Journal of Contemporary Educational Research, 2025, Volume 9, Issue 4
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

Exploration and Practice of Using MWorks Simulation Software to Promote Teaching through Competitions in Vocational Colleges

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Abstract: This article aims to explore the teaching mode of using MWorks simulation software to promote teaching in circuit fundamentals courses in vocational colleges through competitions. By analyzing the limitations of traditional teaching, this article elaborates on the functional advantages of MWorks software and its specific application methods in promoting teaching through competitions, including how to combine skill competitions for teaching design, organizing internal selection and training, and other aspects. Practice has shown that this model effectively enhances students' professional skills, innovation ability, and teamwork spirit, while also promoting the improvement of teachers' teaching level. Finally, the problems encountered during the application process were reflected upon, and improvement suggestions were proposed, providing a reference for relevant teaching reforms in vocational colleges.

Keywords: Vocational colleges; MWorks simulation software; Teaching through competition; Circuit Fundamentals course

Online publication: April 29, 2025

1. Introduction

1.1. Research background

With the rapid development of vocational education, vocational colleges are committed to cultivating high-quality technical and skilled talents that meet the needs of society. In the field of electronic information, the circuit fundamentals course is a core technical course for many majors, and its teaching quality directly affects students' professional competence and development. However, traditional circuit teaching faces problems such as a disconnect between theory and practice, a single teaching method, and limited opportunities for students to practice and operate. At the same time, the rise of various electronic design competitions has provided new ideas and directions for teaching reform, and "using competitions to promote teaching" has become one of the important means to improve teaching quality. MWorks simulation software, as a powerful circuit design and simulation tool, has great potential for application in circuit teaching in vocational colleges [1,2].

1.2. Research purpose and significance

The purpose of this study is to explore how to effectively apply MWorks simulation software in the circuit fundamentals courses of vocational colleges. Through the model of promoting teaching through competitions, it aims to stimulate students' learning interest and potential, cultivate their professional skills, innovation ability, and teamwork spirit, while improving teachers' teaching level and practical ability. It provides useful reference and inspiration for the innovative training mode of electronic information professionals in vocational colleges [3,4].

2. Limitations of traditional vocational circuit teaching

2.1. Separation of theory and practice

Under the traditional teaching mode, circuit courses often start with theoretical lectures and then proceed to experimental courses. Theoretical knowledge is abstract and difficult to understand, and students lack intuitive feelings and in-depth understanding of actual circuits in the learning process, resulting in a significant gap between theory and practice. For example, when explaining complex circuit theorems and analysis methods, students find it difficult to match them with the actual operation of circuits, which greatly reduces their learning effectiveness.

2.2. Limited practical teaching resources

The experimental equipment and venues in vocational colleges are usually limited, making it difficult to meet the practical operational needs of each student. In laboratory classes, students often share experimental equipment in groups, and their actual operating time is limited, which cannot fully exercise their hands-on ability and practical skills. In addition, the update speed of experimental content is slow, making it difficult to keep up with the rapid development of electronic technology, resulting in a certain gap between the experimental projects that students are exposed to and the actual applications.

2.3. Single teaching method

In classroom teaching, teachers mostly adopt the method of cramming, and students are in a passive state of receiving knowledge, lacking the awareness of active thinking and participation. This single teaching method is difficult to stimulate students' interest in learning and innovative thinking, and is not conducive to cultivating students' ability to learn independently and solve practical problems [3,4].

3. Application advantages of MWorks simulation software in vocational circuit teaching

3.1. Powerful circuit design and simulation capabilities

MWorks software has a rich library of electronic components and various circuit design tools, which can quickly build various complex circuit schematics. Its powerful simulation engine can accurately simulate and analyze designed circuits, such as DC operating point analysis, AC small signal analysis, transient response analysis, etc., helping students intuitively understand the working principle and performance characteristics of circuits. For example, when teaching amplification circuits, teachers can use software to design different types of amplification circuits and demonstrate in real time the changes in parameters such as voltage amplification factor and input/output impedance, allowing students to delve deeper into the working principles and design methods of large-scale circuits.

