Thoughts on the Teaching of Electrical Courses in the Mechanical Engineering Major Based on Capability Orientation

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Abstract. Ability generation reflects the effectiveness of teaching. Based on ability oriented teaching design, it can be based on job situations, focus on practicality, and help solve some of the problems currently existing in classroom teaching. Taking electrical courses as the object, the ability oriented teaching system is applied to demonstrate the correlation system between courses. Combined with the teaching objectives of the courses, the design of teaching content and the application of teaching methods are explored and considered, forming a ability oriented teaching mode for the maintenance position.

Keywords: ability oriented, Electrical courses, Project Teaching

1 Introduction

Ability oriented teaching requires educators to put students at the center and comprehensively improve their abilities, rather than just training them in knowledge and skills. Meanwhile, ability is dynamic and constantly growing and changing, and can be improved through experience and guidance[1].

Electrical courses are one of the more important and closely interconnected courses in the field of mechanical engineering. The teaching method is convey knowledge points to students through lectures and measuring students' mastery of theoretical knowledge through knowledge point exams[2]. This teaching method has many problems. The knowledge learned by students cannot be effectively applied in their work, and the various abilities required for work appear insufficient. The maintenance position emphasizes practical application, and electrical courses not only impart theoretical knowledge, but also cultivate analytical skills, self-learning and lifelong learning abilities, and adaptability to job development in electrical engineering problems.

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2 Ability Oriented Curriculum Design Method

2.1 Classification and Connotation of Work Ability

Chinese scholar Xu Guoqing believes that[3] work ability is composed of professional ability, methodological ability, and social ability. Professional competence is directly related to the profession and has occupational specificity; Methodological and social abilities have occupational universality and are not unique to any particular profession, and can be widely transferred between different professions[4]. Work abilities include professional skills, methodological skills, and social skills. Professional competence refers to the enthusiasm and ability to independently complete tasks, solve problems, and evaluate results based on professional knowledge and skills, purposefully and in accordance with professional requirements, using certain methods. Professional competence is directly related to the profession, has vocational specificity, and is obtained through professional education. Methodological ability refers to an individual's ability and desire to interpret, think, judge, and develop their intelligence and design development paths in response to opportunities, requirements, and limitations in work and life. It specifically refers to the ability to learn independently and acquire new knowledge, such as decision-making ability and self-learning ability. Social competence refers to the ability to handle social relationships, understand risks and contradictions, and interact with others in a responsible and friendly manner, including interpersonal communication, public relations management, labor organization, group consciousness, and social responsibility.

2.2 Curriculum System Design Steps Guided by Work Ability

By analyzing the work system, establish its corresponding relationship with the teaching system, and design the course structure by analyzing the structure of work stratification, classification, segmentation, serialization, etc; By extracting and refining typical work tasks, specific content for vocational education courses is formed; By deconstructing vocational standards, including qualification standards, constructing teaching standards for vocational education, and forming a vocational education curriculum design system based on typical work tasks[5]. The specific path description is shown in Figure 1.

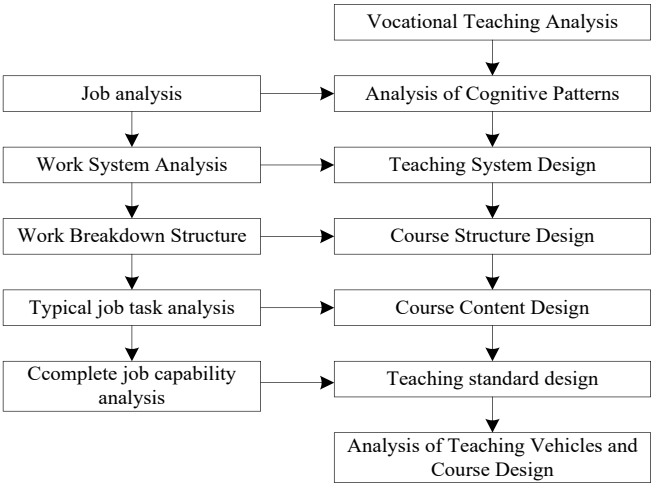

Fig. 1. Systematic analysis of course design based on work ability

3 Problems in the Teaching of Electrical Courses

3.1 There is a Disconnect Between Theoretical Teaching and Practical Application, Resulting in Poor Teaching Effectiveness

Electrical courses are highly interdisciplinary and comprehensive courses. It involves knowledge of mechanical hydraulics, pneumatics, motors, sensors, control circuits, and other related knowledge. However, traditional teaching methods are single.The phenomenon of storing theoretical knowledge in textbooks without reflecting it in the mind or mapping it to the hands results in poor teaching effectiveness. Through course learning, students cannot achieve true growth in their abilities, only a simple accumulation of knowledge[6]. Although the proportion of practical courses for non commissioned officers is high, the phenomenon of a disconnect between practice and theory is becoming increasingly evident, and the boundary between in class practice and comprehensive practice is becoming increasingly blurred.

