Computer Fraud and Security
ISSN (online): 1873-7056

Innovative Teaching Methods and Ideological Education Integration in Circuit Course Reform: A Comprehensive Approach

Guangjun Yuan*, Jiyuan Sun
School of Electrical and Information Engineering, Beihua University, Jilin 132021, China
**Corresponding Author.*

Abstract:
This paper focuses on the teaching reform of the circuit course. On the one hand, it elaborates in detail the practical process and remarkable achievements of applying multiple innovative teaching methods such as concrete analogies, interesting homophones, and innovative mnemonics in the circuit course and deeply integrating ideological and political education. On the other hand, it deeply analyzes the connotation, implementation steps and application results of the "One Thought, Two Guidance, Three Imitation" teaching mode. Both teaching explorations are committed to solving the inherent problems of traditional circuit teaching, effectively improving students' learning effects and comprehensive qualities, and providing extremely valuable experiences and ideas for the teaching reform of the circuit course and related majors.

Keywords: circuit course, teaching reform, innovative methods, ideological education, "One Thought, Two Guidance, Three Imitation" model.

INTRODUCTION

At present, with the rapid development of technology and society, the demand for professionals in the electrical field has increased significantly, and the requirements for their qualities have also been continuously raised[1]. In higher education, circuit-related courses, as the foundation of electrical majors, are extremely crucial for talent cultivation and serve as an important cornerstone for the subsequent study of professional courses and the shaping of students' abilities[2-3].

However, there are many problems in the traditional teaching of circuit-related courses. The teaching concept is teacher-centered, emphasizing knowledge imparting but neglecting the cultivation of students' abilities, resulting in poor active learning awareness among students[4]. The teaching mode is single, and the integration of online and offline is insufficient, making it difficult to meet the diverse learning needs of students. In terms of teaching methods, theory is disconnected from practice, and students lack practical and innovative abilities.

With the advancement of educational reform, new concepts and technologies have brought opportunities for the teaching reform of circuit-related courses[5]. The concept of student learning outcome-oriented has emerged, establishing a student-centered teaching mode. For example, using the knowledge graph to guide the learning of the "Circuit Analysis" course stimulates students' initiative[6]. The integration of SPOC with the advantages of MOOC and traditional teaching is applied in the "Circuit and Electronic Technology" course to improve the teaching effect[7]; the reform of the online teaching mode has also promoted the development of the "Circuit Foundation" course[8]. In terms of teaching methods, the combination of Multisim14.0 software and CDIO project-driven teaching resolves the imbalance between theory and practice[9]; the teaching environment constructed based on the new constructionist theory cultivates students' innovation and collaboration abilities[10]. The integration of ideological and political education into the "Circuit Analysis Experiment" realizes the integration of professional and ideological and political education[11]. The development of educational informatization prompts the construction of a diversified evaluation system for online courses to ensure teaching quality[12].

Although certain achievements have been made in the reform, there are still challenges. This article will sort out existing research, analyze problems, explore reform paths, and contribute to the cultivation of high-quality professionals in the electrical field.

THE PRACTICE OF INTEGRATING MULTIPLE INNOVATIVE TEACHING METHODS AND IDEOLOGICAL AND POLITICAL EDUCATION IN CIRCUIT COURSES

Teaching Innovation of the Time Constant of RL Circuit

In the teaching process of the time constant $\tau = L/R$ of the *RL* circuit, based on the cognitive assimilation theory[13], meaningful learning occurs when new knowledge establishes non-artificial and substantive connections with appropriate concepts in students' existing cognitive structure. Since this formula is rather abstract and difficult for students to understand, an analogical method of vivid scenarios is introduced[14]. As shown in Table 1, the inductance "*L*" is analogized to the roof of a house, and the resistance "*R*" is analogized to the person inside the house (the initial consonant of the pronunciation). Using the familiar life situations of students as cognitive anchors helps students establish connections between abstract circuit knowledge and specific life experiences, promotes the assimilation process of knowledge, and thus effectively resolves the difficulty in understanding. At the same time, based on the social and emotional learning theory, ideological and political elements are integrated into teaching, extending from family emotions to the feelings of the country and the home, guiding students to cultivate positive social emotions and values during the process of knowledge learning, achieving the organic combination of knowledge imparting and value guidance, and strengthening students' patriotism and sense of social responsibility.

