

E-learning Teaching Design for Cultivating Electrical Engineering Talents Based on Industry-University-Research

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Abstract. With the advancement of technology and the updating of teaching models, the E-learning teaching model has been increasingly valued. This model has advantages such as convenience, personalization, quantification, and low cost, making it very suitable for the cultivation and education of applied talents. On the basis of analyzing the main problems in the current teaching of applied talents in electrical engineering, this paper summarizes the advantages of the E-learning model in the cultivation of applied talents, and conducts teaching design throughout the entire cycle from teaching objective analysis, teaching process design, teaching process implementation, teaching effect evaluation, and post evaluation. The method has universal applicability and can guide the talent cultivation work of related majors in similar universities.

1 Introduction

After the 1980s, emphasizing practical teaching and strengthening the cultivation of applied technical talents has become a new trend in the international higher education community. In March 2014, the Ministry of Education of China clarified the direction of education reform, with over 600 out of 1200 ordinary undergraduate colleges and universities in China gradually transitioning towards applied technology oriented universities. Applied technology undergraduate colleges refer to ordinary undergraduate colleges and universities that focus on the type of applied technology rather than academic education. These colleges and universities have played a positive role in meeting China's economic and social development, meeting the needs of high-level applied talents, and promoting the popularization of higher education in China^{[1]-[4]}. The industry-university-research cooperation education model is a key development model for application-oriented undergraduate colleges, especially in practical majors such as electrical engineering. It is a form of education that combines theoretical knowledge, practical ability, production experience, and scientific research practice. Under this educational form, expanding students' ability cultivation from traditional classrooms to extensive internet learning, with a greater emphasis on improving and cultivating practical application abilities, has become a trend and direction of current E-learning methods. This article combines the training characteristics of electrical engineering majors, fully considers the collaboration between industry, academia, and research. Starting from analyzing the weak links in classroom teaching and the advantages of E-learning learning methods in the current training of electrical engineering majors, it

comprehensively and systematically elaborates on the design of the E-learning learning system. This method is applicable to the cultivation of similar professional talents and has universal applicability and practicality^[5].

2 The main problems in the current teaching of applied talents in electrical engineering

Strengthening practical teaching has not yet formed a consistent and universal concept. The discipline of electrical engineering focuses on practice. Currently, the understanding of the cultivation mode of applied talents and the importance of strengthening practical teaching is still superficial, lacking a deep and qualitative understanding. Even though there is already a conceptual understanding, the phenomenon of waiting and watching is still universal due to factors such as conditions, environment, and foundation^[6].

High level teaching methods and methods are still lacking and outdated. For example, the shortage of multimedia teaching facilities cannot meet the needs of teachers in teaching environments such as case teaching and practical demonstrations, and limits their enthusiasm for educational reform. Many courses still remain based on traditional teaching models such as PPT and blackboard. The training simulation venue limits students' opportunities to develop more hands-on skills. The existing training facilities are far from meeting the needs of teaching practice.

The construction of off campus internship bases is weak and cannot effectively meet the needs of teaching practice. At present, there is a common phenomenon of being superficial in internship bases, which is attributed

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to the tendency of managers to pursue short-term maximum benefits after the current restructuring of Chinese enterprises, and on the other hand, it can also be attributed to the limited investment in funds, manpower, and emotions in this field.

3 The advantages of E-learning mode in cultivating applied talents

The main form of E-Learning is online learning or networked learning, which is a new learning method that allows students to access the internet through PC or mobile phones through internet platforms, mobile apps, and other means. In the online learning environment, a large amount of data, archival materials, programs, teaching software, interest discussion groups, news groups, and other learning resources are gathered, forming a highly integrated resource library that facilitates students' flexible learning, intuitive perception, and simulation exercises. Its advantages mainly include: 1)Networking of knowledge: Knowledge learning is not limited to basic textbooks and reference books, but rather to professional knowledge databases related to electrical engineering. With the support of the knowledge base, learning content can be recombined as needed, and new changes will occur in learning and research methods. 2)Autonomy in learning: The wide range of subject knowledge leads to heavy learning tasks for students, while students with different goal orientations also look forward to learning schedules and solutions that are suitable for their needs. E-learning can be freely conducted 24/7. Students are no longer constrained by the teaching schedule and can actively arrange according to their own learning time. 3)More timely update of knowledge system: Thanks to the advantages of internet technology, overall, various learning resources, including learning materials, can be continuously updated and are no longer limited to the limited resources available to teaching teachers. 4)The immediacy of learning: Traditional teaching methods require selecting books and textbooks, arranging teachers, and organizing exams, which undoubtedly require time to arrange. Adopting an

E-Training solution can shorten the preparation time to almost allowing everyone to work in real-time mode^{[6][7]}.

