

Intelligent Teaching Design of Digital Electronic Technology Based on Rain Classroom plus SPOC

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Abstract: Aiming at the difficulties faced by Digital Electronic Technology course, under the guidance of Meyer's meaningful learning theory, this paper formed a new intelligent teaching mode of Digital Electronic Technology course by means of two intelligent teaching tools—rain classroom and SPOC platform. It reshapes the three stages of teaching and learning, inspires the students' learning initiative and enthusiasm, effectively mobilizes the students' thinking ability.

1. Introduction

"Digital Electronic Technology" course is an important engineering technology basic course compulsory for engineering students, with the characteristics of strong theory and practice. The course is the cornerstone for improving students' practical innovation ability and cultivating information thinking ability, and it is also a roadblock in the process of students' learning. With the reform of the undergraduate talent training program, the "Digital Electronic Technology" course is facing the dilemma of reducing the number of hours, increasing the content, reducing the participation in the classroom and the limited degree of ability improvement. How to stimulate students' interest in learning in a limited time, improve learning enthusiasm and autonomy, and cultivate students' engineering literacy is an urgent problem to be solved. At present, the rapid development of a new generation of information technology such as Internet +, AR/VR, big data, cloud computing, 5G and artificial intelligence, the deep integration and innovation of information technology and education and teaching have become an inevitable trend. Based on this, this paper uses smart teaching tools - rain classroom and SPOC platform to carry out smart teaching design.

2. Definition and Characteristics of Smart Teaching

2.1. Definition of Smart Teaching

Wisdom is explained in Ci Hai as "the ability to recognize, discern, judge, process and invent things." The formation of wisdom needs to be continuously enriched and developed under certain circumstances through the help and promotion of education. Therefore, there are two perspectives on the concept of wisdom teaching: from the perspective of education, classroom teaching should not be a simple process of knowledge learning, but a process of comprehensive generation of emotions and wisdom; From the perspective of informatization, it is necessary to use advanced information technology tools to realize the informatization and intelligence of classroom teaching and build a wise teaching environment. Therefore, wisdom teaching is based on learning theories such as constructivism, using the "Internet +" way of thinking and a new generation of information technology such as the Internet of Things, big data, and cloud computing, and supports intelligent and efficient teaching that is applied in the whole process before, during and after class^[1].

2.2. Characteristics of Smart Teaching

Compared with traditional teaching, smart teaching has the following characteristics in the integration and innovation of information technology and education and teaching^[2]:

(1) Digitalization of teaching decisions. With the help of information tools, data collection and

mining analysis of the whole process of student learning are carried out, which makes the teaching process transform from experience-driven to data-driven, and facilitates teachers to arrange and adjust teaching in a targeted manner.

(2) Real-time evaluation feedback. Dynamic learning diagnosis and evaluation throughout the whole process of teaching, realizes real-time and dynamic diagnostic analysis and evaluation information feedback, and reconstructs the formative teaching evaluation system.

(3) Three-dimensional Communication and Interaction. The communication and interaction between teachers and students, students and students is not limited by time and region, and the continuous communication is fully controlled. And the information communication and communication methods are more diversified.

(4) Intelligence of resource push. According to the personalized characteristics and differences of students, intelligent push targeted learning materials to meet the learning needs of learners.

3. Smart Instructional Design

3.1. Top-level Design of Smart Teaching—the Theory of Learning for Meaning

American computer scientist and psychologist H.A. Simon proposed in "Human Cognition - Information Processing Theory of Thinking" that thinking is the process of brain processing information. After human contact with any external information, it will start from sensory memory, filter the information under the mechanism of attention into working memory, encode the information in working memory (including the organization of external information and the integration of internal and external information) into long-term memory, and finally after the information in long-term memory is extracted and then converted into working memory information can be used in work, as shown in Figure 1, of which attention, organization, and integration are the three important links of the meaning learning theory proposed by Professor Meyer of the University of California [3].

