Curriculum and Teaching Methodology (2024)
Clausius Scientific Press, Canada
DOI: 10.23977/curtm.2024.070427
ISSN 2616-2261 Vol. 7 Num. 4

Research and Practice on the "Blended" Teaching Reform of Basic Experiments in Analog Electronics Based on the Teaching Platform

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Keywords: Higher education, Analog electronics, Blended learning, Experimental education, Teaching platform

Abstract: As higher education continues to evolve, the basic experiments in analog electronics, a crucial component of electronic engineering education, urgently need reform to meet the growing demands of students and the challenges of technological advancement. This study explores a "blended" teaching reform for basic experiments in analog electronics set against the backdrop of a university, implemented through a teaching platform. The effectiveness of this teaching model in enhancing student learning experiences and fostering experimental skills has been validated through practical research. The article aims to provide new ideas and methods for university electronic technology experimental teaching.

1. Introduction

Currently, university electronic engineering programs face the urgent need to cultivate students' practical application skills. However, traditional teaching methods for basic electronic experiments encounter limitations due to insufficient equipment and inflexible scheduling, which fail to meet students' learning needs. To enhance the effectiveness of experimental teaching, this study, set in a university context and based on a teaching platform, explores a "blended" teaching reform. It aims to integrate online and offline resources to optimize the experimental education process and cultivate students' practical operational abilities and innovative thinking.

2. Current State and Problems of Electronic Technology Experimental Teaching in Universities

2.1. Student Training Needs in University Electronics Programs

The training of students in university electronics programs aims to develop electronic engineering talents with a solid theoretical foundation and practical operational capabilities. Electronics technology, as a key discipline, encompasses a wide range of applications including communications, automation, and computing. Students in electronics are expected to possess comprehensive qualities, not only requiring a strong theoretical knowledge base but also interdisciplinary competencies. Their education should include an in-depth understanding of traditional electronics as well as the development of innovative thinking and practical experimental skills to meet the challenges of rapid technological advancements. The comprehensive training of electronics students is intended to prepare them for complex and variable electronic engineering tasks in their future careers, contributing intellectual and technical support to technological innovation and societal development[1].

2.2. Problems in Traditional Electronic Technology Experimental Teaching

Traditional electronic technology experimental teaching faces a series of concerning issues. First, the limited availability of experimental equipment restricts large-scale experiments, hindering students' deep mastery of practical operations. Secondly, fixed experiment schedules fail to accommodate individual learning differences among students, lacking the necessary flexibility, which means some students may not fully participate in experiments. Additionally, traditional experimental models have deficiencies in sparking student interest and in real-world engineering applications, lacking effective components to link theory with practice. This results in low student engagement in experiments, subsequently affecting the cultivation of their practical skills. These issues urgently require innovative teaching models to enhance students' learning outcomes and practical abilities.

2.3. Necessity and Feasibility of Teaching Reform

Teaching reform is an urgent requirement in response to the demands of evolving times. In the field of electronic technology, with the acceleration of technological innovation and industrial development, traditional experimental teaching methods have become outdated. Therefore, reforming the teaching of electronic technology experiments is imperative. The aim of the reform is to improve teaching outcomes, enabling students to better acquire practical skills and adapt to future professional development needs. Furthermore, reform based on university teaching platforms is feasible, as these platforms provide the technical support and resources needed for integration, facilitating innovative experimental teaching models that better meet student training needs and real-world societal demands.

3. Blended Teaching Model Design and Teaching Platform Construction

3.1. Selection and Construction of University Teaching Platforms

In the reform of electronic technology experimental teaching in universities, the selection and construction of a teaching platform are critical decisions. Several factors are considered when choosing a platform. First, we focus on the openness and flexibility of the platform to ensure it can adapt to the specific needs of different majors and courses. For this reason, we chose a comprehensive teaching platform known for its flexibility and customizability. This platform not only supports real-time online experiments but also houses a vast and diverse repository of experimental resources, covering a wide range of content in the field of electronic technology.

In terms of platform construction, we are committed to creating a user-friendly interface to ensure that both students and teachers can easily utilize the platform. The interface design considers the intuitiveness and ease of use, allowing students to quickly get started and fully utilize the platform’s features. The simplicity of platform operation also helps teachers more effectively organize and monitor students' learning processes.

To better track students' learning progress, we require the platform to have data analysis capabilities. By collecting and analyzing data on students’ learning behaviors on the platform, teachers can timely understand students' academic progress, providing a basis for personalized guidance and feedback. This real-time monitoring mechanism helps adjust teaching strategies to better meet students' learning needs.

