Research on Multidimensional Interactive Teaching Mode of Power Supply and Distribution Courses

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Abstract: This paper delves into the implementation of a multi-dimensional interactive teaching model specifically tailored for power supply and distribution courses. The traditional teaching model, while serving its purpose, has limitations that hinder the holistic development of students in this domain. To address these limitations, an innovative teaching approach that breaks the mold of conventional methods is proposed. Central to this model is the integration of online and offline learning environments. This blend ensures that students have access to a wealth of resources and materials, both inside and outside the classroom. It also promotes flexibility in learning, allowing students to learn at their own pace and explore areas of interest. Moreover, the proposed model harmoniously combines theoretical knowledge with practical applications. Theory courses are complemented with hands-on experiments and practical projects, providing students with an opportunity to apply what they have learned in real-world scenarios. This approach not only enhances the retention of knowledge, but also fosters a deeper understanding of the subject matter. The multi-dimensional interactive teaching model proposed in this paper aims to ignite students' interest in power supply and distribution, enhance their practical and innovative abilities, and ultimately support the cultivation of high-quality electrical engineering talents. It represents a significant step forward in the reform of teaching methodologies and holds promise for improving the overall quality and effectiveness of power supply and distribution courses.

Keywords: Power Supply and Distribution Courses; Multi-dimensional Interaction; Teaching Model; Information Technology; Teaching Quality

1. Introduction

With the rapid development of the power industry and the constant advancements in electrical technology, the significance of power supply and distribution as a crucial element of the electrical system has been underscored [1, 2]. This domain not only plays a pivotal role in ensuring the reliable and efficient operation of electrical systems but also holds the potential for further innovations that can revolutionize the power industry. Given this backdrop, the teaching and practical demands for power supply and distribution courses have been escalating at an unprecedented rate [3].

However, the traditional teaching approach for power supply and distribution courses often falls short in meeting these demands. It typically relies on a one-dimensional knowledge transfer mechanism, focusing primarily on the dissemination of theoretical information without adequate emphasis on practical applications or student engagement [4]. This approach lacks effective interactions between teachers and students, as well as among students themselves, thereby limiting the depth and breadth of learning. Furthermore, it fails to foster a learning environment that nurtures critical thinking, problem-solving skills, and innovative abilities—all crucial attributes for successful professionals in the power industry.

In addition, the current status of power supply and distribution classrooms reveals a concerning trend. Students often lack the internal drive to actively engage in the learning process, instead, they tend to be passive recipients of knowledge [5]. This lack of participation and exploration can

significantly impact their learning outcomes, leading to a disconnect between classroom knowledge and real-world applications.

Therefore, the significance of exploring a new teaching model for power supply and distribution courses cannot be overstated. Such a model would aim to not only improve teaching quality but also cultivate students' practical abilities, making them better prepared for the challenges and opportunities of the power industry [6]. It is imperative to move towards a teaching approach that is more interactive, integrated, and responsive to the evolving needs of the field.

Teaching reform in this context holds immense promise. It can help address the challenges faced by the traditional teaching approach and provide students with a richer, more immersive learning experience. By introducing innovative teaching methods and leveraging modern educational technologies, a learning environment that encourages critical thinking, collaborative learning, and the development of practical skills can be fostered [7]. This, in turn, can lead to improved learning outcomes, enhanced student engagement, and the cultivation of a new generation of highly skilled and innovative electrical engineers.

Specifically, teaching reform in power supply and distribution courses can bring the following benefits:

(1) Grasp the foreword knowledge and skills: the knowledge and skills in the field of power supply and distribution are updated quickly, and the teaching reform can introduce the latest theoretical and practical achievements in a timely manner to help students grasp the latest skills and knowledge.

(2) Enhance the practical ability: power supply and distribution is a highly practical course, teaching reform can strengthen the practical ability of students to cultivate, so that they are closer to the actual engineering in their learning, and improve the competitiveness of students' employment.

(3) Enhance students' innovative consciousness: the technical changes in the field of power supply and distribution are rapid, which requires students to have innovative consciousness and ability. Teaching reform can stimulate students' innovative thinking and improve their innovative ability by introducing new course content and teaching methods.

(4) Enhancing students' professionalism: The study and practice of plant power supply require students to have strong professionalism. Teaching reform can help students to better understand the application of plant power supply technology in real work by providing more cases and simulation practice sessions, so as to enhance their professionalism.

