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Practical Analysis of Engineering Education in Electrical Engineering under the New Engineering Education Reform

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Abstract: *Electrical engineering education focuses on cultivating versatile talents with both theoretical capabilities and practical skills. Under the new engineering education paradigm, its objectives have been further refined, which also necessitates enhanced educational practices. This paper takes the objectives of electrical engineering education in the context of new engineering disciplines as a starting point, explores current challenges in the field, and concludes by discussing practical approaches to electrical engineering education under this paradigm. These approaches include breaking down disciplinary barriers, optimizing practical methods, and strengthening faculty resources, thereby addressing existing issues and supporting the development of long-term educational management mechanisms.*

Keywords: *New Engineering Education; Electrical Engineering; Educational Practice; Disciplinary Barriers*

1. Preface

Compared with traditional engineering, new engineering focuses on cultivating engineering talents for emerging industries in combination with social development needs and actual changes, including industries and fields with Internet and industrial intelligence as the core, and attaches importance to cultivating talents to understand and master big data, cloud computing, artificial intelligence, blockchain, virtual reality technology and principles, which provides new ideas for electrical engineering education [1].After the announcement of the first batch of "New Engineering" research and practice projects by the General Office of the Ministry of Education in 2018, the work of new engineering education received further attention and guidance at the directional level. In this context, studying the practical issues and methods of electrical engineering education in the context of new engineering disciplines has certain positive value.

2. Objectives of Electrical Engineering Education under the Background of New Engineering

2.1 Ensuring Basic Abilities

Under the background of the new engineering discipline, the direct goal of electrical engineering education is to ensure students' basic abilities, that is, to attach great importance to general theory and practical guidance, so that students can learn to the fullest during their school years and improve their comprehensive literacy, including ideological and moral values, legal awareness, professional ethics, etc. If electrical engineering is related to the design of electrical systems in buildings, it should be combined with the development needs and construction goals of intelligent buildings in the new work context, cultivate students' mastery of electrical design principles and methods, as well as the changes in electrical system design under the characteristics of intelligent buildings, from technology to safety, from theory to practice, to ensure that students' basic abilities are consolidated and solidified.

2.2 Matching New Engineering Characteristics

There are significant differences between new engineering and traditional engineering, with a greater emphasis on capturing social changes, especially the development and application of various modern technologies. This requires that in the process of organizing electrical engineering education,

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the characteristics of new engineering should be matched to enhance educational coverage. Such as big data technology, which focuses on collecting massive amounts of raw information to serve pattern mining, schools can teach students to understand the characteristics and application methods of big data technology. In the future, students can use big data to provide assistance in organizing electrical engineering design, problem analysis, and safety hazard investigation, reducing the energy and resource consumption of personal repetitive data analysis and scheme adjustment, and improving work efficiency and quality.

2.3 Optimizing Thinking Modes

The development of electrical engineering has a certain degree of dynamism, which is related to factors such as changes in social demand, technological development, and sharing, and is also one of the main backgrounds for the proposal of new engineering disciplines. Therefore, when organizing electrical engineering education, it is also necessary to try to optimize thinking, including university education thinking and student learning thinking. For college students, in addition to their regular learning of basic knowledge, they should also master entrepreneurial skills and enhance their innovation awareness. They should actively explore topics such as big data, cloud computing, and intelligent technology to improve their personal abilities and comprehensive literacy, in order to match the increasingly severe employment situation and take the initiative in competition and development[2].

3. Practical issues in electrical engineering education under the background of new engineering disciplines

3.1 Knowledge is Separated from Each Other

Under the background of new engineering disciplines, there are still shortcomings in the practical education of electrical engineering majors in some universities, and there is a situation where knowledge is fragmented. Under the conventional education model, universities can proficiently provide students with knowledge related to electrical engineering. In the context of new engineering disciplines, in addition to basic knowledge related to electrical engineering, students need to simultaneously absorb knowledge related to big data, cloud computing, and intelligent technology. This requires universities to organize relevant knowledge, increase the total amount of knowledge, and enrich its categories. Some universities' work methods are not perfect enough, and the integration of different knowledge is not high or relatively rigid, making it difficult for students to learn. If cloud computing content is integrated into the process of organizing electrical design teaching, but a suitable integration point is not selected for the intrinsic relationship between the two, students' thinking cannot be quickly adjusted, and the absorption effect of knowledge is also affected, which cannot reach the ideal level.

3.2 Lagging Practice Methods

The lag in practical methods refers to the failure of some schools to manage practical aspects when organizing electrical engineering education, resulting in limited practical space and insufficient equipment that cannot match the growth needs of students. Some universities have established training bases that can meet the general practical needs of electrical engineering majors, but the bases have not been updated for a long time, which cannot match the needs of new engineering construction and education, and students' practical achievements are not rich enough. Some universities also have a relatively short period of practical education, and students still have a great interest in new engineering knowledge and electrical engineering content, but cannot be satisfied in the process of practical learning. Some practical doubts cannot be resolved, which is not conducive to students' growth and development.