In summary, the selection and construction of a university electronic technology experimental teaching platform need to comprehensively consider various factors to ensure it can serve as an effective teaching tool, promoting students' comprehensive development and the cultivation of practical skills[2].

3.2. Design Philosophy of the Blended Teaching Model

The design philosophy of the blended teaching model is to fully leverage the respective strengths of traditional face-to-face instruction and online learning to enhance students' educational outcomes and the cultivation of experimental skills. This model is committed to creating a flexible and diverse learning environment, enabling students to comprehensively grasp knowledge and skills.

In terms of online teaching, we focus on flexibility and convenience. Through online video lectures, students can learn autonomously at any time and from any location, overcoming the constraints of time and place inherent in traditional face-to-face teaching. The introduction of simulated experiments also provides students with a safe, virtual experimental environment, allowing them to conduct experimental operations without the constraints of time and place, and become familiar with the experimental steps in advance.

For the in-person experimental component, we emphasize the cultivation of practical skills. Utilizing the rich experimental resources provided by the teaching platform, students can perform real experimental operations in the laboratory, reinforcing theoretical knowledge and developing the ability to solve practical problems. During the experimental process, instructors provide timely guidance and feedback to ensure that students correctly master experimental skills.

The blended teaching model, by effectively integrating online and offline resources, breaks the spatial and temporal limitations of traditional teaching, enabling students to learn more flexibly and develop more comprehensively. This design philosophy aims to provide students with a more personalized and in-depth learning experience, helping them better adapt to the challenges of future technological developments.

3.3. Online and Offline Resource Integration Strategy and Implementation Plan

The advantage of the blended teaching model is reflected in the organic integration of online and offline resources. Online, the teaching platform's multimedia resources enrich the students' learning experience. By designing interactive learning modules, not only is student engagement stimulated, but a variety of learning content is also provided, including text, videos, and simulated experiments. The introduction of online experimental simulations offers students a virtual experimental environment, allowing them to perform practical operations on computers, familiarize themselves with experimental steps in advance, and enhance their sense of practice.

Offline, full use is made of laboratory equipment to organize practical experiments, reinforcing theoretical knowledge and cultivating the ability to solve real-world problems. Through lab practice, students can apply the theoretical knowledge learned online in practical settings, gaining a deeper understanding and mastery of the content through actual operations. Designing tasks such as experimental reports encourages students to summarize and reflect on the experimental process, forming a more complete learning system[3].

Through the organic integration of online and offline resources, we aim to enhance students' experimental skills and promote deep learning. This comprehensive educational approach will provide students with a richer, more comprehensive learning experience, helping them better understand and apply the knowledge learned and lay a solid foundation for future practical applications.

4. Practical Research and Case Analysis

4.1. Research Methods and Experimental Design

4.1.1. Research Methods

To accurately assess the impact of blended teaching in university electronic technology experiments, we have employed a systematic quantitative research design. Initially, we divided students into an experimental group and a control group, ensuring that the experimental group used the blended teaching model while the control group continued with traditional teaching methods. This comparative design helps to more precisely evaluate the impact of blended teaching. We will focus on quantitative indicators such as students' academic grades and laboratory report scores, analyzing the effects of blended teaching by comparing data between the experimental and control groups.

In terms of qualitative research, we used a variety of methods to deeply understand students' feelings and views on blended teaching. Through student interviews and surveys, we will collect data on students' subjective experiences and opinions. This qualitative research design helps complement the quantitative data, providing a more comprehensive research perspective. By delving into students' statements and feedback, we can capture specific scenarios and effects of the blended teaching model in practical application.

4.1.2. Experimental Design

Firstly, we clearly define the research objectives, identifying the questions and focal points of the study. Ensuring clear research goals aids in providing a definitive direction for the experimental design. A randomized controlled trial design is used, randomly assigning students to either the experimental or control group. The experimental group utilizes the blended teaching model, while the control group maintains traditional teaching methods. This division helps control the impact of other variables and more accurately assess the effects of blended teaching.

Data collection is performed through end-of-term academic grades, lab report scores, and other quantitative indicators. Additionally, student interviews and surveys are used to gather subjective perceptions and views, enriching the qualitative data. Statistical methods are employed to analyze the quantitative data, comparing differences between the experimental and control groups. Qualitative data undergo thematic analysis to unearth deeper insights. Through comprehensive analysis, a holistic understanding of the effects of blended teaching is formed[4].

