Teaching Mode of Electronic Technology Courses Based on "Virtual Simulation and Task Driven"

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Abstract. Addressing the existing challenges in electronic technology course instruction, we aim to integrate and learn from the technological advancements and practices of virtual simulation. Guided by student needs and with the learner at the core, we propose a "virtual simulation task-driven" teaching model for electronic technology courses. We further evaluate the feasibility of this model in achieving the teaching objectives.

Keywords: virtual simulation, task driven, electronic technology courses.

1 Introduction

With the advent of the intelligent era and the rapid development and application of technology, various aspects of the education sector are undergoing transformative change. Electronic technology is a foundational course in science and engineering institutions[1]. Currently, teaching presents several challenges, including: (1) Theoretical knowledge is abstract, making it difficult for students to learn, with a lack of visual simulation tools to aid understanding. (2) Most experiments are verification-based, with a limited emphasis on design and integration. Throughout the knowledge acquisition process, students remain passive, merely memorizing what the teacher explains. In experiments, students overly depend on manuals, leading to a lack of active learning and understanding. Despite having independent views, constraints such as limited laboratory hours, equipment shortages, and a lack of advanced experimental tools hinder experimental verification and design[2]. Consequently, this fails to effectively stimulate students' creativity and enthusiasm. This situation persists in hindering the enhancement of their analytical and problem-solving skills, thereby limiting the quality of talent development.

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2 The Practicability of Virtual Simulation Teaching in Electronic Technology Courses

Electronic technology courses equip students with the ability to analyze and test circuits by studying the composition and working principles of typical analog circuits, the composition and working principles of analog-to-digital and digital-to-analog conversion circuits, the composition and working principles of typical digital circuits, and the composition and working principles of DC stabilized power supplies. These courses also cultivate the ability to construct application circuits, formulate experimental plans, complete indicator tests, solve common circuit faults, and address practical circuit issues. Ultimately, these skills equip students to analyze, research, acquire, process, and interpret phenomena related to engineering problems in the field of electronic science and technology.

To achieve the stated teaching objectives, students must repeatedly practice and comprehend the working principles of circuits. Virtual simulation teaching offers a secure learning environment, enabling students to engage in various risk-free practices, thus facilitating repeated practice and swift skill mastery [3-4]. Additionally, it cuts down on the expenses associated with experimental equipment and facilities, conserving educational outlays. Moreover, virtual simulation offers personalized learning plans, transcending the limitations of time and space, enabling students to perform experiments anytime and anywhere, thereby enhancing learning efficiency[5-8]. Therefore, incorporating virtual simulation into electronic technology course teaching significantly enhances the achievement of teaching objectives.

3 Constructing "Virtual Simulation Task Driven" Teaching Model for Electronic Technology Courses

In alignment with the training objectives and teaching requirements, a teaching content system comprising integrated theory-practice courses, theoretical courses, and practical courses is outlined. A teaching model that integrates virtual simulation with a task-driven approach is suggested, with tasks as the central theme, teachers as facilitators, students as central participants, and virtual simulation technology and hands-on experiments as tools. The teaching activity is designed around four key modules: task design and assignment, task analysis, task completion, and teaching evaluation. The teaching process is structured into three phases: pre-class preparation, classroom instruction, and post-class reinforcement. By integrating simulation technology into the blended teaching model, the traditional, isolated classroom teaching approach is enriched. This not only enhances teacher-led instruction and student-centered learning but also boosts teaching efficiency and student engagement, thereby improving overall teaching effectiveness.

3.1 Integrated Teaching Model of Theory and Practice

For the teaching of integrated theory and practice courses, it is generally based on small tasks of the knowledge points in this class, which students can complete in the classroom. For this type of teaching content, let students learn and do while completing tasks; Finally, evaluate the task and summarize it. The teaching mode is shown in Figure 1.

