Online Teaching Design based on Rain Classroom during Epidemic Period

-- Take the Decoder to Realize the Project Teaching Design of Several Typical Circuits as an Example

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Abstract

This teaching design is student-centered, through the rain classroom online teaching platform to carry out group competition project teaching method to complete the circuit design and Multisim simulation, which effectively improves the students' sense of team competition and cooperation, enlivens the classroom atmosphere and makes the circuit function more intuitive and vivid. It is a good test of students' practical ability to design and implement various typical practical circuits by using decoders, and guides students to learn how to evaluate and compare learning, which increases students' interest in learning and improves the teaching effect of online classes during the epidemic.

Keywords

Project-based Instructional Design; Decoder; Multisim Simulation.

1. Introduction

With the in-depth promotion of online and offline mixed teaching in China, it is the most important task of current teaching research and reform to further expand the breadth and depth of teaching content, extend the space and time of teaching, break the limitation of traditional teaching mode and teaching resources, improve the teaching effect and increase students' participation. Since the outbreak of COVID-19 in 2020, the epidemic situation in the whole country has become a multi-point distribution trend. For the needs of epidemic prevention and control, online teaching at home has been carried out in many places. Both teachers and students generally reflect that the effect of online teaching is obviously lower than that of offline teaching. How to improve students' online learning efficiency and enthusiasm requires teachers to carry out rich and interesting teaching designs with the help of online teaching platforms such as Rain Classroom and Learning Pass, and increase effective teacher-student interaction to improve students' enthusiasm for participation.

2. Analysis of the Present Situation of Teaching in Colleges and Universities

The online and offline mixed first-class courses put forward in "The Implementation Opinions of the Ministry of Education on the Construction of First-class Undergraduate Courses " mainly refer to the reform of professional courses on campus based on massive open online course, exclusive online courses or other online courses, using appropriate digital teaching platforms and tools, and combining the actual situation of our school. The school actively organizes teachers to learn the use of various teaching platforms and the construction and training of online courses. Teachers are also

actively exploring the reform of new educational models and teaching methods that deeply integrate educational technology and network technology [1].

With the rapid development of science and technology, the popularization of smart phones and the continuous updating of various media technologies, students lose interest in traditional classroom teaching, and teachers often speak passionately in class, and many students bow their heads and brush their mobile phones. Some colleges and universities have taken the compulsory measure of "separating man from machine" in class, but there are some countermeasures under the policy, and the students will adopt two mobile phones and other countermeasures, so the effect is minimal. How to make students' mobile phones a tool for students to participate in learning, not just entertainers who brush short videos such as Tik Tok and play games.

With, it is the direction of the major teaching platforms. From the initial rain class in Tsinghua University to learning skills, wisdom trees, etc., all of them have launched functions such as quizzes, quizzes, contributions, voting, barrage, group discussions, etc. to try to improve the fun and interactive functions of teaching, and at the same time to improve the sense of experience of teachers and students.

3. Ideas and Processes of Teaching

3.1. Ideas of Teaching Design

The analysis and design of combinational logic circuit is a very important knowledge point in Digital Electronic Technology, and the use of decoder, encoder, data distributor, data selector, etc. in medium-sized combinational logic devices is also the teaching focus of its practical course. During the online teaching process during the epidemic, the author made full use of the interactive function of the online teaching platform of Rain Classroom to carry out the project teaching design of group competition, and assigned the task of grouping and design in advance, requiring students to use decoder 74LS138 to design and realize typical practical circuits such as three-person voting, weight lifting referee, traffic signal light detection, full adder and full subtracter, and to use Multisim to simulate and display them. Teaching design can effectively improve the classroom teaching effect, make the circuit structure and function more intuitive and vivid, and make up for the deficiency of traditional theoretical teaching [3]. Students' team cooperation can complete the design and exhibition, which can well examine students' hands-on practical ability and team cooperation ability, which can help students understand the practicality of digital circuits and increase their interest in learning. [2]

3.2. The Process of Instructional Design

(1) Release the learning tasks and requirements before class and divide them into groups. Because it is online teaching during the epidemic period, it usually takes the form of grouping in dormitories. The teaching process reflects the importance of students' teamwork and increases dormitory cohesion.

(2) In class, the teacher explains that the analysis and design of combinational logic circuit is a reciprocal process. Through the decoder, the examples and steps of combinational logic circuit analysis are learned, so that students can try the design of the same circuit by themselves. Insert the contributions of PPT rain class in the teaching process, and select the top three or random roll call to select the contributions of students who comment on them.