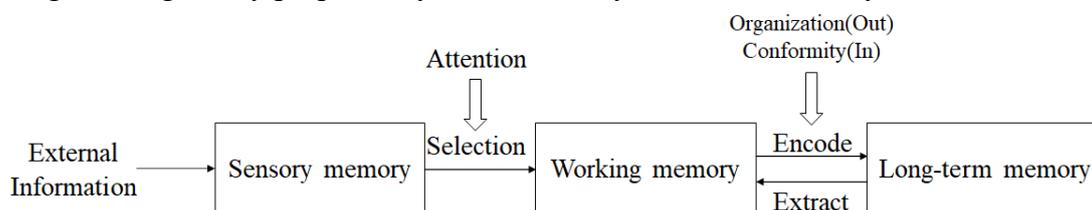


Figure 1 A model of cognitive processes for knowledge construction.

From the cognitive process model proposed by Professor Meyer, it can be seen that learning is not simply imparting knowledge to learners, but to form a meaningful cognitive construction within itself, focusing on the influence of learners' emotional factors on the construction of meaning, which coincides with the definition of wisdom teaching. Implications of cognitive process models for intelligent teaching:

Choice – To attract attention by establishing methods such as suspense and cognitive conflict, improve the attractiveness of teaching, and stimulate the desire to learn.

Coding – The process of connecting knowledge by creating learning contexts to achieve knowledge organization and integration.

Extraction - Through knowledge reconstruction, invisible thinking is realized.

3.2. The Selection of Smart Teaching Tool—Rain Classroom and SPOC Platform

Advanced smart teaching tools are the most powerful support to adapt to the needs of smart teaching and promote the effective implementation of smart teaching. Compared with the 5 steps of teacher "teaching" in traditional teaching (lesson preparation, lecture, questioning, assignment, grading homework) and the 4 steps of students 'learning' (pre-study, listening to lessons, answering questions, completing homework), in smart teaching, teachers' "teaching" becomes 8 steps (learning situation analysis, teaching design, teaching optimization, integration and intensive lectures, case introduction, summary and expansion, personalized push, practical guidance), and students'

"learning" has also become 8 steps (independent preparation, pre-class test, display sharing, classroom test, group discussion, Summarize and reflect, expand thinking, practice and improve). According to the needs of the "8+8 mode" of smart teaching, choose the SPOC platform and the Rain classroom smart teaching tool to implement the whole process of teaching data collection and mining analysis, real-time and dynamic evaluation information feedback, three-dimensional teaching interaction and intelligent push.

1) SPOC Platform--Course Management Tool

SPOC (Small Private Online Course) is aptly Chinese translated as "private class," a concept developed by Armand of the University of California, Berkeley. Professor Fox was the first to propose and use it. The SPOC platform of Chinese University MOOC was chosen as a course management tool because the function of the SPOC platform can meet the needs of smart teaching for information technology tools: (1) The SPOC platform provides a course from the organization and release of course content (micro-courses, PPT courseware, announcements, tutorial cases, expansion resources), the placement of test questions and homework questions to online discussion and Q&A, evaluation mechanism and monitoring, and other full-process services, which is the most convenient management course tool. (2) The SPOC platform can also provide more fine-grained and accurate to the individual data analysis service, which can get the learning behavior and learning effect of each student at each specific time period. For example, how many Xueshi watched the corresponding video before class? Did you do a test question? What is the correct rate of doing the question? Which students are too low in online learning activity? Wait a minute. (3) The SPOC platform can implement group management within a class and customize different learning plans for different groups, making it possible to teach according to their aptitudes.

2) Rain Classroom—Classroom Management Tools

Rain Classroom is a new type of intelligent teaching interactive tool based entirely on PowerPoint and WeChat launched by Tsinghua University in 2016, which has the characteristics of simple installation, rapid start-up and informative data. Rain Classroom class has a limited time question push, send bullet screen, submission, voting and other functions, real-time, dynamic information feedback can not only let students maintain attention, but also make the learning effect more comprehensive, more profound, more durable. After-class detailed teaching data includes how many students come to class, which slides they do not understand, which questions are not answered correctly, excellent students and early warning students list push, etc., these data can faithfully restore the vast majority of the teaching process of the real classroom, so that teaching is no longer all based on experience, teachers and students can improve their teaching and learning process through data. Because of this, Rain Classroom is currently one of the most powerful tools for classroom teaching management.