Finally, conclusions are drawn based on the data analysis results, discussing the strengths and weaknesses of the blended teaching model and suggesting possible explanations and recommendations. This comprehensive experimental design aims to provide a scientifically feasible approach for the reform of electronic technology experimental teaching in universities.

4.2. Implementation of Blended Teaching in Universities

4.2.1. Construction of Teaching Platform and Online Learning Resources

In the implementation of blended teaching at universities, the focus is on developing a teaching platform to provide rich learning resources, ensuring that students can learn anytime and anywhere. We selected an open and flexible teaching platform that supports real-time online experiments and houses a comprehensive experimental resource library. This platform not only provides online lectures and experimental simulation videos but also stimulates students' learning interest through interactive learning modules. Committed to building a user-friendly, easy-to-operate interface, our goal is to enable students to conveniently engage in online learning and experimental operations.

Through the construction of the teaching platform, students gain flexibility and convenience in their learning. The availability of online lectures and experimental simulation videos allows students to access educational content without time and place restrictions. This personalized learning approach helps meet students' diverse learning paces and subject needs, enhancing their autonomy in learning.

4.2.2. Experiment Task Design and Student Participation

During the implementation, we ensure that students fully master the experimental content through carefully designed experimental tasks. This involves hands-on experimental segments where students can deepen theoretical knowledge and develop problem-solving skills in actual experimental operations. The design of experimental tasks focuses not only on imparting theoretical knowledge but also emphasizes integrating theory with practical operations, providing a more comprehensive learning experience for students.

During the experimental process, instructors monitor students' experimental operations through the platform, providing timely guidance and feedback. This real-time monitoring mechanism ensures the smooth progression of experiments and also offers personalized guidance for students. Through the platform's feedback system, instructors can provide specific suggestions on students' experimental operations, helping them better understand and master the content of the experiment.

4.2.3. Collaborative Learning and Teamwork

Another innovative aspect is the introduction of collaborative learning through student teamwork. This approach fosters team spirit by promoting cooperation among students. Collaborative learning not only helps in sharing learning resources but also stimulates students' creativity and teamwork. Through interactions with peers, students can better understand and apply the knowledge learned and appreciate the importance of teamwork.

In the implementation process, we focus on the individualized needs of students, encouraging independent learning and practice. While monitoring the students' learning processes, teachers adapt their teaching strategies flexibly to meet the diverse learning needs of students. This personalized attention motivates students to engage more actively in learning, thereby improving the quality and effectiveness of their educational experience.

4.2.4. Student-Centered Implementation Process

The entire implementation process is student-centered, aiming to cultivate students' abilities in independent learning, practical skills, and teamwork. By enabling students to autonomously utilize online learning resources, actively complete experimental tasks, and interact in collaborative learning groups, we strive to create a learning environment centered around the students. This setup better prepares them for future career development needs. This student-centered approach helps to ignite students' initiative and creativity in learning[5].

4.3. Student Participation and Feedback Analysis

Student engagement and feedback are critical indicators for assessing the effectiveness of blended teaching. Observations of student activity and participation on the online learning platform reveal that students are more actively and proactively engaged in the learning process. In laboratory practicals, students show higher interest in experiments and are more proactive in completing experimental tasks. Feedback surveys from students indicate widespread approval of the blended teaching approach, with many noting that this model is more aligned with practical engineering applications and makes learning more targeted. Additionally, students have offered suggestions such as increasing the diversity of online experiments and enhancing the interactivity of the teaching platform, providing valuable insights for future teaching improvements.

Through practical research and case analysis, blended teaching has been shown to effectively enhance student participation and experimental skills in university electronics experiments, providing robust support for innovation in experimental teaching methods. The positive engagement of students and their approval of the teaching model further validate the practical effects of blended teaching, offering valuable experiences and insights for future university teaching reforms.

5. Effectiveness Assessment and Future Development Recommendations

5.1. Teaching Effectiveness Assessment Indicators

5.1.1. Academic Performance Assessment

Academic performance is one of the important indicators for assessing the effectiveness of blended teaching. We conduct a quantitative assessment of students' knowledge acquisition by monitoring their regular homework and exam scores. This assessment covers not only the mastery of theoretical knowledge but also the application of practical operational skills. By evaluating academic performance, we can objectively determine the impact of blended teaching on students' academic achievements.