(3) Assigning design tasks in class can use direct PK for boys and girls, and students will be given grades according to the speed and correctness of submission. At the same time, make use of the rain classroom contribution function to explain and comment. First, let the other party reply whether it is correct and explain the problem. Let students feel the rigor of design steps and the importance of details to determine success or failure.

(4) After class, the homework is to arrange the project-based practical teaching tasks of Multisim simulation of four typical circuits, so that students can watch the practical teaching videos in online course resources in the after-class time, and take the dormitory as a group to complete the simulation design according to their selected project names. Design combinational logic using medium-scale integrated circuits

When compiling circuits, the steps are basically consistent with the design method of small scale integrated circuits. The first step is to define the input and output variables and the meanings of values 0 and 1, and list the truth table according to the specific logic requirements. The second step is to write the logical function according to the truth table; The third step is not to reduce it to the simplest AND/OR formula, but to make necessary formal transformation according to the selected standard form of input and output of medium-sized integrated devices. The fourth step is to draw the logic circuit diagram according to the design requirements; Fifth, according to the design drawing, the corresponding logic devices are selected in Multisim simulation platform to build circuits to realize the logic function [4].

(5) Organize students' self-evaluation and mutual evaluation in class, and guide students to compare the truth tables and circuit diagrams of four typical circuits, inspire students to discover the correlation among various circuits, and summarize the methods and skills of circuit design.

4. Student-centered, Inspiring Students to Learn by Contrast

**Table 1.** Comparison table of truth tables of several typical circuits

Truth table of three-person voting circuit				Truth table of weightlifting referee circuit				Truth table of traffic signal lamp detection circuit			
A	B	C	Y	A	B	C	L	A	B	C	Z
0	0	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	1	0	0	0	1	0
0	1	0	0	0	1	0	0	0	1	0	0
0	1	1	1	0	1	1	0	0	1	1	1
1	0	0	0	1	0	0	0	1	0	0	0
1	0	1	1	1	0	1	1	1	0	1	1
1	1	0	1	1	1	0	1	1	1	0	1
1	1	1	1	1	1	1	1	1	1	1	1
Truth table of full adder							Truth table of full reducer				
A	B	C	S	Co			A	B	C	D	J
0	0	0	0	0			0	0	0	0	0
0	0	1	1	0			0	0	1	1	1
0	1	0	1	0			0	1	0	1	1
0	1	1	0	1			0	1	1	0	1
1	0	0	1	0			1	0	0	1	0
1	0	1	0	1			1	0	1	0	0
1	1	0	0	1			1	1	0	0	0
1	1	1	1	1			1	1	1	1	1

In the process of teaching design, "teacher-led, student-centered" is used to fully mobilize students' enthusiasm and initiative in learning [5], so that learning is no longer "teachers take the initiative to teach students passive learning" [6], but through reasonable and ingenious teaching design, the knowledge in textbooks can be turned into interesting competition items, and students can be guided to discover the fun of learning and the links between knowledge

before and after. Let learning originate from textbooks and be higher than textbooks, thus realizing the advancement of knowledge.

The comparison table of truth tables of several typical circuits is shown in Table 1, which guides students to find that the value of output variable Y of three-person voting circuit is the same as that of full adder to high-bit carry output CO, because three-person voting means that as long as there are more than two ones in ABC, the output Y will be 1, and the binary operation rule is "every two into one", that is, 1+1=10, so it is also required for full adder to take 1 to high-bit carry output CO. Because A is the referee and BC is the assistant referee, the referee circuit requires that A must be 1, and when more than one BC is 1, the output L is 1. Therefore, compared with the truth table of the three-person voting circuit, there are fewer A'BC items. The output Z of the red, yellow and green lights represented by the traffic signal detection circuit ABC is 0 except that only one is 1, and the output Z of the other five fault situations are all 1, so there are more A'B'C' items compared with the truth table of the three-person voting circuit. The standard difference d of the full subtracter and the standard of the full adder are the same as s.