2. Reform Programs and Implementation Plans

The reform of the power supply and distribution courses is an intricate process that aims to enhance the overall learning experience and outcomes for students. This section delves into the specific reform elements that constitute the multidimensional interactive teaching approach.

2.1 Specific Reform Elements

The multidimensional interactive teaching reform of power supply and distribution courses includes the following:

(1) Introduction of Virtual Reality technology (VR): The integration of VR technology into the classroom revolutionizes the way students engage with power distribution knowledge [8]. VR equipment and Internet resources are utilized to present complex concepts and systems in a highly visual and interactive format. This immersive experience enhances students' visual and auditory perception, making abstract theories more tangible and easier to grasp. VR simulations also allow students to virtually explore and manipulate power distribution systems, providing a hands-on learning experience without the need for expensive and potentially dangerous hardware.

(2) Blended teaching: Blended teaching combines the best of both worlds: traditional face-to-face instruction and the flexibility of online learning. This approach allows students to access learning materials and resources anytime, anywhere, fostering a more autonomous learning style. In the classroom, teachers can focus on delivering key concepts and facilitating discussions, while students can engage with the content at their own pace and delve deeper into areas of interest. Blended teaching also enables teachers to provide more personalized feedback and

support, addressing students' individual needs and challenges.

(3) Project-driven teaching: Project-driven teaching is a hands-on approach that centers around real-world engineering projects. Students are assigned to work on actual power distribution cases, from design to implementation. This process not only applies the theoretical knowledge learned in class but also challenges students to think critically and creatively. By working on real projects, students gain practical experience, develop problem-solving skills, and enhance their innovation capabilities. Project-driven teaching also helps to foster a sense of accomplishment and purpose among students, increasing their motivation to learn.

(4) Cooperative learning: Cooperative learning emphasizes the importance of collaboration and teamwork in the learning process. Students are organized into groups or teams and assigned tasks that require them to work together to achieve a common goal. This approach fosters communication, sharing of ideas, and mutual learning among students. Through collaborative efforts, students can pool their knowledge and skills, overcoming challenges and solving problems together. Cooperative learning also helps to develop students' leadership and organizational skills, preparing them for future roles in the workplace.

(5) Personalized learning: Personalized learning recognizes that every student is unique and has different learning needs and preferences. To cater to this diversity, personalized learning programs and resources are designed to meet the individual needs of students. This approach involves assessing students' strengths, weaknesses, and interests, and then tailoring the teaching content, methods, and pace to suit their needs. Personalized learning ensures that teaching is more relevant and engaging for students, increasing their motivation to learn and their ability to learn independently.

2.2 Reform Objectives

the objectives of the multi-dimensional interactive teaching reform of the power supply and distribution course are: to provide students with a more high-quality and interesting learning experience, to improve students' motivation and independent learning ability, to strengthen students' subject knowledge and application ability, and to effectively enhance students' learning effect and course performance. Specifically, this paper hope to achieve the following objectives:

(1) To stimulate students' intrinsic motivation and independent learning ability: to stimulate students' interest and motivation in learning and to cultivate their independent learning ability and habits through a variety of interesting, lively and interactive teaching methods;

(2) Improve students' subject knowledge and application ability: through guiding students to actively explore and think, so that they can master more subject knowledge and practical application skills in the interaction;

(3) Enhance students' learning effect and course performance: through the multi-dimensional interactive teaching method, change the single teaching method of traditional classroom, enhance students' learning experience, and improve students' learning effect and course performance.

2.3 Key Issues to be Addressed

In the process of multidimensional interactive teaching reform of power supply and distribution course, the key issues to be solved are:

(1) improving the teaching effect: through the introduction of VR technology, interactive learning and other means, students are more actively involved in learning, stimulating students' interest in learning and improving the teaching effect;

(2) Expanding the scope of teaching: through the Internet and other technologies, the teaching content covers a wider group of students and expands the scope of teaching;

(3) Providing personalised learning: through differentiated teaching for each student's learning needs and interests, providing personalised learning to meet students' various needs;

(4) Promoting interactive learning: through "teacher-student" interaction, "student-student" interaction, "virtual-reality" interaction, "human-machine" interactive learning and other forms. Interactive learning: Through "teacher-student" interaction, "student-student" interaction, "virtual-reality" interaction, "human-computer" interaction and

other forms of interactive learning, it promotes communication and interaction among students, and improves their learning effect;
(5) Improve the teaching level of teachers: through the innovation of teaching technology, improve the teaching level of teachers, improve the effect of teachers' lectures and improve the quality of teaching.

