

## Practice and Thinking of Bilingual Digital Logic Circuit Teaching

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**Abstract:** Connecting with the world and opening the future bilingual teaching has become the trend of the future development of colleges and universities. in line with "to the course of life, let the education alive" the idea, colleges and universities began to select the bilingual curriculum teaching reform, the goal is to make the universities open courses to keep pace with The Times, based on the digital logic circuit bilingual course teaching as a benchmark, Firstly, the characteristics of digital Logic Circuit, bilingual teaching materials, content and Proteus simulation practice are analyzed. Then, some teaching methods and laws are summarized. Finally, the problems encountered in bilingual teaching practice and solutions are analyzed.

### 1. Introduction

In order to make the faster delivery by talents in universities and colleges to adapt to the demand of the society, the Ministry of Education to encourage the use of bilingual teaching in colleges and universities, and colleges and universities want to introduce a batch of good, good original English teaching materials for teaching, but also the support in the process of teaching in colleges and universities according to actual needs to write your own bilingual teaching materials and lecture notes. The course Digital Logic Circuit of School of Big Data and Artificial Intelligence of Xinhua University of Anhui takes the lead in bilingual teaching on the basis of university-level excellent courses, and has achieved good results. Since autumn 2016, the bilingual teaching of digital Logic Circuit has been carried out in the Software Engineering major of The School of Big Data and Artificial Intelligence, requiring teachers to use bilingual teaching in class, including: Teaching plans, lecture notes, courseware, homework and exams should be bilingual at least 60% of the time. The Teaching Affairs Office will strictly examine the lecture notes, teaching plans, PPT, students' homework and examination papers used by teachers at the beginning, middle and end of each semester.

So far, the bilingual teaching of Digital Logic Circuit has been practiced for 5 years, and the first batch of 2016 software engineering students who accept the bilingual teaching have completed the learning, experiment, practice and other links of basic professional courses[1].

From the feedback information of students, the "digital logic circuit" bilingual study is the first bilingual courses of college career, the whole learning process to give the students a more profound impression, from began to contact English teaching material of vacant after a period of time to sharpen like watching original English teaching materials, and to realize Chinese and western cultural differences; From the teacher's refusal of English courseware to the active acceptance of the teacher's teaching content; From the installation of simulation software Proteus Chinese version of learning to the full English learning. Through all of this learning,

Students' ability to read English literature was improved, and their interest in learning was enhanced. Students really enjoyed the learning process in the whole learning process. Proteus simulation truly reproduces the experimental scene, the purpose: to help students learn more easily, more effective learning. Bilingual teaching opens students' strong interest in learning specialized courses, masters the essentials of specialized courses, and opens the door to the world [2].

## **2. Characteristics of Bilingual Digital Logic Circuit Teaching**

### **2.1. Characteristics of Bilingual Digital Logic Circuit Course**

Fast development of integrated circuit, integrated circuit is an introductory course to the most basic digital logic circuit, some cutting-edge information about integrated circuit has about 80% is written in English, in order to make college more quickly adapt to the demand of the society, the talent cultivation in colleges and universities to choose the digital logic circuit as a bilingual course is a wise choice. The ancestor of integrated circuit can be found in the course of Digital Logic Circuit. The binary "0" and "1" are derived from The Chinese Tai Chi, with strong regularity. For example, a D trigger can constitute a binary addition counter; Two D flip-flops can be cascaded to form a 4 - digit addition counter. Three D flip-flops can form a base 8 addition counter by cascade; Four D flip-flops can form a hexadecimal addition counter by cascade; N D flip-flop can form  $2N$  base addition counter through cascade; In changing the clock signal, you can change the addition counter to the subtraction counter. You can derive it by analogy[3].

Bilingual Digital Logic Circuit is to train students' ability of analyzing and designing circuit and their reading. The ability of extensive English literature is intended to enable students to better integrate into the development and design of integrated circuits. By learning voltage and current signals that change with time to continuously changing signals or discontinuously changing signals; From the most familiar decimal learning in daily life, summed up the three elements of decimal, also constitute the three elements of binary, introduced octal, hexadecimal and other n-base three elements, gradually introduced new knowledge points. From base system to code system, I mastered the rules of 8421BCD, residual three code, Grad, ASCII and parity check code, especially Grad. At the beginning, it was difficult for students to understand that there was only one argument between adjacent codes. Finally, I explained the problem by using the principle of mirror mapping, and the problem was solved easily. Boolean algebra is relatively easy to learn ordinary algebra, all variables are not 0 or 1, learning to let students know the law of non-law, overlapping law, elimination law, absorption law, Morgan law, learning is easier[4].