5.1.2. Experimental Performance Assessment

Experimental performance is another key indicator of the effectiveness of blended teaching. By evaluating experimental report grades and practical operational skills, we gain a comprehensive understanding of students' performance in experimental components. The assessment of experimental performance focuses not only on students' understanding of theoretical knowledge but also emphasizes their capabilities in practical operations. This helps in evaluating the effectiveness of blended teaching in cultivating students' practical skills.

5.1.3. Learning Attitude and Participation Survey

Learning attitude and participation are important subjective indicators that reflect the effectiveness of blended teaching. Through surveys and other methods, we obtain students' subjective feedback to understand their perceptions and attitudes towards the teaching model. This helps to identify the impact of blended teaching in stimulating students' interest in learning and enhancing their initiative. Surveys on learning attitude and participation provide crucial references for assessing the comprehensive effects of blended teaching.

5.2. Analysis of Student Academic Performance and Experimental Performance

5.2.1. Analysis of Student Academic Performance

Through the collection and analysis of teaching effectiveness assessment indicators, blended teaching has achieved significant improvements in student academic performance. The average grades of students in the blended teaching group have increased compared to those in the traditional teaching group, reflecting that blended teaching better meets students' learning needs and enhances their level of theoretical knowledge. The improvement in academic performance not only encompasses mastery of theoretical knowledge but also reflects progress in students' practical application skills.

5.2.2. Analysis of Experimental Performance

In terms of experimental performance, students under the blended teaching model have shown higher practical operational abilities and problem-solving capacities. Scores on experimental reports have also significantly increased compared to those in the traditional teaching group. This indicates that blended teaching effectively promotes the integration of theory and practice, enhancing students' application abilities in practical operations. Students under the framework of blended teaching better understand and apply the knowledge learned, further strengthening the practicality and effectiveness of the experimental components.

These analysis results emphasize the comprehensive enhancement of students' overall qualifications through blended teaching, providing robust data support for the further promotion and optimization of the blended teaching model in the future.

5.3. Suggestions for Improvement and Future Development Directions for Blended Teaching Models

Although blended teaching has achieved positive results in this study, we recognize that there is still room for improvement. To better meet students' learning needs and promote the enhancement of teaching quality, we propose the following suggestions for improvement and future development directions:

5.3.1. Optimize the Teaching Platform

Further optimizing the teaching platform is a priority for current improvements. Enhancing the platform's interactivity and user experience is crucial to ensure that students can more easily engage in online learning and experimental operations. Introducing more intuitive and user-friendly interface designs and strengthening the platform's ease of use can help increase students' acceptance of blended teaching.

5.3.2. Enrich Experimental Content

Adding more experimental scenarios and enriching the content of experiments are key to improvements. Considering the differentiated needs of students, introducing more experimental projects can meet the interests and depth of knowledge of students at different levels. This helps to stimulate students' enthusiasm for electronics technology and improve their practical operational abilities.

5.3.3. Exploration of Innovative Teaching Methods

In future development, further exploration of innovative teaching methods can be considered. For example, introducing virtual reality (VR) technology could provide students with a more immersive learning experience. Through virtual laboratories, students can perform practical operations in a safe environment, expanding their academic horizons and increasing the interest and effectiveness of experiments.

5.3.4. Introduction of Industry Collaboration Projects

Consider introducing collaborative projects with the industry to help students better understand the application of electronics technology in real engineering projects. By participating in actual projects, students will better comprehend the practical application of course knowledge, enhancing their professional competence and adaptability. Such cooperation also helps to build a bridge between schools and the industry, promoting the deep development of industry-academic collaboration[6].

Through these suggestions, we aim to continually refine the blended teaching model to make it more suitable for university electronics technology experimental teaching. The discussion of these improvement suggestions and future development directions will lay a more solid foundation for training more well-rounded professionals in electronics.

6. Conclusion

Through the implementation of a "blended" teaching reform for basic experiments in analog electronic technology based on a teaching platform in a university setting, this study confirms the positive effects of this teaching model in enhancing student learning experiences and cultivating experimental skills. However, further improvements are needed in the teaching platform, enrichment of online and offline resources, and a focus on flexibility and personalization to better adapt to the diversity of university teaching environments. This research provides a viable direction for reform in university electronic technology experimental teaching and has a positive significance in enhancing students' comprehensive qualities.

Acknowledgement

School-Level Middle-Aged and Young Teachers' Educational Reform Project (Number: SYJPZQ2024058); Sanya College Virtual Faculty Pilot Construction Project (SYJZXN202303).

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