3.2 Lack of Case Design and Knowledge Domain Design, Leading to Repetition in Teaching

In the actual teaching process of electrical courses, there is a focus on understanding knowledge and neglecting case-based discussion teaching, resulting in low student participation and difficulty in deepening the course implementation. Electrical courses have strong practicality and are related to real-life and work-related cases[7]. The design of typical work case materials and discussions can enable students to have a sensory understanding of theoretical knowledge in classroom teaching, fully mobilize their enthusiasm, and enhance their interest points. At the same time, due to the wide range

of courses and the involvement of theoretical knowledge in various fields, such as motors and power supply, there are specialized course materials available. There is a correlation between various subjects, and some students have found that some knowledge points have been learned in previous courses during the course learning process, ignoring the differences in the content taught by the instructor and losing interest in learning. In fact, the courses we previously studied were more focused on the research of theoretical knowledge, while the electrical courses we are engaged in for the mechanical engineering major are more focused on practical application.

4 Exploration of Ability oriented Teaching Methods in Electrical Courses

4.1 Guided by Job Competency, Universities and Military Units Jointly Determine Competency Development Projects

The electrical knowledge taught in the course and the professional skills cultivated must face the students' mechanical positions. Transform the course structure through projects to form project tasks that correspond to the course content. In the teaching process, students are the main body, teachers are the leader, project tasks are the center, real projects are used as carriers, and learning is achieved through "work", that is, the content of learning is work, reflecting the idea of "teaching, learning, and training in one". Using inspiring methods to guide students to independently explore, analyze, and solve problems through logical thinking. According to the training objectives of electrical courses, the course positioning is based on the requirements of the work process, and the teaching process is designed with the specific job positions involved as the carrier. Understand the entire process of working in electrical related positions, reflect on the curriculum arrangement in traditional teaching processes according to the ideas of the work process, and re select, organize, and design new teaching content.

The electrical courses for the maintenance position are mainly aimed at students majoring in comprehensive avionics. Through questionnaires and surveys with relevant personnel in the military, it was found that the maintenance position has a clear direction, with typical tasks including daily maintenance of power supply equipment and lines, maintenance of electrical signal lines, inspection of the working condition of electromechanical cross-linking equipment, and identification and elimination of electrical faults. During the work process, it will demonstrate a serious and responsible, accurate and meticulous maintenance style (attitude and ability), and the ability to deepen layer by layer. The curriculum can start with motor courses, connect with courses on power supply or power supply, and ultimately focus on electrical control courses for design. Taking the electrical control equipment course as an example, the implementation of specific courses can take the inspection of electrical system work in mechanical work as the learning goal for students, designing three types of work: disassembly and assembly of electrical equipment, inspection of electrical system circuits, and troubleshooting of electrical systems. Each electrical system can be decomposed into these three working processes, in which problem orientation is integrated to solve knowledge

output and skill output by setting questions, answering and finding answers to problems. As shown in Figure 2.

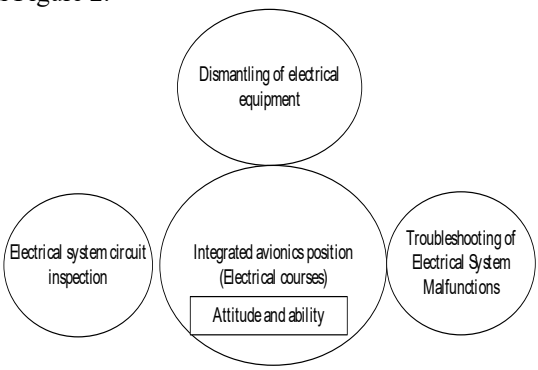

Fig. 2. Disassembly of the working process of the electrical course in the mechanical engineering major

4.2 Widely Utilize Online Information Resources

The application of network technology in the field of teaching is becoming increasingly perfect, and extracurricular resources are abundant. We can use modern intelligent network technology to set up a large model platform based on the campus network. By utilizing artificial intelligence technology, we can integrate network platform resources such as online courses, teaching videos, and generative educational resources, making it convenient for students to learn independently. With the assistance of artificial intelligence, network resources are no longer discrete knowledge points, but can form a knowledge graph that adapts to learners' thinking patterns. By truly utilizing network resources and supplementing the insufficient resources in class, students' learning is no longer limited by space, and they can engage in self-directed learning at any time and place.