For the study of combinatorial logic circuit, first let the students learn the most basic three kinds of gate: and gate, or gate, not gate. Gate circuit is a unit circuit that constitutes combinatorial logic circuit. Proteus simulation is interspersed in the course of explanation to assist understanding and learning. Speaking of and gate, you can use the chip 74LS08, you can also input the keyword and, you can find the corresponding and gate symbol, the function can also be demonstrated on Proteus, students learn, understand is very easy. Make sense of a door, can be introduced to the function of other doors, play a role. Other compound types of gates can be derived from the three most basic gate circuits by logical transformation.

All in all, students can be trained to learn the thinking mode of digital logic circuit layer by layer based on the working principle and application of the circuit, and form a knowledge network architecture diagram from point to surface and from surface to body. The same circuit can also be designed skillfully by comprehensive use of the knowledge learned.

### **2.2. Characteristics of Bilingual Digital Logic Circuit Teaching Material**

Digital Logic Circuits is taught in English by Digital Fundamentals(Elventh Edition), edited by Thomas L. Lloyd of The Publishing House of Electronics Industry, and in Chinese by Yan Shi, a professor of Tsinghua University in Beijing and editor of Higher Education Press. English teaching step by step a further introduce the basic theory of digital system, Chinese teaching materials is a classic textbook, a simple introduction to circuit analysis and design, in both Chinese and English teaching complement each other, comprehensively and systematically introduce the basic concepts of circuit, numerical and code system, Boolean algebra, logic gates, triggers, combinational logic circuit and sequential logic circuit, etc. During the teaching process, Proteus simulation software is used for auxiliary teaching. When a logical circuit theoretical analysis is finished, Proteus simulation is properly carried out, and the effect is very good. It is easy for students to grasp the key points of knowledge in the process of Proteus simulation through Proteus simulation for difficult knowledge

points. At the same time, it can improve the efficiency of practice, and students can greatly reduce the failure rate when welding circuit board practice operation.

### 2.3. Students' Characteristics of Bilingual Digital Logic Circuit Course

Bilingual teaching course "digital logic circuit" object is big data and artificial intelligence, software engineering students, a freshman arranged by the first bilingual courses next semester the digital logic circuit, schools have no selection English good students as the teaching object, but all the students of software engineering in a large open the first bilingual courses, This undoubtedly increases the difficulty for teachers. In the course of lesson preparation, problems in class should be taken into account comprehensively. As a result, many teachers are reluctant to teach[5].

## 3. Bilingual Teaching Method of Digital Logic Circuit

### 3.1. Rain of Life Interactive Classroom Teaching

Interactive classroom teaching makes education fresh. Compared with Chinese teaching, bilingual teaching of professional basic courses is more challenging for students. The birth of rain classroom injected fresh vitality into the classroom, so that students from playing mobile phone to use mobile phone for classroom learning, greatly improve the efficiency of students' classroom learning, but also add to the fun of learning, for the traditional classroom teaching teachers and students to provide a new interactive solution. Rain through classroom teaching, the teaching of information can be found in the background in the rain the classroom, students can make use of fragmented time to go to school, under the environment of the mobile Internet, students can be anywhere at any time through the rain of the background to see live playback, to don't understand the knowledge point by the rain class background to ta, answer by the ta. The birth of rain classroom injected vitality into the students of the course.

### 3.2. Integration of Theory with Practice

For the teaching of digital Logic Circuit, the teaching method of integrating theory with practice has been recognized by students. The hardware is not enough to supplement the software. In the teaching process, the experimental indexes of hardware cannot meet the requirements. In the course of learning, Proteus teaching is just introduced locally, which can skillfully integrate theory and practice. In this way, students will not be rejected in the learning process, but actively into the classroom teaching, improve the efficiency of students' learning. The circuit structure of the bidirectional shift register is shown in Figure 1. When explaining the theoretical knowledge of the bidirectional shift register, it is difficult for students to understand the realization of the shift function. At this time, it is easy to understand the simulation circuit with Proteus, as shown in Figure 2. Results can be easily obtained from the simulation circuit as shown in Table 1 truth table of bidirectional shift register function[6].