Figure 1 is a comparison diagram of several typical circuit simulations designed by students, which guides students to find that the output Y of the three-person voting circuit is the same as the carry-to-high output Co of the full adder circuit. Compared with the three-person voting circuit, the weightlifting judging circuit lacks Y_3' (namely $A'BC$), while the traffic signal detection circuit has more Y_0' (namely $A'B'C'$) than the three-person voting circuit. The standard difference D of the full subtracter is the same as that of the full adder and the output circuit S.
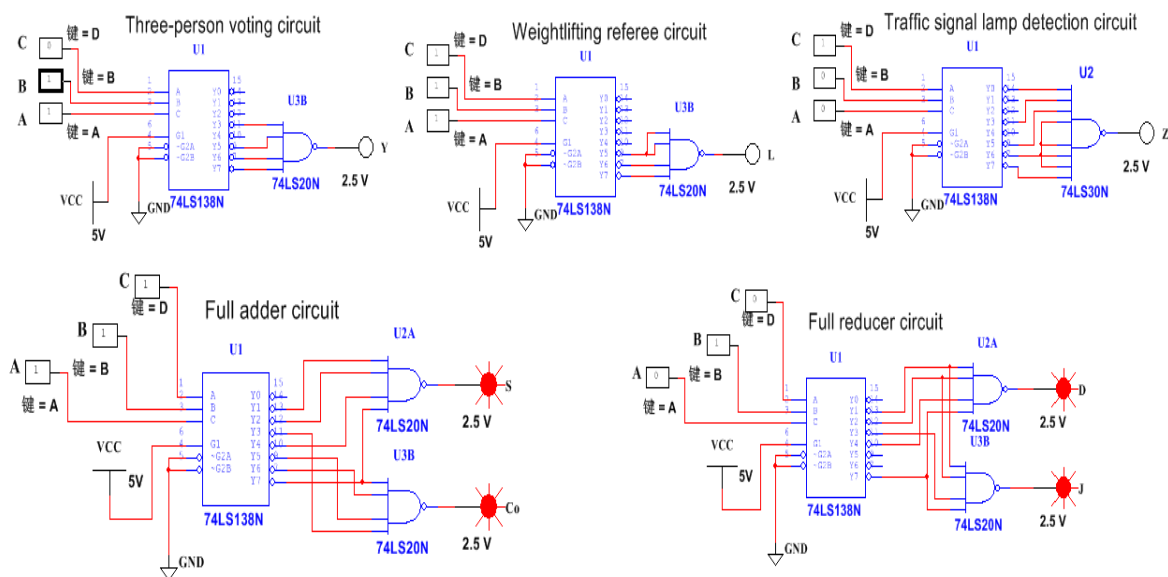
Figure 1. Comparison of several typical circuit simulations

Project-based teaching design can be extended to the whole teaching process of Digital Electronic Technology. Encoder, decoder, data selector, ROM and PLA can all realize the design of combinational logic circuit. The sequential logic circuits and counters composed of flip-flops can be designed by Multisim simulation to realize addition and subtraction and time counting circuits. In the course design stage, advanced comprehensive design projects can be carried out, such as digital clock, eight-way intelligence responder, ward pager, et. By comparing the Multisim simulation design of typical circuits, students can learn to draw inferences from others, and better understand that there can be no mistakes in circuit design, because "the difference is a thousand miles away".

5. Teaching Effect

In order to understand the students' learning effect of project-based teaching based on the rain classroom teaching platform, I communicated with some students, and designed a questionnaire by using the voting function of rain classroom. By anonymous voting, I got a true understanding of students' ideas. More than 90% of the students praised the effective teaching interaction, and their participation in the interaction was very positive, which improved students' sense of experience and learning efficiency. After completing the group project, the students' practice report reflects the fun of participating in the competition in the classroom promotion. After completing this project, they have deepened their understanding of the design and analysis of combinational logic circuits, felt the sense of accomplishment of applying what they have learned, were able to skillfully use medium-scale integrated devices to design digital circuits, and were confident of trying to complete more complex digital circuit designs.

Acknowledgments

References

[1] Yun Liu. Research on the Reform and Innovation of Online and Offline Mixed Teaching Mode [J]. Theoretical Research and Practice of Innovation and Entrepreneurship, 2022, 3 :41-43.

[2] Yueqiao Li, Bing Fan. Research on Hierarchical Comparative Learning of Combinatorial Logic Module Based on Project Teaching Method [J]. Industry and Information Education, 2021,2:76-79.

[3] Caibo Bai, Ping Wang. Research on the application of online and offline mixed teaching mode in the integration of theory and practice.[J]. Science and Technology World, 2022,53 (9): 177-179.

[4] Li Chai, Yang Sun, Hong Li et al. Design of comprehensive experiment of digital circuit decoder [J]. Integrated Circuit Application, 2022,39(1):10-12.

[5] Xuanping Hu, Tao Feng, Qi Wang, etc. Analysis of the connotation and characteristics of reverse instructional design aiming at core literacy [J]. Teaching and Management, 2022,3:85-98.

[6] Chang Liu. Problem Representation and Strategy Analysis of Blended Curriculum Teaching Design [J]. Mechanical Vocational Education, 2021,7:49-52.