3.3 Weakness of teaching staff

From a macro perspective, the duration of electrical engineering education has been relatively long, but the introduction of new engineering disciplines has been relatively short. This has led to a shortage of electrical engineering education talents under the background of new engineering disciplines, which cannot match the specific needs of students' learning and professional development. Some universities

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have been offering electrical majors for a long time and have rich work experience. Teachers are accustomed to using traditional methods and thinking to teach, and the changes and requirements brought by the new engineering disciplines cannot receive sufficient attention or be fully put into practice. Some universities also have limited work experience, short construction time, and overall weak faculty. Even if the impact of new engineering disciplines is taken seriously, the school has not been able to quickly organize faculty team building according to their needs, resulting in students being unable to grow with high quality.

3.4 Lack of Scalability

Lack of scalability refers to the failure of some universities to consider the long-term nature of electrical engineering teaching in the context of new engineering disciplines, concentrating teaching work in the classroom and campus. Students cannot continue to receive professional guidance during holidays, internships, or after school, and their growth quality cannot meet expectations. Some universities believe that higher education is different from primary and secondary education, as it focuses more on students' initiative in learning and does not require schools to provide additional teaching outside of the classroom. Some universities have also built digital resource pools on campus, which can serve students' after-school and holiday learning. However, the content of the resource pool is limited and updated slowly, which cannot match the characteristics of new engineering disciplines. Students may not be able to obtain the necessary knowledge through the resource pool, and the extension of teaching is still relatively limited.

3.5 Single assessment method

The single assessment method is one of the common problems in electrical engineering education under the background of new engineering disciplines. It refers to the inadequate assessment methods adopted by universities, which cannot accurately understand students' learning trends, and students cannot analyze their personal learning deficiencies based on this, affecting their subsequent growth. Some universities still use the traditional credit and paper assessment model, which can evaluate students' daily performance and theoretical level, but cannot be used to evaluate their practical ability. Considering the high practical requirements of electrical engineering in the context of new engineering disciplines, only conducting paper and daily assessments may lead to biased results. Some universities also focus on analyzing students' practical abilities, but the selection methods are not appropriate enough, using simple problem-solving and on-site operations for skill assessment. The knowledge capacity within the assessment methods is limited and insufficient to deeply reflect students' abilities.

4. Practical methods of electrical engineering education under the background of new engineering disciplines

4.1 Breaking down disciplinary barriers

In the context of future new engineering disciplines, electrical engineering education should pay attention to the synchronization of different knowledge, advocate breaking down disciplinary barriers, and select appropriate ways to integrate multiple knowledge. Optional methods include project-based teaching, micro lesson mode, etc.

Taking project-based teaching as an example, universities can combine several related knowledge into one learning project based on the goals of new engineering disciplines, requiring students to complete their studies within a certain period of time. During this process, teachers only provide limited guidance and do not interfere with students' specific learning processes. When learning electrical safety knowledge, students can be required to design intelligent circuit breakers and provide design ideas and drawings. If conditions permit, computer simulation experiments should be conducted to demonstrate the feasibility of the project. This project includes four categories of knowledge, namely basic knowledge related to electrical engineering, intelligent technology knowledge, computer operation and application knowledge, and practical skills. During the project-based learning process, students perceive, interact with, and apply four types of knowledge through different channels and methods, and unconsciously complete their thinking and mastery. Due to the integration of the project, the problem of knowledge fragmentation is controlled, and students can gradually complete their learning under the guidance of project issues, which helps to control disciplinary barriers and also meets the goal of cultivating new engineering talents, serving the high-quality growth of students[3].

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4.2 Optimizing Practice Methods

The lack of practical experience directly restricts the growth of electrical engineering students and is not conducive to the school's implementation of the new engineering talent cultivation strategy. The main suggestions for the future are to seek breakthroughs from two aspects. One is to optimize the construction of training bases, and the other is to introduce virtual practice mechanisms.

In terms of the construction of practical training bases, universities with existing training bases can initiate an update plan, focusing on optimizing according to the goals of new engineering construction and talent cultivation, such as adding more intelligent devices, information tools, etc. Universities that have not yet established practical training bases can organize their construction according to the requirements of new engineering disciplines. Considering the limited funding and scale of some universities, a regional cooperation model can be adopted. Several universities that offer electrical majors can cooperate to build large and medium-sized practical training bases to meet the practical learning needs of relevant university students. In the field of electrical engineering, some practical content carries certain risks, and equipment prices are high and consumables are expensive. In order to control costs, improve the safety, universality, and repeatability of practical teaching, universities can also use information technology to build virtual practice models. Complex practical content can be divided into several models and provided to students step by step. Virtual technology can be used to enhance practical coverage. After students' abilities are significantly improved, offline practical operations can be organized to improve the rationality of resource allocation and application[4].