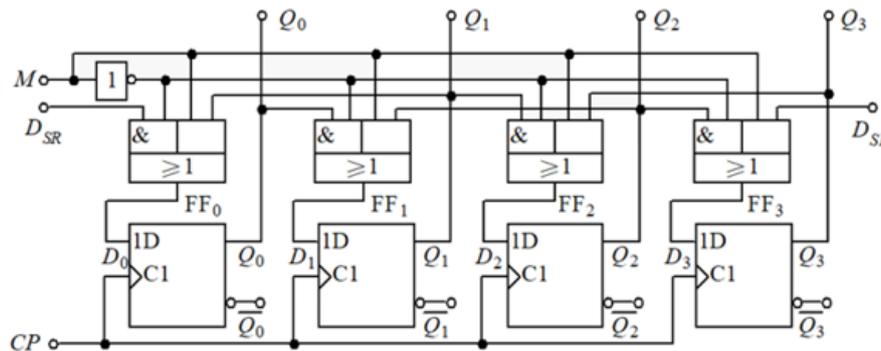


Figure 1 Bidirectional shift register circuit structure.

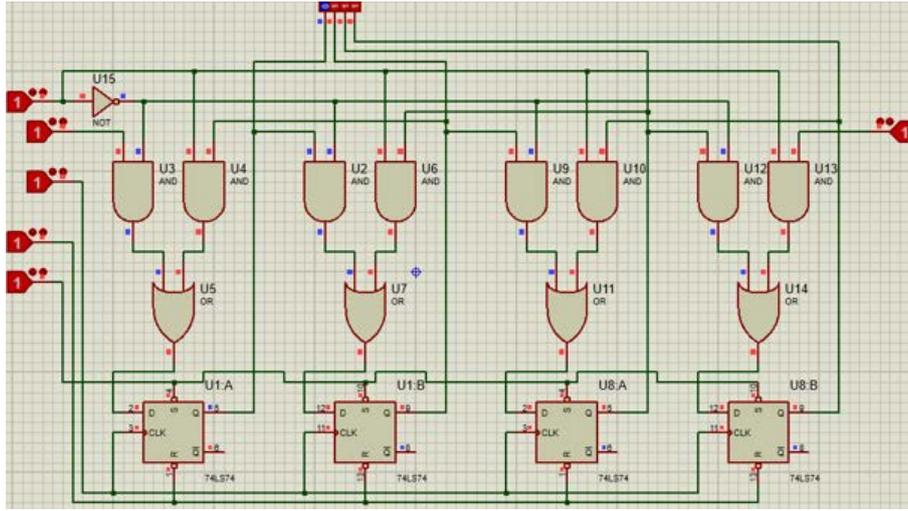


Figure 2 Bidirectional shift register Proteus simulation circuit.

From simulation to theoretical explanation, the driving equation is shown in Formula (1), and the state equation is shown in Formula (2). According to the value of  $M$ , we can get the right shift formula (3) when  $M=0$ , and the left shift formula (4) when  $M=1$ . Finally, we focus on the left shift formula and the right shift formula, and also get the functional truth table as shown in Table 1.

$$\begin{cases} D_0 = \bar{M}D_{SR} + MQ_1^n \\ D_1 = \bar{M}Q_0^n + MQ_2^n \\ D_2 = \bar{M}Q_1^n + MQ_3^n \\ D_3 = \bar{M}Q_2^n + MD_{SL} \end{cases} \quad (1)$$

$$\begin{cases} Q_0^{n+1} = \bar{M}D_{SR} + MQ_1^n \\ Q_1^{n+1} = \bar{M}Q_0^n + MQ_2^n \\ Q_2^{n+1} = \bar{M}Q_1^n + MQ_3^n \\ Q_3^{n+1} = \bar{M}Q_2^n + MD_{SL} \end{cases} \quad (2)$$

$$\begin{cases} Q_0^{n+1} = D_{SR} \\ Q_1^{n+1} = Q_0^n \\ Q_2^{n+1} = Q_1^n \\ Q_3^{n+1} = Q_2^n \end{cases} \quad (3)$$

$$\begin{cases} Q_0^{n+1} = Q_1^n \\ Q_1^{n+1} = Q_2^n \\ Q_2^{n+1} = Q_3^n \\ Q_3^{n+1} = D_{SL} \end{cases} \quad (4)$$

