to the task requirements, and master the methods of circuit welding and program writing in practice, including the drawing of schematic diagrams. The reasonable layout of PCB and the standard connection of circuit are the teaching focus. This course is a bridge between electronic technology and MCU interface technology, STM32 project training and other courses, and plays a connecting role in higher vocational education courses.

## 1. Current teaching situation of electronic circuit CAD Course in Higher Vocational Colleges

### 1. current situation of electronic circuit CAD textbooks in Higher Vocational Colleges

(1) The operating steps of the textbook are too detailed and the text is dense, so that the practicability of the textbook is not prominent for students of higher vocational colleges who are less active in learning according to the textbook; (2) The software version of some tutorials is updated too quickly, resulting in the software version and tutorials are not corresponding, and students can not find the corresponding operation entry in the process of learning; (3) The course examples are too old-fashioned and derailed from the actual project of the enterprise, which can not improve the practical ability of students to connect with their jobs. (4) There is a general lack of comprehensive training (including drawing and welding debugging, and even completing a practical project), which is not practical for the employment of students in higher vocational colleges.

### 2. Study status of students in Higher Vocational Colleges

(1) Most of the students in higher vocational colleges are not very interested in the study of theoretical knowledge, have poor learning habits, have clear learning objectives, but their autonomous learning ability is weak. For the development goals during the University, some students think it is to comprehensively improve their own quality and prepare for the realization of their life ideals. When the teachers' classroom teaching is not enough to attract them, Only a few students' attitude is to double focus and try to keep consistent with the teacher's ideas, and more students fail to effectively devote themselves to learning; (2) Many students' energy is not in study, but spend their spare time on entertainment or other things. As a result, many students are not good at professional courses and other things, and lack of enterprise practice and exercise. Basically, when they graduate, their abilities in all aspects are relatively low, and it is relatively difficult to find a better job; (3) Most of the students in Higher Vocational Colleges feel that their self-learning ability is average, and a few feel that they are relatively poor, showing that they do not adapt to the learning life in the university stage, and their learning consciousness is not strong. They need to rely on supervision and learning, and the majority of students're learning ability is not strong; (4) Many students attributed their learning difficulties to the learning environment, curriculum, major, etc., and did not correct their learning attitude, nor did they find reasons from themselves, so their self-consciousness was more prominent. This requires teachers to guide them to learn by repeating many times, going from simple to deep, hands-on practice, recording short videos and other methods to cultivate students' learning ability, encourage students to learn and face up to their problems.

### 3. Current teaching situation of electronic circuit CAD Course in Higher Vocational Colleges

The old learning content and students' Weariness of learning constitute the traditional teaching situation. In the teaching process, it is common to explain the theoretical knowledge first, and then introduce the content of the drawing. Moreover, the computer configuration in the computer room is not enough to meet the operation of the software, and there will be a crash during the operation, which will affect the classroom teaching. In addition, the learning content of the whole class is relatively concentrated and involves many steps. It is difficult for students to take notes in class. Less students can fully remember the steps and take the initiative to do exercises after class. This is the current situation of teaching. As a result, the later the teaching progress is, the fewer people will listen carefully to the class, and gradually become bored with learning. There are more people who fail the final exam. In addition, the practicality of teaching content has not been updated, and students' comprehensive professional ability has not been improved.

## 2. The development concept of electronic circuit CAD Course

In view of the current situation of students' learning in higher vocational colleges, under the guiding ideology of practice driven learning method, teaching is designed and implemented from simple to deep, from small to large, through projects that fit with the actual application of enterprises. For example, students can get familiar with the application interface of software by simply finding components, and then draw a relatively simple schematic diagram, Master the drawing method of schematic diagram; The components in the library may not be complete, so the drawing of the component library is also essential; Finally, we will guide and explain the drawing of single panel and double-sided panel which are difficult for students, and properly integrate the ideological and political elements, so that students can develop the good habit of paying attention to details, which is the basic quality necessary for engineers. Through this learning mode, students' spirit of independent inquiry is stimulated, the curriculum is interesting, students like it, and students' learning efficiency and quality are enhanced, their skill level is improved, and their comprehensive practical ability is improved.

## 3. Project case implementation

### 1. Project selection

Whether the selection of the project is appropriate or not will largely affect the implementation effect of the project. In order to achieve better teaching effect, teachers need to choose appropriate projects for teaching. Generally, the following two principles are used to select projects: 1. Select projects similar to the products of the enterprise or similar to the production process of the workshop of the enterprise in the process of project development as far as possible; 2. The scope of knowledge points should be moderate and the difficulty should be gradual. Based on this, we will use the STM32 development module as a case. STM32 development module is used to learn the software and hardware development of STM32 Series MCU. At present, many electronic products on the market are developed and tested using STM32 development module, which is one of the commonly used tools in the field of automation control and embedded, and conforms to the characteristics similar to enterprise products. In teaching, we first started with the design of simple drawing principle graphic devices (such as stm32f103rbt6 (microcontroller of development module, i.e., MCU) and Mini USB) and schematic packaging, followed by the design of schematic diagram, and finally imported the schematic diagram into PCB for difficult layout adjustment and drawing, covering all the knowledge of PCB design. The difficulty went from simple to profound, The overall design meets the requirements of academic conditions.