Table 1. Analogies and ideological and political correlation table in *RL* circuit time constant teaching

Analog element	Image representation	congruent relationship	Ideological and political association
inductance *L*	The roof of the house 	To provide shelter for the house, associated with the time constant, the greater *L* the, the longer the time to reach steady state	Home is a warm harbor, extending to the country is the people's dependence, to cultivate the feelings of the country
resistance *R*	People in the house 	The relationship with the inductance affects the establishment speed of the stable state. The larger the *R*, the shorter the time to reach the stable state	Individual role and responsibility in the family and the country, strengthen the sense of social responsibility

The first order circuit full response three elements formula teaching innovation

In response to the memory predicament of the three-element formula for the complete response of the first-order circuit, based on the learning optimization theory[15], the "First Kiss" interesting homo phonic memory method is adopted and combined with vivid patterns, as shown in Figure 1. This method creates a unique and emotionally charged coding form for the formula elements, increasing the cues and retrieval paths for memory, which is conducive to the storage and retrieval of information in long-term memory, thereby significantly enhancing the memory effect. The integration of formula element memory and ideological and political education is shown in Table 2. Starting from the emotional education theory[16], the emotional symbolic significance contained in this memory method is deeply explored, guiding students to relate it to key events in life and national development, stimulating students' national pride and patriotic enthusiasm, enriching the connotation of ideological and political education, promoting the all-round development of students in terms of morality and emotion, and enabling students to achieve the sublimation of emotional attitudes and values while mastering professional knowledge.

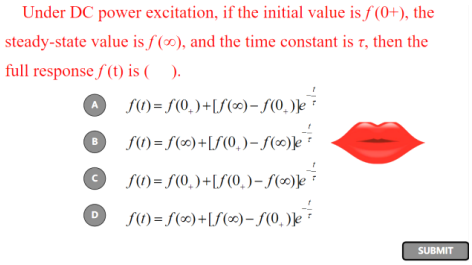


Figure 1. Image diagram of the three-element full-response formula of the first-order circuit

Table 2. Formula element memory and ideological and political integration

formula essential factor	Homophone expression	Memory assistance	Ideological and political sublimation
Initial value of $f(0_+)$	At the beginning	Combine with "kiss" into "first kiss", with image pattern to deepen memory	Guide students to recall the first experience in life, such as the success of the first experiment, similar to the first breakthrough in major national science and technology, stimulate national pride
steady state value $f(\infty)$	lips		

Teaching Innovation of Writing the Incidence Matrix in Matrix Equation

In the teaching link of writing the elements of the incidence matrix A in the matrix equation, based on the information processing theory[17], in order to reduce students' cognitive load on complex knowledge and improve information processing efficiency, the associative mnemonic method is adopted. By associating abstract matrix elements with vivid and easy-to-remember words and chunking complex information, students can encode, store, and retrieve knowledge more efficiently. For example, by using the idioms "break faith and abandon righteousness" and "promise marriage when pregnant" and ingeniously corresponding to the matrix elements and node relations through homo-phony, this method conforms to the principle of knowledge simplification and efficient memory in cognitive psychology, as shown in Table 3. At the same time, through the idioms "break faith and abandon righteousness" and "promise marriage when pregnant", teachers naturally guide students to realize that in study and life, they need to uphold integrity and responsibility, not be perfunctory about knowledge, and revere knowledge as they keep promises, achieving common growth of knowledge and morality, and becoming talents with both virtue and ability to serve the society.

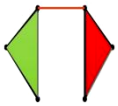
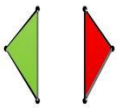
Table 3. Writing of Incidence Matrix A: Idioms, Homo-phony, and Case Analysis

Idiom Description	Homo-phonic Meaning	Corresponding Matrix Element	Node Relationship Example
Break Faith and Abandon Righteousness	Righteousness	1	When a certain situation is in line with "departing" from the node, it is denoted as 1. For example, the current direction departs from a node ,it can be recorded as 1.
Promise Marriage when Pregnant	Pregnant (Negative)	-1	When "pointing" to a node, it is denoted as -1. For instance, the voltage drop direction points to the node ,it can be marked as -1.