4.3 Introducing the "Situation+Discussion" Teaching Method into the Classroom

Ability grows and develops through specific work, requiring the creation of realistic teaching scenarios and cultivation within those contexts. Therefore, contextualization of teaching is a fundamental factor in cultivating abilities. To make ability oriented teaching play a practical role in teaching, it is necessary to create teaching contexts that can cultivate students' abilities. The work process that is close to reality or the actual life of students can inspire them the most, stimulate their senses and past experiences. Therefore, it is necessary to select suitable materials for the maintenance environment and manually create scenarios for certain types of maintenance work, such as the dismantling and installation of generators during regular maintenance work, and emergency troubleshooting in case of power failures. In the specific process of creating sit-

uations, we can start from two aspects: first, providing resources and elements for learning and use; The second is to design comprehensive scenarios for specific learning activities. No matter which way you create a situation, the most important thing is to be close to real work. The ability of students determines where they place the center of their learning. Based on the knowledge mastered by students and the designed learning context, students can realize the importance of their learning. We should always attach importance to the role of situational teaching, because the knowledge learned in the classroom can only be connected to knowledge from practical life experience through specific contexts. In other words, without context, there is no ability. To convey knowledge in a context and use it in a way that is close to the real situation, on the one hand, without knowledge reserves, it is impossible to cultivate abilities; On the other hand, without suitable situations that can enhance one's abilities, knowledge is also difficult to accumulate. No one can escape from a situation, people are always in one situation or another.

At the same time as creating a situation, there will inevitably be conflicts between the knowledge system and the situation, and the conflict point is often a bottleneck for the extension of theory to practice. So it is necessary to clarify the problem here and guide students to engage in sufficient discussion, using the principles learned to analyze various hypotheses during the discussion. Teachers should provide sufficient guidance, not only to give full play to students' thematic status and initiative, but also to ensure that the discussion does not deviate from the theme and can directly address the core of the problem. The final course will be organized and carried out in seven steps: situational introduction, highlighting problems, guiding analysis, drawing conclusions, applying theories, summarizing abilities, and evaluating new questions.

4.4 Ability Oriented Assessment Mechanism

The final assessment methods for electrical courses are mostly in written form and closed book exams. The exam format is single, and some students cannot understand the theoretical knowledge they have learned, relying solely on rote memorization.

In response to this situation, the curriculum evaluation system integrates ability orientation, gradually guiding students to form habits and generate learning abilities. Assessment consists of three parts: process assessment, theoretical assessment, and project practice. It can assess students' learning attitude and knowledge, as well as their skills and proficiency; Assessment is project driven and adopts various forms of modular assessment; Pay attention to the learning process, conduct comprehensive evaluations based on multiple subjects and proportions. For example, the assessment and evaluation of the working process design project for starting a generator can be divided into two aspects: professional ability and quality ability. Professional ability includes the design and use of electrical schematics, hardware disassembly and debugging, and technical document writing; In terms of quality and ability, it includes teamwork spirit, adherence to time, safety awareness, and personal expression.

At the same time, the scoring rules should not only describe the standards of "behavioral performance", but also depict various levels of performance from low to high, and set scoring levels. The classification of levels should not only be based on the core

scoring elements, but also follow a "holistic approach", so it is necessary to adopt practical scoring rule types. It should be emphasized that the grading level has domain specificity, and the overall learning level of students in different external environments, courses, and levels of classes varies, resulting in different grading levels.

5 Conclusion

The ability oriented teaching reform of electrical courses is an artistic work. After fully considering the situation where some students are not interested in learning, avoid or give up professional theoretical courses, and most students lack self-control, we propose the ability oriented teaching method, which is specifically carried out in the form of project-based teaching, situational teaching, role-playing discussion, task-based teaching, etc., to enhance students' learning interest and build a bridge between theory and practice.Developing students' vocational skills, comprehensive abilities, and competitiveness have been strengthened. The teaching effect has significantly improved.

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