3.2. Advantages of virtual experimental environment

3.2.1. Breaking through spatial limitations

The virtual experimental environment built by MWorks software is not limited by the number of laboratory sites and equipment, and students can conduct circuit experiments anytime, anywhere with a computer network. This greatly improves the accessibility of experimental equipment, provides students with more practical opportunities, and helps them conduct independent experimental exploration after class, deepening their understanding of classroom knowledge.

3.2.2. Reducing experimental costs and risks

Conducting experiments in a virtual environment eliminates concerns about component damage, instrument malfunctions, and other issues, reducing experimental costs and safety risks. Students can boldly try different circuit design schemes and experimental parameters, and even if errors occur, they will not cause damage to the actual equipment, thus encouraging students to actively innovate and explore.

3.3. Good compatibility with actual hardware

The circuit design in MWorks software is highly consistent with the actual situation, and the circuits designed by students in the software can be easily converted into actual hardware circuits. This lays a solid foundation for students to engage in practical electronic circuit design and development work in the future, enabling them to better combine theory with practice and improve their engineering practical abilities in the learning process.

4. Application method of MWorks simulation software in the mode of promoting education through competitions

4.1. Updating teaching content in conjunction with skill competitions

4.1.1. Guided by the requirements of the competition

Universities should thoroughly study the event settings and requirements of various electronic design competitions, such as the National Vocational College Skills Competition, Provincial Electronic Design Competition, etc., and integrate the circuit design and production knowledge points involved in the competition into daily teaching. For example, based on common projects such as power circuit design and signal processing circuit design in competitions, corresponding teaching content and experimental projects should be added to the circuit foundation course to enable students to master the knowledge and skills required for the competition in a targeted manner during the learning process.

4.1.2. Integrating cutting-edge technology

Universities need to pay attention to the development trends and new technology applications in the electronics industry, and timely introduce cutting-edge technologies into teaching. For example, with the rise of technology, the design and simulation of related circuits such as wireless sensor networks and ZigBee communication are added to teaching, allowing students to understand the latest technological trends in the industry, broaden their knowledge and horizons, and cultivate their innovative consciousness and ability to adapt to industry development.

4.2. Classroom teaching reform based on MWorks software

4.2.1. Situational teaching

Real-life circuit design scenarios are created using MWorks software, such as simulating the project

development process of an electronic product development company. Students are divided into groups to play different roles, such as circuit designers, test engineers, etc., to jointly complete a circuit design project. In the teaching process, teachers guide students to gradually complete the entire process from requirement analysis, scheme design, circuit construction to simulation testing, so that students can master the methods and processes of circuit design in the context, improve their teamwork ability and problem-solving ability.

4.2.2. Interactive teaching

Changing the traditional classroom teaching method, teachers should guide students to use MWorks software for interactive operations when explaining circuit principles and knowledge points. For example, when explaining the application of integrated operational amplifiers, teachers can first draw a circuit schematic on the blackboard and then demonstrate it in software, allowing students to observe the changes in output waveform and encouraging them to change circuit parameters themselves, analyzing the impact of different parameters on circuit performance. Through this interactive teaching method, students' learning enthusiasm and initiative are enhanced, and classroom teaching effectiveness is improved.

4.3. Using MWorks software to organize on-campus skill competition selection and training

Using MWorks software to organize on-campus circuit design competitions as a selection mechanism for participating in off-campus skill competitions. During the competition, students are required to independently complete circuit design and simulation tasks using MWorks software and evaluate their work based on their performance, innovation, feasibility, and other aspects. Through campus competitions, not only can students' interest in learning and competitive awareness be stimulated, but also excellent student talents can be discovered, which can reserve talents for participating in high-level competitions.