3. Features and Innovative Points of the Electricity Supply and Distribution Course

The characteristics and innovations of the multi-dimensional interactive teaching reform of power supply and distribution courses are mainly concentrated in the teaching methods, teaching content and teaching objectives, etc. Through the use of a variety of technological means and teaching methods, to improve the practicality and timeliness of the courses, so that the students are better adapted to the needs of professional development, the project's characteristics and innovations can be summarized in the following four aspects:
(1) Introducing "virtual reality" assistive technology and multimedia interactive teaching methods: the use of multimedia interactive teaching methods for abstract concepts and complex knowledge can be natural, vivid, visualization of the display, improve students' understanding and memory.
(2) Emphasis on practical teaching: Combine the course content with actual work scenes, pay attention to the independent completion of practical work, and improve the practical ability and professionalism of students.
(3) Personalized teaching: Personalized teaching is realized by means of educational technology, and different teaching plans are formulated according to the characteristics and needs of individual students, so as to improve the learning efficiency and interest in learning.
(4) Timeliness of course content: The course content is updated in time and new technologies and concepts are introduced to ensure the timeliness and practicability of the teaching content and to provide students with better career development prospects.
(5) Emphasis on students' subjectivity: Through the teaching of students' subjectivity, students can better use the knowledge they have learnt in practice, and at the same time form good learning habits and motivation for independent updating, so as to achieve comprehensive knowledge improvement and professional skills enhancement.

4. Evaluation of the Effectiveness of Multi-dimensional Interactive Teaching Mode

4.1 Construction of Teaching Effect Evaluation System

In constructing the evaluation system of teaching effect, it is crucial to establish multi-dimensional and multi-level evaluation indexes that encapsulate diverse aspects such as knowledge mastery, practical skills, innovative capabilities, and learning attitude. To uphold objectivity and fairness in the evaluation process, various evaluation techniques are employed, including questionnaire surveys, classroom observations, homework analysis, and test score assessments. Additionally, emphasis is placed on the meticulous collection and processing of data to guarantee the precision and credibility of the evaluation outcomes.

4.2 Evaluation and Analysis of Teaching Effect

The evaluation of the teaching effect of the multidimensional interactive teaching mode in the power supply and distribution course offers a comprehensive understanding of its impact on student learning. This teaching approach has yielded significant outcomes across several key areas.
Firstly, the students' knowledge mastery has undergone a substantial transformation. Their improved performance in exams and the quality of their homework assignments are testament to the mode's effectiveness in deepening their understanding of the subject matter. This enhanced comprehension not only reflects in their academic achievements but also equips them with a solid foundation for future studies and professional endeavors.
Secondly, the mode has been instrumental in cultivating students' practical abilities and innovative capabilities. Their superior performance in course experiments and project design demonstrates their ability to apply theoretical knowledge in practical settings and to think creatively in solving problems. This hands-on approach to learning has fostered a more engaged and active

learning environment, encouraging students to explore and experiment.

Moreover, there has been a noticeable shift in students' learning attitudes. Their increased participation in classroom activities and heightened interests in learning suggest a more positive approach to education. This positive change is indicative of the mode's ability to engage students and spark their curiosity, leading to a more fulfilling and enriching learning experience.

However, it is also important to acknowledge that the evaluation has revealed certain issues and shortcomings. One significant challenge is the varying levels of student engagement in interactive sessions. While some students actively participate and engage in discussions, others remain passive and reserved. This suggests that further efforts are needed to motivate and guide all students to fully participate in the interactive learning process.

Additionally, the implementation of the teaching model has encountered some operational difficulties and challenges. These may include issues related to resource allocation, technological integration, and teacher training. To address these challenges, it is essential to continuously improve and optimize the teaching model, ensuring that it is well-suited to the needs and abilities of the students.

Overall, the evaluation offers a balanced perspective on the strengths and weaknesses of the multidimensional interactive teaching mode in the power supply and distribution course. It highlights the need for continued efforts in enhancing student engagement, addressing operational challenges, and optimizing the teaching model to maximize its potential in fostering student learning and development.