Table 1 Truth table of bidirectional shift register functions.

inputs										outputs			
R'	S'	M	CP	D <sub>5L</sub>	D <sub>5R</sub>	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>
0	1	x	x	x	x	x	x	x	x	0	0	0	0
1	0	x	x	x	x	x	x	x	x	1	1	1	1
1	1	0	↑	x	0	x	x	x	x	0	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>
1	1	0	↑	x	1	x	x	x	x	1	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>
1	1	1	↑	0	x	x	x	x	x	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	0
1	1	1	↑	1	x	x	x	x	x	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	1

The teaching method of integrating theory into practice injects vitality into the course. Proteus simulation truly reproduces the experimental scene and truly simulates the changing data flow, which opens up the logical channel for the course with strong theory and truly realizes the fresh concept of the course[7].

### 3.3. Competition Elements are Injected into the Curriculum to Improve Students' Independent Learning Ability

Taking bilingual digital Logic Circuit classroom teaching reform as the breakthrough point, the curriculum reform is carried out to empower new subjects, improve students' independent learning ability, inject competition elements into the curriculum, and guide students to refer to the enthusiasm, personal experience and the experience gained by learners themselves. To build an intelligent application-oriented undergraduate teaching platform of "give life to curriculum and make education fresh", attach importance to the operation and management of learning process, enhance the attention to student experience through operation, improve the experience and learning results, and stimulate the initiative and enthusiasm of learners.

### 3.4. Establish Competitive Disciplines to Improve Students' Ability to Broaden Knowledge Boundaries

Taking bilingual digital Logic Circuit classroom teaching reform as the breakthrough point, curriculum reform is carried out, competition discipline is established, the ability of students to broaden knowledge boundary is improved, and the intelligent mode applied undergraduate teaching platform of "give curriculum life, make education fresh" is constructed. While practicing basic skills, competition discipline is established. The experiment shows that the intelligent application-oriented undergraduate teaching platform of "give life to curriculum and make education fresh" improves students' ability of comprehensive application of knowledge and broadens students' ability of knowledge boundary.

### 3.5. Build a Bridge to Improve Students' Ability to Get a Well-paid Job

Taking bilingual digital Logic Circuit classroom teaching reform as the breakthrough point, curriculum reform is carried out to build an intelligent mode applied undergraduate teaching platform of "give curriculum life and make education fresh". Intelligent mode education is the catalyst for students' happy growth and gives birth to the fun of students' learning. A large number of existing technical personnel, their skills need to rapidly evolve, to train students to learn and use the ability, college students through competition to build a bridge between schools and enterprises, improve the ability of students to get a high salary employment, alleviate the talent constraints of high-tech industry development.

### 3.6. Teaching Customization and Gamification Change to Increase Interest and Interaction

Taking bilingual digital Logic Circuit classroom teaching reform as the breakthrough point, curriculum reform is carried out, teaching customization and gamification reform increase interest and interactivity, and students' active practice ability is cultivated through competition. Through the teaching customization and gamification reform to increase the interest and interaction, that is, through the integration of fun grouping, role playing, timely incentive, process evaluation,

homework evaluation, interactive q&A and other operational means to carry out rich and interesting classroom operation and management; At the same time, operation experience managers also pay attention to the whole process, through praise, criticism and other ways to let students experience a variety of emotions in the teaching process. Through teachers' step-by-step guidance, students can not only learn knowledge and experience the whole process, but also connect the current learning with the past and future, and stimulate their internal enthusiasm and initiative through external guidance.

#### **4. Thinking on Bilingual Digital Logic Circuit Teaching**

##### **4.1. Establish a Sound Bilingual Teaching System**

In a society where the development of science and technology is changing rapidly, it has become the trend of the future development of colleges and universities to connect with the world and open the bilingual teaching in the future. According to the requirements of the Ministry of Education, the bilingual courses in colleges and universities must reach the standard, which requires colleges and universities to establish a perfect bilingual teaching system when setting bilingual courses. Rather than follow one's inclinations specify which course you can use the bilingual teaching on the identified using bilingual teaching, should be considered on the cohesion of the course content before and after, to slowly transition, thus avoiding the student shows some does not adapt, need step by step, bilingual curriculum teachers teaching more need to accumulate and learning. In order to meet the requirements of the Ministry of Education, it is extremely urgent to perfect the bilingual teaching system of each major in colleges and universities.