3.3. Smart Teaching Process Design—Online and Offline Blended Teaching

In view of the dilemma and problems encountered in the course of "Digital Electronic Technology" in our school, under the guidance of the cognitive process model proposed by Professor Meyer, with the help of the information-based intelligent teaching tools of Rain Classroom and THE SPOC platform, the online and offline hybrid teaching mode is used to implement intelligent teaching. According to bloom's 6 educational goals from elementary to advanced ^[4]: memory → comprehension → applied → analysis → evaluation → creation, the content of memory and comprehension is placed before class by students to learn independently, the classroom solves some of the problems in comprehension, covering the whole of application and analysis, involving the evaluation and creation of parts, and the evaluation and creation of the remaining parts is achieved by students after class. Using online learning to feed back into the offline classroom can not only solve the contradiction between less school hours and more content, but also challenge students at a higher level of cognition. Taking "Multivibrator and Its Application" as an example, the design of smart teaching process is introduced, as shown in Figure 2.

Stage	Smart Teaching Process			Smart Tools
	Student	Interaction	Teacher	
Pre-class	Self preparation Pre-class testing	Resources to push ← Preview feedback →	Learning analysis Teaching design Teaching Optimization	SPOC platform
In-class	Show sharing Time-limited testing Group Discussion Presentation of results	Feynman output ← Quiz push → ← Task push → ← Instant feedback →	Integration Well-taught Case import Summary development	Rain Classroom
After-class	Conclusion reflection Expansion thinking Practice ascension	← Homework push → ← Communication →	Personalized push Practice guidance	SPOC platform

Figure 2 Smart teaching process.

1) Pre-class stage-- Take learning situation analysis as the core
Teacher: Design learning paths Enhance teaching engagement

With the advent of the Internet + era, information resources are becoming more and more abundant, and students' attitudes and habits are also changing. The difficulty for students is not how to acquire knowledge but what to learn. How to learn? Therefore, it is particularly important to design a good learning path before class. Let the students clear the teaching goal and a series of learning activities to achieve the goal, just like the game, each learning activity to complete a step closer to the goal, such instant feedback and instant sense of achievement activate the dopamine circuit in the brain, get pleasure and have the desire to continue learning. Of course, the design of learning activities should have certain attraction, or establish suspense or create cognitive conflict with life, stimulate students' curiosity and interest in learning. Teachers release the learning path and other resources through SPOC platform, and optimize the teaching design according to the analysis of students' learning data on SPOC platform, so as to achieve the goal of teaching according to learning.

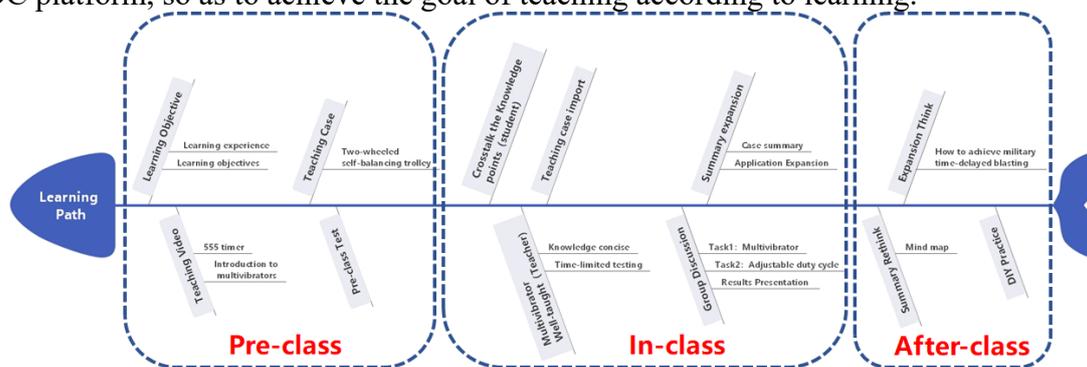


Fig.3 Learning Path Design.