4. E-learning Teaching Design for Electrical Engineering Teaching

4.1 Guiding Principles and Ideas for Teaching Design

Electrical engineering is a discipline that studies and applies electricity, electronics, and electromagnetics, with characteristics such as interdisciplinary, high industry demand, advanced technology, and practical problem-solving. Considering the characteristics of electrical engineering and other disciplines, the guiding ideology of e-learning teaching design applicable to them should include the following principles: 1) It should be tailored to the learning needs of different students, fully considering the differences in teaching background, learning ability, understanding ability, and acceptance ability of students, and aiming at the same training objectives, achieving "individualized teaching" and "tailored learning". 2) Targeted towards cultivating solutions to practical problems. Teaching design should provide students with more thinking space, allowing them to have more exposure to problems, actively think about problems, turn students into proactive, cultivate independent learning ability and creative thinking to solve problems. 3) The guiding position of teachers should be more fully reflected. In the teaching process of E-Learning, students' learning is basically autonomous, which does not weaken the role of teachers. On the contrary, it is necessary to further strengthen and reflect the teaching guidance position of teachers, so that students have evidence to follow and rules to follow. Based on the above design ideas, the entire teaching process is designed according to the analysis of teaching objectives, design of teaching processes, implementation of teaching processes, evaluation of teaching effectiveness, and post evaluation. The flowchart is shown in Figure 1^[8].

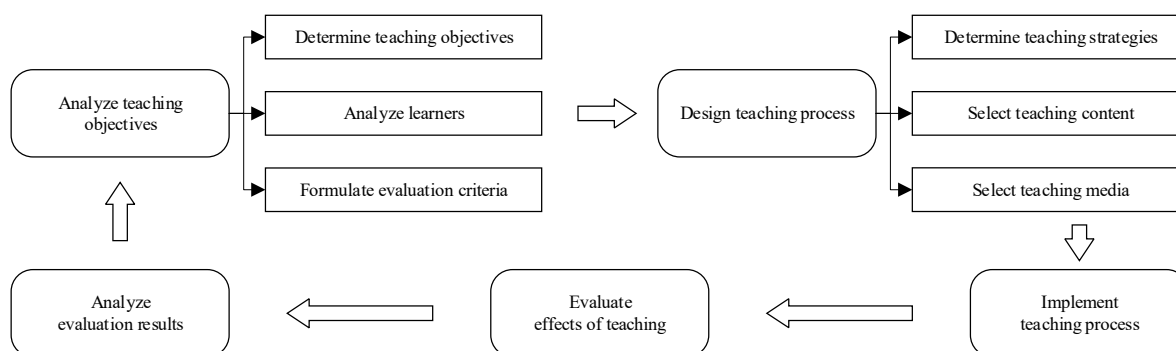


Figure1. E-Learning flowchart for Electrical Engineering

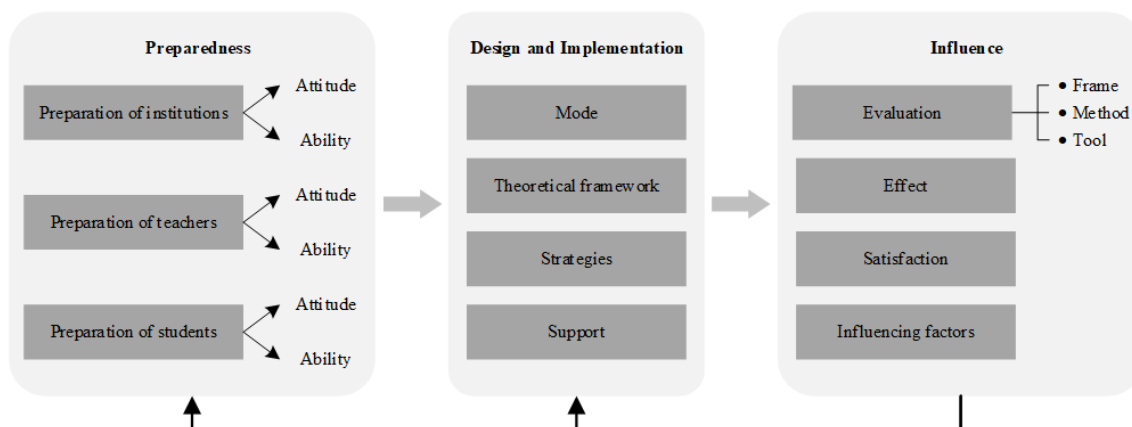


Figure 2. Teaching implementation system applicable to E-learning

4.2 Analysis and Design of Teaching Objectives Teaching Process

The analysis of teaching objectives mainly includes determining teaching objectives, analyzing learning objects, and formulating evaluation criteria. Based on a thorough analysis of students' characteristics, corresponding teaching objectives and strategies should be formulated, and the evaluation criteria for expected objectives should be clarified.