##### **4.2. Create a New Mode of "Enterprise Leading, University Operation and Win-win Cooperation"**

Bilingual Digital Logic Circuit is a basic course for computer majors. How far the major can go depends on the firmness of the basic courses. Under the background of scientific and technological revolution and industrial transformation, bilingual teaching in colleges and universities is overwhelming. How to better integrate into the international wave, bilingual teaching is a problem that every college educator should think about. Colleges and universities must form alliances with enterprises in order to cultivate talents advancing with The Times. Enterprise want to survive, must keep up with the pace of science and technology, to a large number of know the frontier science and technology talent, talent of output in colleges and universities to adapt to the needs of the enterprises, to create a "leading enterprises, colleges and universities operate, win-win cooperation" of the new model, so education supply side can efficient output industry needs talents, to adapt to the demand of The Times.

##### **4.3. Integration, Construction of Ecological Teaching**

5G is the early stage of an intelligent society, the Internet of all things and the intelligent connection of all things, which will bring huge ecological changes to the education industry. How to integrate bilingual digital Logic Circuit into benign education ecology is to construct ecological teaching and make scientific and efficient personalized development to a higher direction.

Education reform is a manifestation of the development of science and technology, which is the core driving force of current education. With the arrival of 5G, artificial intelligence and big data, education reform should also keep pace with The Times. This requires modern education to break the traditional teaching mode, conform to the needs of The Times, construct ecological teaching, and train students' ability of scientific and technological innovation.

##### **4.4. Take Advantage of the Trend and Build a Talent Training System in Line with Industrial Development**

It is an accelerator to train talents in line with the development of the industry to construct the intelligent application-oriented undergraduate teaching platform of "give life to the curriculum and

make education fresh". Industry is the important source of innovation and the application of the innovation goal, conform to the industrial development of talent cultivation system must conform to the trend of the development of the industry, with large data, cloud computing and artificial intelligence represented by the new technology is increasingly penetrated into all disciplines and fields, to generate new scenes and new mode, the new changes in organic into the talent cultivation system. On system design, both must respond industry trend of new technology, new mode of general education courses, at the same time in the existing curriculum innovation case in advance with The Times, also want to set up a reaction to the new change of new major, big data in recent years, new media marketing, finance, science and technology and artificial intelligence, etc., should be more in the practical training link closely docking industry, inducing labor organization form, fusion education base and so on Let students have access to real scenes and effectively integrate innovative cases into the process of knowledge internalization.

#### **4.5. Without Breaking Ground, Reshape the Intelligent Mode Applied Undergraduate Teaching Platform**

The construction of intelligent application-oriented undergraduate teaching platform of "give life to curriculum and make education fresh" must be reflected in the classroom, because the classroom is the most direct link to implement talent cultivation. The curriculum is sorted into a knowledge map composed of relatively independent knowledge points, and the whole is divided into parts. Identify and classify knowledge points, and find the competition content with high degree of professional relevance as the entry point. The content of the competition is reconstructed into new knowledge points by the way of scene, and the reconstructed knowledge graph is integrated to maintain consistency and indirectness. Reshape the intelligent mode applied undergraduate teaching platform organically inject the competition elements into the existing knowledge points, form the same frequency resonance of knowledge points, so that students can seamlessly receive the new knowledge after fusion in the learning process, so as to understand the theory, promote the integration and grasp the practice can be truly reflected.

### **5. Conclusions**

Under the current environment, information technology is developing rapidly. In order to better adapt the talents cultivated by colleges and universities to the needs of the society, colleges and universities must carry out teaching reform and innovation from classroom teaching, vigorously promote smart classroom, and cultivate talents in line with information technology. The development and iteration of new science and technology have been promoting the transformation of teaching mode in colleges and universities. We teachers should comply to a line, to join the teaching wisdom, let the wisdom of teaching and the teaching innovation on teaching mode for effective integration, complete the teaching curriculum content and curriculum reconstruction, make the digital logic circuit from the traditional teaching mode to innovative teaching mode, improve teachers' teaching effect and students' learning goals. Create first-class courses together.

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