5. Practical case of MWorks simulation software applied to vocational circuit education to promote teaching through competition

5.1. Pre-competition training using Jiangsu Vocational College Skills Competition as an example

5.1.1. Training plan formulation

Before the 2024 Jiangsu Vocational College Skills Competition, a detailed training plan was developed based on the competition outline and past exam analysis. The training plan covers the review of basic theoretical knowledge of circuits, advanced application skills training of MWorks software, and explanation of various typical circuit design and simulation cases. The plan is divided into basic training stage, intensive training stage, and simulation competition stage, each with clear teaching objectives and tasks.

5.1.2. Implementation of training content

In the basic training stage, students are required to systematically review circuit theory knowledge, such as circuit theorems, signals and systems, analog electronics technology, and digital electronics technology, through a combination of theoretical lectures and software operation demonstrations, and become proficient in the basic operations and commonly used functional modules of MWorks software.

During the intensive training phase, a series of complex circuit designs and simulation projects were designed based on the characteristics and requirements of the competition projects, such as high-precision

DC stabilized power supply design, intelligent temperature control system design based on a single-chip microcontroller, etc. Under the guidance of the teacher, students complete the project in groups, from circuit schematic design, PCB drawing to software programming and debugging, using MWorks software for simulation verification throughout the process. During the training process, teachers focus on guiding students to optimize circuit design, improve circuit performance indicators, and cultivate students' teamwork and problem-solving abilities.

During the simulation competition stage, students participate in the simulation competition according to the time and rules requirements of the competition. During the simulation competition, students are required to independently complete a given circuit design task and submit their work within the specified time. Teachers evaluate and grade students' work, analyze and summarize the problems that students encounter during the simulation competition, and propose improvement measures and suggestions.

5.2. Reforming the course assessment method through competition to promote teaching

5.2.1. Construction of a diversified assessment system

In order to comprehensively evaluate students' learning effectiveness and overall quality, a diversified curriculum assessment system has been constructed. The assessment system includes four parts: regular performance, experimental performance, project assignment performance, and competition performance. The usual grades mainly test students' performance in class, such as attendance, enthusiasm for participating in discussions, etc.; the experimental grades focus on students' operational skills and the quality of experimental report writing in the experimental course; the grades of project assignments are evaluated based on students' completion of the course project; the competition results will be given corresponding bonus points based on students' awards in various levels and types of electronic design competitions.

5.2.2. Implementation and effectiveness of assessment methods

During the teaching process, students are strictly assessed and evaluated according to a diversified assessment system. In this way, students' learning enthusiasm has been greatly improved, no longer limited to memorizing textbook knowledge, but paying more attention to the cultivation of their comprehensive abilities. At the same time, the assessment results can also objectively and comprehensively reflect students' learning situation, providing a basis for teachers to adjust teaching strategies.

6. Evaluation and analysis of the effect of MWorks simulation software applied to vocational circuit education through competition promotion

6.1. Assessment of student learning outcomes

6.1.1. Knowledge and skill enhancement

Through a comprehensive analysis of students' academic performance, experimental reports, competition works, and other aspects, it was found that students have significantly improved in basic circuit knowledge, circuit design and simulation abilities, and teamwork skills. Students can proficiently master the usage skills of MWorks software, quickly and accurately design circuit schematics that meet requirements, and optimize circuit performance through simulation. In actual electronic design competitions, students' works demonstrate a high level of innovation, functionality, and stability.

6.1.2. Changes in learning interest and attitude

After adopting the competition-driven teaching model, students' interest in learning has significantly increased, and their attitude towards learning circuit courses has shifted from passive acceptance to active exploration. Many students have expressed that through participating in competition projects and practical activities, they have gained a deeper understanding of the importance and practicality of circuit knowledge, and have developed a stronger interest and enthusiasm for the field of electronic information. This positive learning attitude is not only beneficial for students to achieve better grades in circuit courses, but also lays a solid foundation for their future career development.