Teaching Innovation of Graph Theory

At the beginning of the teaching of graph theory, based on the collaborative theory of discipline integration and ideological and political education, the concept of graph connectivity is organically integrated with the practical significance of national unity [18]. The path state between the nodes of graph G is analogized to the close connection among various parts of the national-territory, and the inevitability of national unity is explained from the perspective of professional knowledge, allowing ideological and political elements to naturally permeate the teaching content, as shown in Table 4. In this process, following the sociocultural perspective of constructivism, students learn knowledge in a specific sociocultural context. Through the in-depth understanding and construction of graph theory knowledge and the connotation of national unity, students' sense of national responsibility and patriotic emotions are stimulated, achieving mutual promotion of knowledge learning and value shaping, strengthening students' firm belief in maintaining national unity, and enhancing students' comprehensive quality and sense of social responsibility.

Table 4. Integration of Graph Theory Memory and Ideological and Political Education

Graph Theory Concept	Graphical Example	Analogical Example	Ideological and Political Meaning
Connected Graph		There are paths connecting the nodes of Taiwan and the mainland (such as abstract representations of geographical transportation, cultural and economic connections, etc.)	Taiwan is an inseparable part of China, reflecting the close connection and inevitability of national unity
Disconnected Graph		If some key connection paths are cut off (such as an abstract illustration of the temporary separation caused by external forces' interference in history)	Emphasize the irrationality of division and reinforce the importance of national unity

Comprehensive Effects of Innovative Teaching Methods

In the teaching of circuit courses, considering students' difficulties in understanding knowledge such as the three elements of the first-order circuit, incidence matrix, and graph theory, this paper closely adheres to their learning difficulties and cognitive laws and designs innovative teaching methods. By using homo-phony, analogy, etc., professional knowledge is transformed into vivid forms, such as explaining complex concepts with vivid metaphors, reducing students' burden and stimulating their enthusiasm for learning.

After the implementation of this innovative teaching method, the results are remarkable. Judging from the data of the degree of achievement of course objectives (Figure 2), there are obvious improvements in multiple items for the 23rd grade compared to the 22nd grade. For example, the achievement degree of course objective 1 jumped from 0.7215 to 0.8526, an increase of 0.1311, and there are significant improvements in homework and test scores. In the classroom, students have shifted from passive acceptance to active exploration, actively speak during discussions, and collaborate and have active thinking in group projects.

Meanwhile, by ingeniously and naturally integrating ideological and political education and circuit knowledge, this paper creates a unique learning atmosphere, which enables students not only to deepen their professional knowledge but also to have significant improvements in emotional attitudes and values. Judging from the degree of achievement of course objectives, they perform better in understanding the social value and responsibility of circuit knowledge, can relate circuit knowledge to the feelings of the country and the home in practical applications, and have a stronger sense of mission and motivation to solve problems when facing complex circuit problems, comprehensively promoting the advancement of comprehensive quality and effectively promoting the innovation and development of circuit course teaching.