4.3 Strengthening the teaching staff

The teaching staff directly affects the level of electrical engineering education under the background of new engineering disciplines. In the future, it is recommended that universities strengthen their teaching staff from two perspectives according to work needs: internal exploration and training, optimization of team management, and optimization of recruitment.

Each university can collect information on the situation and general information of teachers, select personnel who can meet the teaching needs of electrical engineering under the background of new engineering as candidates, and with the informed consent of relevant personnel, carry out strengthened training, such as the application of intelligent electrical technology, the development of electrical technology, the latest technological trends, market employment needs, etc., to further enhance their abilities, and then transfer personnel to electrical teaching positions to participate in work. In terms of team management, emphasis should be placed on load control to avoid excessive work pressure for teachers, and teachers should be encouraged to actively apply for training related to electrical engineering. Universities can simultaneously strengthen the management of young and middle-aged teachers, gradually increasing the amount of tasks they undertake in academic affairs and frontline teaching work. For elderly teachers with rigid thinking and insufficient abilities, their work content should be appropriately adjusted to gradually detach them from frontline teaching positions. In terms of recruitment, universities should set new recruitment thresholds, requiring teachers to master the general skills and theories of electrical engineering, familiarize themselves with the changes brought by new engineering disciplines, project-based teaching models, etc., and enrich their teaching teams to enhance their professional strength.

4.4 Improving Scalability

Considering the rapid changes in electrical engineering under the background of new engineering disciplines, on the basis of regular campus education and classroom guidance, universities should also strive to improve the extensibility of teaching work, advocate strengthening the construction of network databases, and replace traditional teaching methods with mutual aid group models.

In terms of database construction, universities should regularly collect knowledge related to electrical engineering and independently build databases. On this basis, universities should also select staff to collect real-time information on the dynamics of the employment market, technological changes, etc., and the results obtained from the collection should be entered into the database in a standardized form. The results obtained from the collection should be entered into the database in a standardized form. Similar methods can be used to improve the richness of resources in the database, such as the current employment trends in electrical engineering at home and abroad, the integration and development of intelligent technology and conventional electrical engineering, and the characteristics

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of the job market. The database is open in real time, allowing teachers and students to access and download relevant content at any time to match students' learning and comprehensive growth needs. The mutual aid group model emphasizes the analysis of students' learning characteristics, dividing them into several categories such as strong theoretical ability, strong practical ability, and strong organizational ability. Students are mixed with ordinary students and grouped together to learn in small groups, each leveraging their strengths to drive group members to learn, share learning experiences in electrical engineering design, practical operation, and other aspects, improve students' growth efficiency, and make learning no longer limited to the classroom, but naturally extend to after class and holidays.

4.5 Improving assessment methods

The assessment of electrical engineering should also seek improvement by adding more assessment content and changing the assessment format in accordance with the requirements of the new engineering discipline, with the focus on increasing the proportion of practical modules.

In practical work, universities can retain the final exam mode and daily credit accumulation mode, and improve the assessment content based on new engineering disciplines, such as adding knowledge related to big data, cloud computing, and information technology, to evaluate students' comprehensive abilities. In terms of assessment format, it is advocated to adopt a parallel approach of virtual practice and offline practice, providing students with several optional questions. Students can participate in the assessment in groups and complete complex electrical engineering assessment projects, such as troubleshooting and building electrical system design. They can also participate in the assessment as individuals and complete relatively simple assessment projects, including circuit connections, small-scale electrical design, etc. In terms of handling assessment results, the weight ratio of practical module scores can be adjusted. The cultivation of practical talents in electrical engineering under the background of new engineering disciplines has received more attention, and the weight of practical assessment scores can be increased to 60%. The weight of scores for both paper assessment and daily credit accumulation modules is 20%. After superposition, the total score of students can be obtained as the basis for subsequent management.

5. Conclusion

In summary, under the background of new engineering disciplines, electrical engineering education should seek innovation to match the requirements of new engineering disciplines and promote students' comprehensive growth. From the current situation, some universities have not clearly recognized the requirements and impacts of the new engineering disciplines, and their electrical engineering education work is not perfect enough. There are problems such as knowledge fragmentation, lagging practical methods, and incomplete assessment methods. To cope with this, it is recommended to try to break down disciplinary barriers and adjust practical methods in actual work. At the same time, adjustments should be made from the perspectives of teacher team management and teaching method extension. Finally, the assessment method should be optimized to comprehensively address the current deficiencies in electrical engineering education and provide more support for student growth and discipline construction.

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