6.2. Analysis of the promoting effect on teaching quality

6.2.1. Optimization of teaching methods

The competition-driven teaching model encourages teachers to continuously explore and improve teaching methods. In the teaching process, teachers pay more attention to closely integrating theoretical knowledge with practical teaching, adopting diversified teaching methods such as project-driven and situational teaching, making classroom teaching more vivid, interesting, and attractive. At the same time, teachers have also improved their teaching level and professional competence by participating in competition training and guidance work.

6.2.2. Integration of teaching resources

In order to better support the promotion of education through competitions, the school has integrated various teaching resources, including the construction of specialized electronic design laboratories, the purchase of advanced experimental equipment and software, and the development of high-quality textbooks and courseware. The integration and sharing of these resources provide students with better learning conditions and a practical environment, which helps to improve teaching quality and talent cultivation level.

7. Problems and countermeasures of MWorks simulation software applied to higher vocational circuit education through competition promotion

7.1. Existing issues

7.1.1. The gap between software functionality and actual application

Although MWorks software has powerful capabilities in circuit design and simulation, there is still a certain gap between it and actual electronic circuit design and industrial production environments. For example, some component models in software may not be precise enough and may differ from the characteristics of actual components. The results of software simulation may be limited by computer performance and algorithms, and may have certain deviations from actual test results. These issues may affect students' practical understanding and application skills in circuit design.

7.1.2. Teachers' lack of ability to integrate software with competitions

Although some teachers are familiar with the basic operation of MWorks software, there are still some problems in deeply applying it to the teaching process of using competitions to promote teaching. For example, when designing software-based competition projects and teaching content, teachers may have an inaccurate grasp of difficulty and disconnect from the actual needs of the competition. When guiding students to use software for competition design, it may not be possible to solve complex technical problems encountered by students in a

timely manner. This has to some extent affected the effectiveness of using competitions to promote teaching and students' learning enthusiasm.

7.2. Countermeasures

7.2.1. Strengthening cooperation between software and enterprises

In order to narrow the gap between MWorks software and practical applications, schools should strengthen cooperation with software development companies. On the one hand, invite enterprise technicians to participate in software development and optimization work, improve the component model library in the software based on school teaching and actual enterprise needs, and enhance the accuracy and reliability of software simulation; On the other hand, establishing practical bases for school enterprise cooperation provides students with the opportunity to experience real electronic design projects and production processes of enterprises, and further understand the connection and differences between software and practical applications in practice.

7.2.2. Enhancing teachers' professional competence and teaching ability

Schools should have teachers participating in relevant training and further education activities to address the problems in the integration of software and competitions. For example, organizing MWorks software advanced application training courses, electronic design competition guidance experience exchange meetings, etc., inviting experts, scholars, and enterprise engineers to give lectures and training; encouraging teachers to participate in corporate internships or practical research projects to enhance their practical abilities and professional skills. At the same time, establishing a teacher teaching ability assessment and evaluation mechanism to motivate teachers to continuously improve their own qualities and teaching quality.

8. Conclusion

The application of MWorks simulation software in the teaching of circuit courses for electronic information majors in higher vocational education to promote teaching through competitions is an effective innovative teaching mode. By integrating the powerful functions of software into various aspects of promoting education through competitions, students' learning interest and effectiveness can be effectively improved, and their professional skills, innovative thinking, and teamwork abilities can be cultivated. At the same time, it also helps to promote the improvement of teachers' teaching methods and the enhancement of teaching quality. However, there are also some issues that need to be taken seriously and addressed in the practical process. By strengthening cooperation between software and enterprises, enhancing teachers' professional competence and teaching ability, and cultivating students' self-learning awareness and methods, this teaching model can be further improved, providing strong support and guarantee for the cultivation of electronic information professionals in higher vocational education. In future teaching practices, we should constantly explore and innovate, fully leverage the advantages and role of MWorks simulation software in promoting education through circuit competitions in vocational colleges, and cultivate more high-quality electronic information professionals who can meet the needs of society.

Funding

This article was from the MWORKS University Application Verification Project (BX2024C081).

Disclosure statement

The author declares no conflict of interest.

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