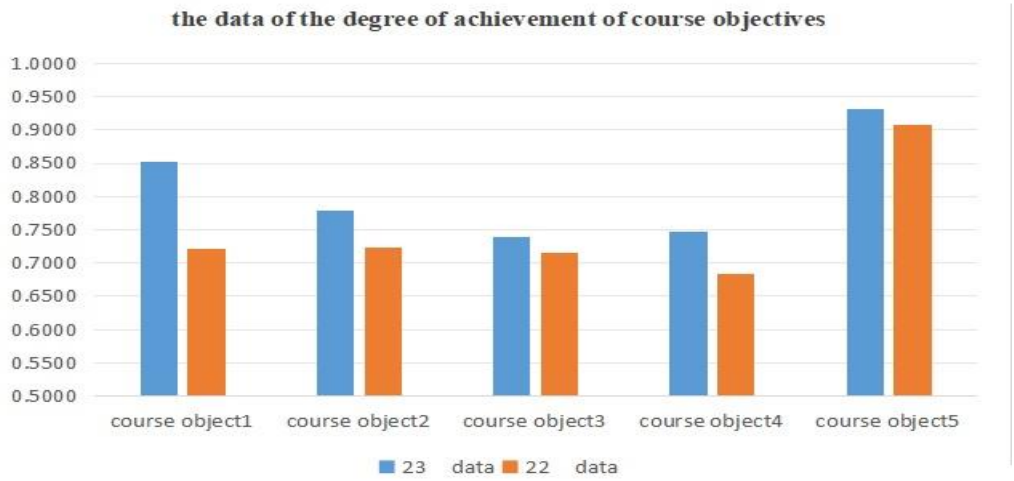


Figure 2.Comparison of Achievement of Objectives between Level 22 and Level 23

Through the implementation of the innovative teaching method, it is clearly visible from the data of the degree of achievement of course objectives that students have made significant progress in dimensions such as knowledge acquisition, practical application, and value formation, laying a good beginning for cultivating talents with both virtue and ability[19]. However, the teaching reform still needs to be continuously deepened. The "One Thought, Two Guidance, Three Imitation" teaching mode further integrates teaching resources, expands teaching dimensions, and assists students' growth.

THE APPLICATION OF THE "ONE THOUGHT, TWO GUIDANCE, THREE IMITATION" TEACHING MODE IN CIRCUIT COURSES

Analysis of the Connotation of "One Thought, Two Guidance, Three Imitation"

Under the traditional mode, the integration of ideological and political education and professional knowledge in circuit course teaching is rigid, students have few opportunities for autonomous learning, and the practical link emphasizes verification rather than innovation. To break through these teaching bottlenecks, this paper proposes the "One Thought, Two Guidance, Three Imitation" teaching mode, bringing vitality to teaching and promoting the improvement of teaching quality and the all-round development of students.

One Thought: Integration of Ideological and Political Education, Laying a Solid Ideological Foundation

"One Thought" is the ideological bond throughout the entire teaching process and the cornerstone of the "One Thought, Two Guidance, Three Imitation" teaching mode. It deeply integrates ideological and political education with professional knowledge of circuits and ingeniously excavates ideological and political elements from teaching practices such as innovative teaching methods of circuit knowledge and breakthroughs in problem-solving ideas. Just as mentioned above, when explaining the connected graph and disconnected graph, this paper uses the closely connected relationship between the mainland and Taiwan as an analogy to elaborate on the profound connotation of connection. While allowing students to understand the knowledge, they profoundly comprehend the inseparable bond between the two sides of the strait and stimulate patriotic feelings, laying a solid ideological foundation for professional learning.

Two Guidance: Two-pronged Approach, Building the Knowledge Bridge

"Two Guidance", as the key support for students to construct the knowledge system, contains two mutually reinforcing aspects.

The first is the guidance of teachers in the learning direction and methods. In the early stage of the course, based on the teaching syllabus and fully considering the actual learning situation of students, teachers accurately formulate clear learning goals and tailor learning paths for students, enabling students to be clear about "what to learn" and "how to learn". At the same time, teachers continuously optimize and improve the knowledge graph of the circuit course, providing a strong guarantee for the effective implementation of personalized teaching[20].

The second is to closely integrate the ideological and political connotation in "One Thought" and lead students to draw ideological and political integrated mind maps, helping students build their own knowledge network framework. Taking the sorting out of the analysis method of the first-order dynamic circuit as an example, on the basis of drawing the memory nodes of common formulas by referring to the innovative teaching methods in this paper, students add the ideological and political branch that elaborates on the important significance of the formulas in the energy-saving application of the power system and closely relate it to the concept of green development of energy in our country, guiding students to deeply think about the intrinsic connection between circuit design and the national sustainable development strategy. This process can not only deepen students' understanding and memory of professional knowledge and effectively cultivate students' logical thinking and inductive summary ability, but the integrated ideological and political branch can also permeate all aspects of students' learning, endowing the learning process with a profound value orientation.

Three Imitation: Focusing on Practice, Achieving a Leap in Ability

"Three Imitation": A key module for the advancement of practical ability and the integration of ideology and politics. Centered on students and closely connected with "One Thought and Two Guidance", it focuses on the improvement of students' practical ability.

During the simulation, students build a full response simulation model of the first-order circuit using professional software, observe the curves by adjusting component parameters, and master the principles of the transient and steady states of the circuit. Teachers combine "One Thought" to tell the stories of power technology workers to stimulate students' sense of responsibility; based on the knowledge of "Two Guidance", guide students to combine theory with practice and achieve the simultaneous accumulation of knowledge and ideology and politics.