The design teaching process mainly includes determining teaching strategies, selecting teaching content, and selecting design teaching media. The starting point and destination of teaching strategy research are both for students' "learning", serving as a bridge connecting learning theory, teaching theory, and teaching practice. The selection of teaching content should not only reflect the relocation of traditional teaching materials, but also reflect the development of the discipline, showcase the future of the discipline, and form a tree structure of the entire teaching content. When choosing to design teaching media, it is necessary to introduce videos and animations appropriately in conjunction with the course, giving the content a distinct, rich, and strong sense of liveliness, presenting various ideas to students, and leaving enough room for them to think. The teaching implementation system applicable to E-learning is shown in Figure 2.

4.3 Teaching implementation process

The implementation of the teaching process mainly includes clarifying the teaching objectives, presenting the teaching content, strengthening learning guidance, and timely summarizing and summarizing. Clarify the teaching objectives through brief text or explanations, explaining the teaching objectives and basic learning requirements of the course and each unit, clarifying the knowledge and skills to be learned, as well as the level of learning, and stimulating students' desire to learn. Presenting teaching content is done through careful design and organization to avoid obstructed interpersonal communication caused by the internet, and to maximize the dissemination of teaching content suitable for e-

learning to students. Strengthening the guidance of learning methods should teach students the methods of analyzing and solving problems, in order to improve their self-learning ability. The purpose of timely induction and summary is to promote and strengthen students' enthusiasm for learning, and at the same time, set up some "feedback points" reasonably at different stages of e-learning, and check through necessary homework and other forms to grasp students' learning situation. The homework management process applicable to E-learning is shown in Figure 3.

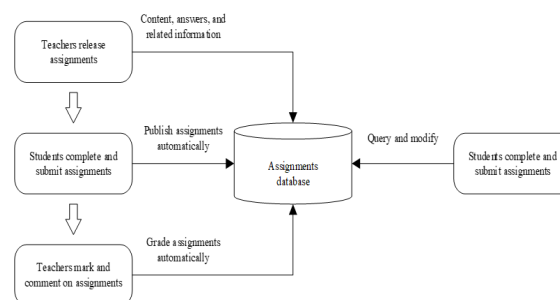


Figure 3. Homework management process to E-learning

4.4 Teaching effectiveness evaluation and analysis evaluation improvement

Whether the evaluation of teaching effectiveness is objective, scientific, and accurate is of great significance in teaching work, and is the basic recognition of the effectiveness of teaching models. From the common "teaching effectiveness evaluation standards", comprehensive evaluation is mainly carried out in terms of teaching objectives, teaching content, teacher behavior evaluation, student behavior evaluation, and other aspects. The E-learning model has natural advantages in evaluating teaching effectiveness. The powerful information storage and processing capabilities of computers and information networks can provide objective and comprehensive assessments for the entire teaching process, which greatly reduces the complexity and subjectivity of assessments and brings convenience to improving the teaching process and effectiveness. A teaching effectiveness evaluation system suitable for E-learning is shown in Figure 4.

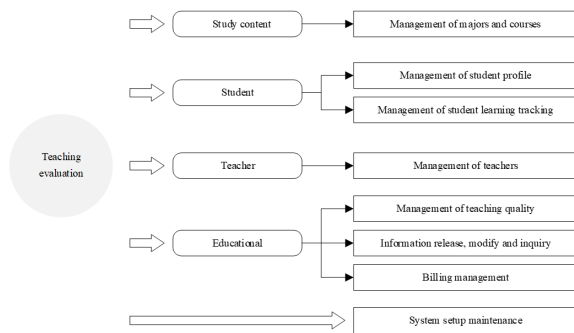


Figure 4. Teaching evaluation system suitable for E-learning

Analysis, evaluation, and improvement are the end of one teaching cycle and the basis for improvement and correction in the next teaching cycle. Through the basic data and behavioral analysis generated in interactive activities, teachers can have a clear understanding of students' learning process, improve teaching methods and means, and be able to teach students according to their aptitude. Students can also summarize their shortcomings in the learning process through the statistics of the above data for improvement.

5. Conclusion

Compared to traditional teaching, the E-learning platform allows anyone to learn freely at any time, anywhere, and is more flexible, adaptable, and open. It is an interactive and promoting learning method. E-learning has advantages such as convenience, personalization, quantification, and low cost, and its range of use is constantly expanding. It can be foreseen that with the continuous improvement of computer and network technology, e-learning will continue to achieve growth. From a practical perspective, further highlighting the subjectivity of students and the leading role of teachers, fully leveraging the overall advantages of the E-learning teaching system, and promoting comprehensive optimization of course design will become the future development direction of E-LEARNING. Combining the integration of industry, academia, and research, while fully considering the characteristics of electrical engineering disciplines, fully valuing the application of e-learning mode, and also selecting appropriate e-learning technologies and platforms based on the professional needs.

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