4.3 Optimization Strategies for the Teaching Model

Based on the aforementioned evaluation results, several optimization strategies are proposed to further enhance the effectiveness of the multidimensional interactive teaching mode in the power supply and distribution course [9]. Firstly, addressing the issue of low student participation is crucial. To this end, it is recommended to design more engaging and practical interactive sessions that cater to the interests and needs of the students. By incorporating real-world scenarios, case studies, and problem-solving activities, students can be motivated to actively participate and engage in the learning process. Additionally, strengthening the assessment and motivation of student participation is essential. Establishing clear participation criteria and incorporating them into the overall evaluation system can encourage students to take a more active role in class discussions and activities.

Secondly, addressing the difficulties and challenges encountered in the implementation of the teaching model is paramount [10]. To this end, further improvements in the construction of teaching platforms and resources are necessary. This includes enhancing the functionality and user-friendliness of the online learning platforms, providing a wider range of learning materials and resources, and ensuring seamless integration of technological tools into the teaching process. By providing richer and more convenient teaching support, teachers can effectively facilitate student learning and promote the effective application of the teaching model.

Moreover, teacher training and learning exchanges should be prioritized. By organizing regular workshops, seminars, and training sessions, teachers can enhance their teaching skills, learn about the latest teaching methods and technologies, and share successful practices with their peers. This not only improves the teaching quality but also fosters a collaborative and innovative teaching culture within the institution.

Looking ahead, it is imperative to continue exploring the innovative development direction of the multidimensional interactive teaching mode. By leveraging new technologies and incorporating innovative ideas, the mode can be continuously improved and optimised to meet the evolving needs of the electric power engineering industry. This includes exploring the integration of artificial intelligence, virtual reality, and other advanced technologies into the teaching process to create more immersive and engaging learning experiences for students.

By implementing these optimization strategies and exploring innovative directions, the multidimensional interactive teaching mode can make greater contributions to the

cultivation of high-quality electric power engineering technology talents. It will empower students with the necessary knowledge, skills, and abilities to excel in their future careers and contribute significantly to the development of the power industry.

5. Conclusions

After conducting thorough research and implementing practical applications in the realm of multi-dimensional interactive teaching mode for power supply and distribution courses, several profound conclusions have been drawn. Firstly, the implementation of this teaching mode has demonstrated remarkable benefits in enhancing student engagement and enthusiasm towards learning. This mode effectively ignites students' interest, stimulating them to actively participate in classroom activities and discussions. As a result, students' practical skills and innovative thinking capabilities are significantly improved.

Furthermore, the multi-dimensional interactive teaching mode has facilitated seamless communication and collaboration between teachers and students. Through the establishment of a diversified teaching platform that incorporates various interactive elements, teachers are able to provide students with a richer and more immersive learning experience. This, in turn, enhances the overall quality and effectiveness of teaching, ensuring that students not only grasp theoretical knowledge but also develop practical skills. Moreover, the successful implementation of this teaching mode has resulted in the cultivation of a cohort of highly skilled electric power engineering talents. These individuals possess a solid theoretical foundation as well as practical abilities, making them well-equipped to contribute towards the innovation and development of the electric power industry.

Looking ahead, there is immense potential for further exploring and expanding the application of the multi-dimensional interactive teaching mode. Firstly, a more systematic approach to collecting and analyzing teaching cases and data would be beneficial in providing a comprehensive evaluation of the teaching effectiveness of this model. Such an analysis would allow for the identification of best practices and areas for improvement. Secondly, there is an opportunity to explore the application of this teaching mode in other related courses or fields. By doing so, the scope and impact of the multi-dimensional interactive teaching mode can be broadened, leading to its widespread adoption and innovative development. Lastly, it is crucial to keep abreast of technological advancements and emerging concepts that could potentially enhance the multi-dimensional interactive teaching mode. The integration of new technologies, such as artificial intelligence and virtual reality, could further enrich the learning experience and improve teaching outcomes. By continuously adapting and innovating, the quality and effectiveness of this teaching mode can be continually enhanced.

In conclusion, the multi-dimensional interactive teaching mode holds promise in revolutionizing the way power supply and distribution courses are taught. With its ability to engage students, foster collaboration, and cultivate skilled talents, it is poised to make significant contributions to the advancement of the electric power engineering field.

Acknowledgments

This study is supported by the Curriculum reform project at the University of Huizhou “Research on Multi-dimensional Interactive Teaching Mode of Plant Power Supply Course”.

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