In the stage of imitation and innovation, students innovate by referring to classic cases, such as changing the structure in the first-order circuit design to reduce energy consumption. The ideological and political concept of "One Thought" enables students to think from the perspective of sustainable development, and teachers use the thinking cultivated by "Two Guidance" to help students analyze the feasibility of innovation and cultivate innovative thinking and scientific spirit.

In the real simulation practice, teachers design projects close to engineering practice, such as the response optimization of the first-order circuit of the regional power grid. Students collaborate in teams, solve problems based on the knowledge system of "Two Guidance", and improve their collaboration ability. The ideological and political education of "One Thought" prompts students to pay attention to social responsibility, turn ideological and political concepts into actions, improve comprehensive quality, and lay the foundation for career development.

The "One Thought, Two Guidance, Three Imitation" teaching mode has closely linked and progressive links. From ideological guidance to knowledge construction and then to practical innovation, it forms an organic whole, injecting new vitality into the teaching of circuit courses and helping students achieve the deep integration and leap of knowledge and ability.

Implementation Path of "One Thought, Two Guidance, Three Imitation"

Based on the analysis of the connotation of "One Thought, Two Guidance, Three Imitation", transforming it into specific teaching practice requires a rigorous and practical implementation path to ensure that this teaching mode can take root and be effective in the teaching of circuit courses. The implementation path is detailed in Figure 3.

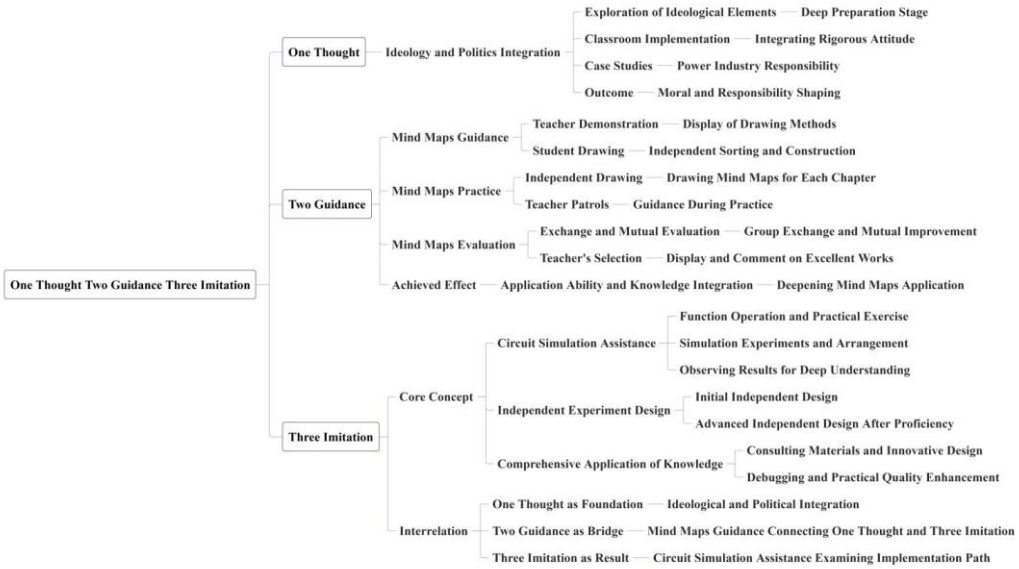


Figure 3. Mind map of the implementation path of "One Thought, Two Guidance, Three Imitation"

Teaching Preparation Stage

During the lesson preparation stage, the teacher team needs to conduct in-depth discussions, improve the knowledge graph with the assistance of AI for teaching, and deeply excavate the ideological and political elements behind each knowledge point in combination with the forefront of science and technology. At the same time, teachers should master multiple circuit simulation software, such as Multisim, PSpice, etc., to make technical preparations for the subsequent simulation teaching[21].