### 2. Project establishment

In order to enable students to fully integrate into the learning practice of the project, the implementation of STM32 development module project needs a total of 8 class hours, and the schematic diagram, PCB drawing and welding test need 4 class hours respectively. Before the implementation of the project, it is necessary to prepare computer rooms with smooth network, good configuration and sufficient quantity, purchase the products required for the project (such as STM32 microprocessor, crystal oscillator, capacitor, interface, diode, etc.) and training tools, and make a complete teaching plan and the implementation process of the project; Reasonable grouping and selection of team leaders, reasonable division of labor; Make project assignment, report sheet and evaluation form, and strengthen teaching management and teaching research.

### 3. project implementation

The implementation of STM32 development module project runs through the task driven approach:

(1) Distribute the assignment book, show the schematic diagram, PCB diagram and produced physical drawing of STM32 development module to students, and briefly introduce the development module to attract students' attention and stimulate their learning desire;

(2) Organize students to have a group discussion and analyze the content of the project. For example, individual components of STM32 development module do not exist in the schematic library. It is necessary to first design the schematic graphics and packaging of components, and then draw the schematic diagram. In the process, compile, check and modify the errors; Finally, when designing PCB, we need to consider: a) set the electrical contour of the development module to 1755mil\*2755mil; b) Screw holes need to be placed in the four corners of the development module, and positions need to be reserved in the process of component typesetting; c) According to the actual use, JTAG socket, Mini USB interface and i/o interface are arranged on the edge of the backup plate; d) The MCU power filter capacitor is placed near the power pin; e) The clock crystal oscillator circuit and reset circuit shall be close to the relevant pins of MCU chip as far as possible; f) If space permits, widen the ground wire and power line; g) In order to ensure the strength of the printed wire, it is necessary to add tears to the pad and via; h) The components and parts shall be arranged manually to adjust the components and parts to reduce the crossing of flying wires. Manual wiring is not allowed to have sharp angles or right angle routing (because sharp angles and right angle routing will change the linewidth of the transmission line, resulting in the discontinuity of impedance. The change of linewidth will lead to the change of impedance. When the equivalent width of routing changes, it will cause the reflection of signal). During the drawing process, the teacher needs to tour for guidance and summarize the difficulties of the project according to the questions raised by the students;

(3) After completing the schematic diagram and PCB drawing, the team members check each other according to the information on each point on the evaluation table, timely find the problems of the work completed by the team members, put forward and solve the problems together, promote the communication and cooperation between the team members, enhance the feelings between each other, and play the role of progress and growth together;

(4) Each group compresses and packs the drawn PCB drawings in the form of ASCL code, and sends them to the official website of domestic jialichuang for printing. After the printed circuit board is obtained, the purchased components and parts are welded to the circuit

board using the practice of 4 class hours. During this period, attention should be paid to the welding process, and no false soldering and missing soldering should be allowed. The wrong components and parts should be avoided as much as possible. Finally, an LED lamp control experiment is arranged to verify whether the circuit board drawn and the welded circuit have problems. If there is no problem with the LED lamp detected by a multimeter, However, the LED lamp can not work normally, which indicates that there may be a problem with the circuit welding, and a multimeter is needed to detect the connection of the circuit one by one along the line direction of the LED lamp, or there may be a problem with the code, and the circuit interface is not connected properly.

(5) Complete the report form in the form of a group, including: circuit design process, problems encountered in the process of project completion, solutions to problems, and gains in the process of learning the project.

#### 4. Project presentation and evaluation

The teacher will provide a display platform. Each group will show the completed works to the teacher and students one by one, and share the problems encountered in the implementation of the project, how to deal with them, and other experience. The teacher will give bonus points according to the completion of the group works. Through the link of display and evaluation, students' language expression ability, information transmission and communication ability can be enhanced, and students' courage and self-confidence can be improved; By allowing students to solve problems cooperatively, they can learn the knowledge hidden behind the problems (such as communicative competence) and form problem-solving skills, which plays a positive role in promoting students in Higher Vocational Colleges and cultivating students' good learning behavior and team cooperation consciousness; Through the comparison and learning between groups, the students' practical ability can be improved, the methods to solve problems are more diverse, and the thinking is more open. After the works are displayed, students' mutual evaluation and teachers' evaluation can help students learn from each other and make up for their shortcomings, laying a good foundation for subsequent courses.

### 4. Concluding remarks

The practice driven learning teaching method in the course of electronic circuit CAD takes the STM32 development module project as the carrier, and the practice driven higher vocational education teaching mode as the guidance, which guides students' autonomous learning and thinking, excavates the potential of students' hands-on creation, and greatly improves students' ability to analyze problemsThe ability to solve practical problems, so as to achieve good teaching effect.

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