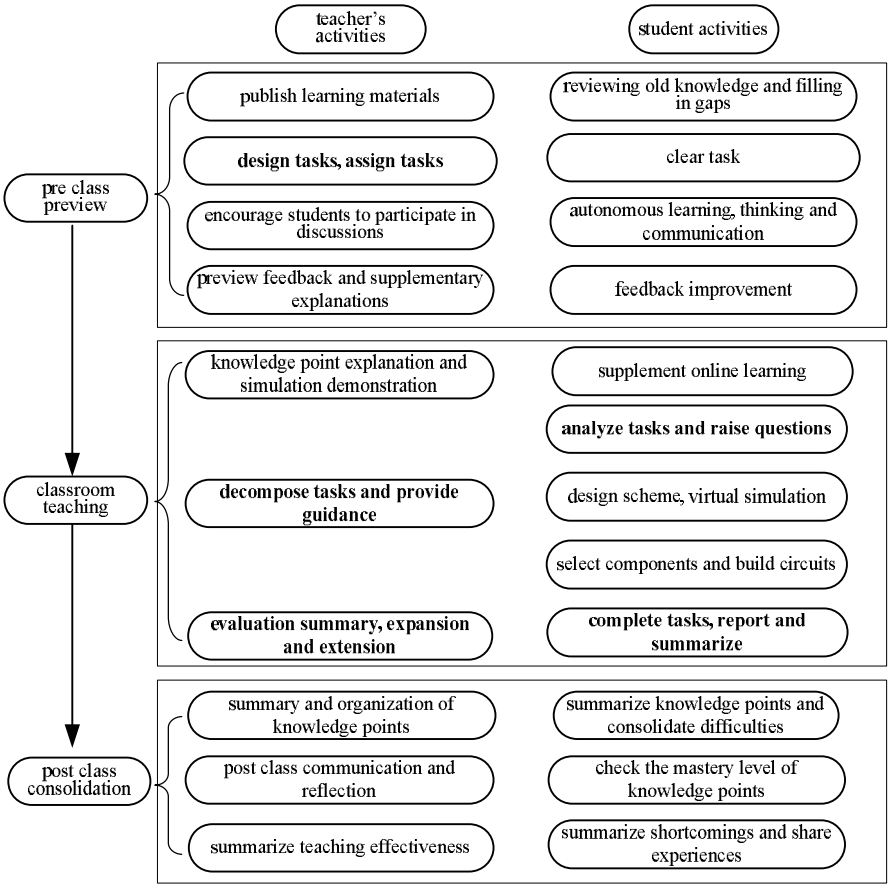

Fig. 1. Teaching Mode of Integrating Virtual Simulation and Task Driven Learning - Integrated Theory and Practice Teaching.

3.2 Theoretical Teaching Mode

For theoretical teaching, students must finish this lesson to gain a precise and clear understanding of the assigned tasks. Additionally, teachers need to allocate more classroom time to explain the fundamentals. Hence, virtual simulations of circuits are

completed after class, with only the task design being done in class. The teaching model is illustrated in Figure 2.

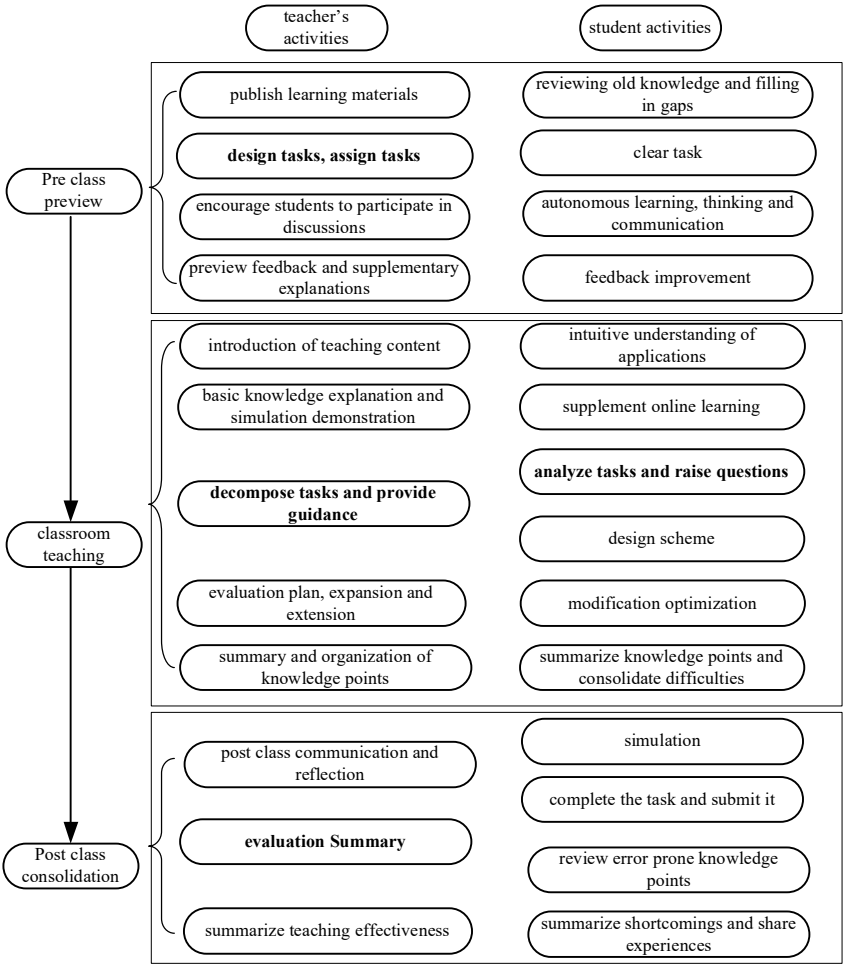

Fig. 2. Teaching mode combining virtual simulation and task driven approach - theoretical teaching