Integrating "One Thought" into Teaching Implementation

In the classroom introduction stage, teachers naturally introduce the key role of technological innovation in power development by means of dynamic illustrations of power technology achievements, such as the efficient operation of smart grids, to stimulate students' thirst for knowledge. When explaining the characteristics of circuit components, analogize the stable operation of components to the rigorous requirements of engineering to guide students to establish a rigorous working attitude. Intersperse practical cases such as power poverty alleviation to enable students to imperceptibly perceive the dedication of power workers and cultivate professional ethics and social responsibility. Encourage students to exchange their thoughts and feelings immediately to deepen the effect of ideological and political integration.

Promoting Knowledge Construction with "Two Guidance"

Teachers first utilize multimedia tools, taking a certain complex circuit system as an example, to gradually demonstrate the process of drawing a mind map. Starting from the basic components of the circuit, extending to the working principles, interrelationships of each part, and related formulas and theorems, while integrating the corresponding ideological and political elements. For instance, when explaining the stability of the circuit, it is associated with the stability of teamwork. Subsequently, a small circuit knowledge topic is assigned, allowing students to independently draw the mind map. During the students' drawing process, teachers conduct rounds of guidance and promptly offer assistance for problems such as logical confusion and unemphasized key points. After the completion of the drawing, group discussions are organized. Students share their mind maps with each other, conduct mutual evaluation and revision, and finally select representatives for presentation to the entire class. Teachers comment on the achievements of each group, emphasizing the importance of mind maps in knowledge organization and the cultivation of innovative thinking, guiding students to further perfect their knowledge system.

Strengthening Practical Innovation with "Three Imitation"

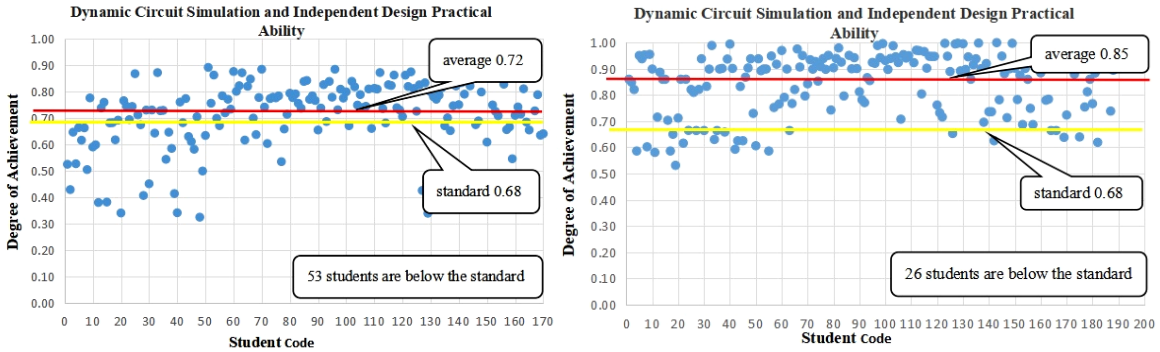
In the teaching of circuit courses, "Three Imitation" is a crucial link and of significant importance in strengthening practical innovation ability. Its teaching activities are carried out orderly around before class, during class, and after class. Before class, teachers meticulously prepare online open courses, covering key points of circuit knowledge and critical steps of simulation experiments, and require students to independently study and complete the corresponding assignments for submission. Taking the preview experiment of simple circuit principles as an example, students independently build circuits in a virtual environment, collect and analyze data, cultivate independent thinking and practical operation abilities, and lay the foundation for classroom learning. During class, teachers first systematically explain circuit theoretical knowledge, making it vivid and understandable by combining examples and demonstrations. Subsequently, they conduct detailed reviews of students' pre-class assignments and reports, accurately point out the problems in the preview experiments of circuits, and guide group discussions and mutual evaluations. Then, using simulation software, complex circuit scenarios are constructed, encouraging students to independently explore the influence of parameter changes on the circuit, stimulating their ability to actively think and solve problems, and changing the traditional mode of passive knowledge reception. After class, teachers design simulation practical projects that simulate actual engineering, such as the planning and design of a community power grid. Students collaborate in groups and comprehensively apply knowledge to complete tasks from architecture design to parameter optimization. During the process of answering students' questions during the design, teachers combine the ideological and political concepts in "One Thought" to guide students to consider the feasibility of the design plan from the perspectives of energy conservation, environmental protection, and sustainable development. Based on the thinking mode cultivated by "Two Guidance", they help students analyze the rationality of the circuit structure, the direction of parameter optimization, etc., promoting students to enhance innovation and teamwork abilities in practice, accumulate experience for participating in major innovation and electronic design competitions, and achieve the coordinated development of knowledge, ability, and values, effectively promoting the teaching of circuit courses to a new height.