Student: Autonomous learning Check and Fill gaps

Students can check learning resources on the SPOC platform, learn independently, complete relevant test questions, and check and fill in relevant learning experience during the process to meet the personalized independent choice.

2) In-class Stage—Take teacher-student interaction as the key

Teacher: Construct the System Create the Situation

In the classroom, the teacher talks about the ins and outs of knowledge and the knowledge behind knowledge to help students build up the knowledge system, so that students can see both trees and forests, and can stand on the main line of knowledge system to see the specific knowledge points. At the same time, import teaching cases, such as "multi-vibrator" this lesson, guide students to analyze the "two-wheel self-balancing car" case, let students find problems from the perspective of demand,

draw this lesson two tasks: 1, multi-vibrator circuit design; 2. Duty cycle is continuously adjustable. Rain classroom bullet screen, contribution, timed test, random roll call and other functions to improve students' attention, promote students' active thinking, scientific and deliberate practice, accurate grasp of class progress.

Student: Efficient input Code integration

a) Crosstalk the Knowledge points

According to the learning pyramid, the most effective way to learn is to tell others, which is the most famous Feynman learning method. The core mechanism of Feynman's learning method is to adopt the principle of "output learning" to allow students to more clearly "output" the content that has been extracted from his brain and further make it "dominant". Through the results of the students' cross-talks, it is clear whether they really understand or fake understanding. At the same time, a quick question and answer session is set up so that students dare to ask questions and are good at asking questions. Through the students' knowledge points, you can not only review the low-level knowledge points, but also exercise the students' expression ability and independent thinking ability.

b) Group Discussion

With the help of the flat thinking tool " Six Thinking Hats " , the task is used to conduct effective group discussions. Six classmates are used as basic units to play six different hats: white hat stating facts, red hat setting goals, green hat solution, yellow hat merit assessment, black hat questioning, blue hat summary display ^[5]. Due to the clear division of labor, it can not only improve efficiency, but also train students to think in the face of problems and exercise teamwork skills. With the help of simulation software and physical verification, students seek the best solution in the process of continuously discovering problems, analyzing problems and solving problems, stimulating students' curiosity and realizing the application and transfer of knowledge.

3) After-class stage—Take the practical improvement as a focus

Teacher: Personalized Push Practical Guidance

One of the characteristics of the mind is implicit, how can it be strengthened and consolidated? It must be extracted, and in the process of extraction, the knowledge will be reconstructed, and in this process, the relationship between information will naturally be strengthened, and the explicit thinking of invisibility will be realized. Mind maps are an effective way to structure and publish mind map assignments through the SPOC platform after class. At the same time, according to the pre-class preparation and classroom learning of each student, group management is implemented, and targeted theoretical homework and practical DIY homework tasks are pushed through the POPC platform, so as to truly achieve hierarchical teaching and let students at each level have something to gain. Through the interactive communication of the SPOC platform discussion board, diy homework is guided, learning obstacles are solved in a timely manner, overcoming burnout, supervising the progress of DIY homework, and being an assistant and supporter of student learning.

Student: Efficient output Retrieve the extract

The process of completing the mind map after class is a process of efficient output, which promotes students' thinking and realizes the connection between the knowledge learned and the old knowledge, thus forming a knowledge community to form a knowledge system. Practice DIY homework from program design, simulation verification to physical construction, debugging and improvement to summary reflection, writing reports, really let students move, the process of practice is the process of active retrieval, improve students' practical ability.

4. Summary

This paper aims at the problems encountered in the teaching process of the "Digital Electronic Technology" course, combined with the definition and characteristics of smart teaching, under the guidance of Meyer's meaning learning theory, with the help of the intelligent teaching tools of Rain Classroom and THE SPOC platform, designs the online and offline hybrid wisdom teaching process of "Digital Electronic Technology", reshapes the three stages of teaching and learning, determines the goals of each stage of teaching and learning, pays attention to stimulating students' initiative and enthusiasm in learning, so that students can ask middle school (thinking and questioning), and move

middle school (physical construction). Thinking middle school (summary and expansion), using middle school (learning to apply), effectively mobilize students' thinking ability, and form a mental model of students thinking about problems.

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