3.3 Practical Teaching Mode

In practical teaching, to enhance students' hands-on experience and task completion in the classroom, students are expected to complete task design and simulation prior to class. In the classroom, the teacher first provides feedback and evaluation on the design proposals submitted by students, addressing key points, challenges, and common errors in the designs. Following this, students engage in discussions to refine their plans,

conduct simulation demonstrations, select components, build and debug circuits, and ultimately complete the tasks. The teaching model is illustrated in Figure 3.

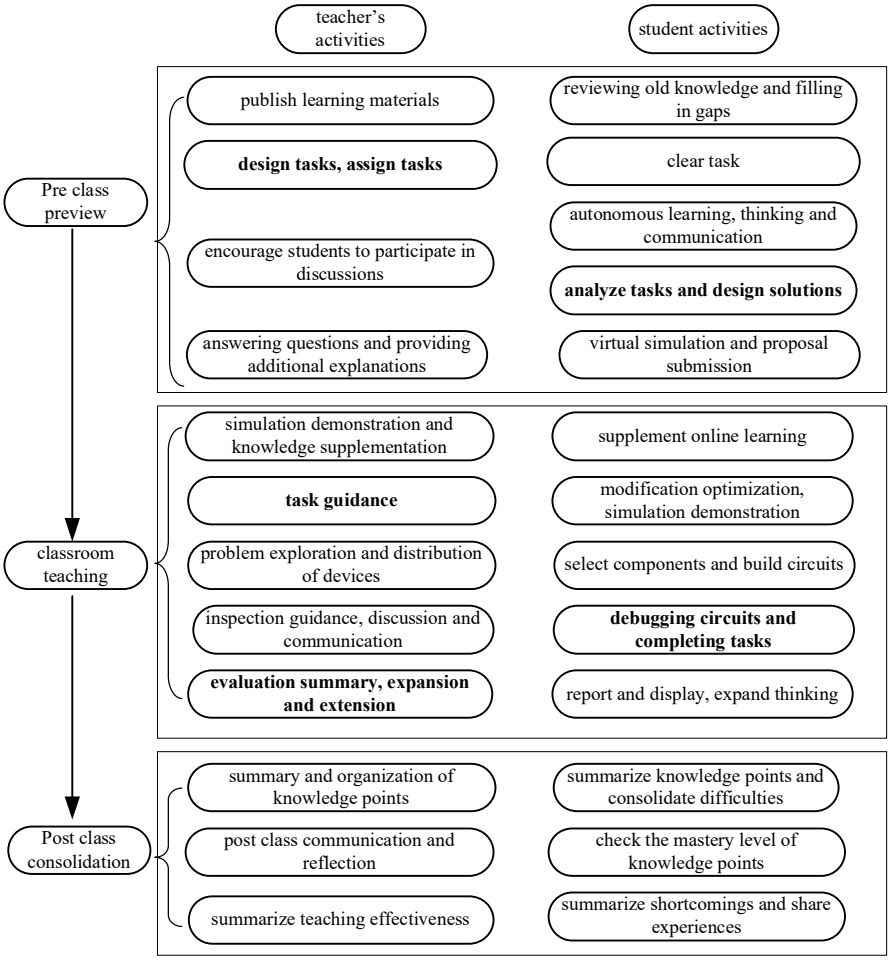

Fig. 3. Teaching mode combining virtual simulation and task driven approach - practical teaching

4 Conclusion

Analyzing the current teaching practice of electronic technology courses, under the "virtual simulation task-driven" teaching model, the teaching content has been divided into theoretical teaching, integrated theory and practice teaching, and practical teaching. For each type of teaching content, corresponding tasks have been designed for students.

Based on the segmented teaching content and in conjunction with specific tasks, we produced some courseware and wrote lesson plans. We also pre-determined the duration, specifics, experimental equipment, and content for each segment. Additionally, to foster students' ability to apply the electronic technology knowledge system comprehensively to problem-solving, we developed project cases. In our teaching practice, we broke down projects according to the knowledge points, progressing from simple to complex and from linear to nonlinear. This facilitated the interconnection and interrelation of application units in practical skills, culminating in students gaining an understanding and knowledge of electronic systems.

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