Through the above implementation paths, the "One Thought, Two Guidance, Three Imitation" teaching mode can be advanced orderly in the teaching of circuit courses, achieving the organic unity of ideological and political education, knowledge imparting, and practical innovation.

Application achievements of "One Thought, Two Guidance, Three Imitation"

The "One Thought, Two Guidance, Three Imitation" teaching mode has achieved remarkable results in the application of circuit courses. In terms of enhancing students' learning enthusiasm, the integration of ideological and political elements in the classroom effectively stimulates students' internal learning motivation. The application of mind maps and simulation software in teaching drives students to actively explore and practice, achieving the transformation from a passive to an active learning mode.

From the perspective of the cultivation of practical innovation ability, a large number of simulation experiments and independent design projects have played a key role. Taking course objective 1 "Dynamic Circuit Simulation and Independent Design Practical Ability" as an example, as shown in Figure 4.



(a) Grade 22 (b) Grade 23

Figure 4. Scatter plot of achievement degree for circuit theory course objective 1

From the comparison of the scatter plots of the degree of achievement of course objective 1 of the circuit theory course for the 22nd and 23rd grades, it can be known that the average degree of achievement of this objective for the 22nd grade students was 0.72, and 53 students were below the standard value of 0.68. The average degree of achievement of the 23rd grade students rose to 0.85, and only 26 students were below the standard value. The specific data analysis is shown in Table 5.

Table 5. Comparative analysis of the scatter plot data

Comparison Dimension	Before Reform (Left Scatter Plot)	After Reform (Right Scatter Plot)	Conclusion
Average Value	0.72	0.85	The average value increases after the reform, and the overall level of students improves
Number of Students Below the Standard Value	53	26	After the reform, the number of students below the standard value decreases, and more students meet the standard
Degree of Data Dispersion	The scatter points are distributed more dispersedly	The scatter points are distributed more concentratively	The reform reduces the difference in students' grades and makes the teaching effect more balanced
Number of Students in the High-score Segment	The number of scatter points in the high-score segment is small	The number of scatter points in the high-score segment increases	The reform helps tap students' potential and cultivate more excellent students

Proportion of Students Meeting the Standard	The proportion of students meeting the standard is relatively low	The proportion of students meeting the standard increases significantly	The innovative teaching effectively helps more students meet the course ability standard

Through the comparative analysis of the data, it indicates that this teaching mode has effectively exercised students' practical operation and innovative thinking abilities in circuits, and the quality of students' experimental reports and design achievements has significantly improved. At the same time, the course satisfaction has greatly increased, which has strongly promoted the development of circuit course teaching, laid a solid foundation for the cultivation of professional talents, and also provided a highly valuable demonstration and reference for the reform of similar courses.

RESULTS

In the exploration of circuit course teaching, the multiple innovative teaching methods and the "One Thought, Two Guidance, Three Imitation" mode have achieved outstanding results. The innovative teaching methods dissolve knowledge difficulties with unique techniques, such as analogies of RL circuits, homo-phonic memory of formulas, etc., and ingeniously integrate ideological and political education, breaking the limitations of traditional teaching and integrating knowledge imparting and value shaping. The "One Thought, Two Guidance, Three Imitation" mode innovates teaching from multiple dimensions. "One Thought" integrates ideological and political education and professional knowledge to lay a solid ideological foundation; "Two Guidance" helps construct the knowledge system and promotes knowledge internalization; "Three Imitation" strengthens practice and realizes the leap from theory to practice. The two complement each other, make up for the shortcomings of traditional teaching, and significantly improve students' learning quality and efficiency and comprehensive qualities. In the future teaching, the application of these strategies should be deepened, experiences accumulated, and innovations developed to inject vitality into the education of electrical, electronic, and information majors, promote the improvement of the teaching quality of higher education, and facilitate the continuous deepening and expansion of the teaching reform of circuit courses and related disciplines.

ACKNOWLEDGMENTS

This work was supported by the Project : Reform and exploration of the teaching mode of "One Thought, Two Guidance, Three Imitation" in the course of "Circuit Theory" of Beihua University (No.: 202221jxzd0224672022-05-21000141)

REFRENCES

[1] Wei Yu, Fang Zhijun, Wang Xiuxiu. Exploration and practice of the training mode of large electrical talents under the perspective of industrial development. Research in Higher Engineering Education, 2022, (06): 56-61.
[2] Zhang Zhiyong, He Chaoying. The purpose, dilemma and breakthrough of the integrated reform of the system and mechanism of educational science and technology talents under the perspective of higher education. China Audio-visual Education, 2025, (02): 14-20.
[3] Huang Qinyuan, Xiong Xingzhong, Cao Lijia. Exploration of the teaching reform path of electrical information majors under the background of new engineering. Science and Education Guide, 2024, (25): 30-32.
[4] Yuan Cheng. Student-centered classroom teaching. Ideological and Political course teaching, 2024, (11): 58-60.
[5] Liu Haitao, Tang Fang, Lin Zhi, et al. Simulated integrated circuit design course experimental project driven teaching reform. Laboratory Research and Exploration, 2024,43 (04): 117-120.
[6] Wang Cui, Cao Xiaomin, Liang Yan. Reform and practice of electrical and electronic Experimental Teaching under the background of Engineering Education Certification. Office Automation, 2024,29 (10): 31-34.
[7] Zhou Chun, Wang Lili, Zhao Yang, et al. The Application of the hybrid teaching mode based on SPOC in the course of "Circuit and Electronic Technology". Science and Technology Wind, 2025, (02): 128-130.

[8] Zhang Yufeng. Exploration of online teaching mode reform of The Circuit Foundation course. China Electric Power Education, 2023, (08): 56-57.
[9] Yin Fagen, Wu Tiefei. Research on teaching method reform of Circuit Analysis driven based on CDIO Project. Journal of Yichun College, 2024,46 (06): 117-121.
[10] Li Xiaohua, Li Jun, Jia Feng, et al. New constructivism improves students' innovation ability in the circuit experiment course. Laboratory Research and Exploration, 2024,43 (12): 141-145.
[11] Du Li, Li Zhijun, Zhang Wenxiang. Exploration and practice of the integration of course teaching and course ideological and political affairs of "Circuit Analysis Experiment". Heilongjiang Education (Theory and Practice), 2025, (01): 98-100.
[12] Chen Guangming, Si Yiping. Research on the construction of multiple evaluation system of online courses in colleges and universities. Journal of Ningbo Vocational and Technical College, 2021,25 (01): 85-88 + 104.
[13] Ge Hanhong. Application of cognitive assimilation theory in the teaching of "buoyancy". Physics Teacher, 2023,44 (03): 35-38 + 43.
[14] Dai Xiumei. Take the formula-difference formula as an example. Mathematical Bulletin, 2024,63 (10): 33-37.
[15] Meng Han, Ma Liang, Liu Yong. Human learning optimization algorithm for fused learning psychology. Computer Applications, 2022,42 (05): 1367-1374.
[16] Wang Kun. Based on emotion: a study on the improvement of university teaching paradigm guided by moral education. Research on Educational Development, 2023,43 (23): 68-77.
[17] Liu Lu. Based on the theory of entropy change and information processing theory. University Education Management, 2023,17 (03): 12-20.
[18] He Zhaoshui, Tan Beihai, Xie Kan, et al. Exploration of the teaching practice of "six in one and three improvements" of information course under the background of three full education. Research in Higher Engineering Education, 2023, (06): 82-86.
[19] Jiang Chengxiang. Value orientation of the evaluation of course goal achievement: from proof to empowerment. Heilongjiang Higher Education Research, 2025,43 (02): 109-114.
[20] Guo Caili, Liu Fangfang, Yang Yang. Exploration and research on the construction of knowledge graph enabling curriculum system —— Take signal and information processing courses as an example. University Teaching in China, 2024, (11): 54-60 + 87.
[21] Wang Leying, Zhi Shaolei, Zhang Jun. Multisim Application of simulation technology in PLC teaching. Laboratory Research and Exploration, 2024,43 (05): 89-92.