The Construction and Practice of Power Grid Planning Curriculum Training System

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Abstract. This article explores the construction and practice of an electric grid planning course training system. By analyzing the current development needs and challenges in the field of electric grid planning, an innovative training system framework has been proposed. The framework covers clarifying training goals and content, innovating training methods and methods, improving training evaluation mechanisms, strengthening faculty construction, optimizing resource library construction, strengthening practical links, and promoting international exchanges and cooperation. Through empirical analysis and case studies, the effectiveness and practicality of the training system have been verified.

Keywords: Power grid planning; Course training system; Blended Learning Model

1 Introduction

1.1 Research Background

With the rapid changes in the global energy transition and electricity market, grid planning is facing unprecedented challenges and opportunities[1]. The traditional methods of power grid planning are no longer able to meet the demands of new technologies and applications[2]. Therefore, it is particularly important to cultivate professionals in power grid planning with advanced knowledge and skills. This article aims to construct an innovative training system for power grid planning courses to address these challenges.

1.2 The Necessity of Constructing a Power Grid Planning Course Training System

With the development of social economy and the continuous growth of electricity demand, the scale and complexity of the power grid are also increasing[3]. This requires power grid planners not only to master basic professional knowledge, but also to have the ability to respond to new technologies and challenges. In addition, power grid planning is a comprehensive work involving multiple disciplines and fields, re-

J. Yin et al. (eds.), *Proceedings of the 4th International Conference on New Media Development and Modernized Education (NMDME 2024)*, Advances in Intelligent Systems Research 188,
https://doi.org/10.2991/978-94-6463-600-0_25

quiring a large number of talents with professional knowledge and practical experience. However, the current course training system for power grid planning is not yet perfect, lacking specificity and practicality, which to some extent restricts the cultivation of power grid planning talents and the improvement of power grid planning quality. Therefore, it is particularly urgent to establish a scientific and systematic training system for power grid planning courses.

2 The Current Status and Problems of Grid Planning Course Training System

2.1 The Course Content is Disconnected from the Job Requiremen

For the power grid planning course, the course content should be a reproduction of actual work scenarios, with strong practicality, foresight, and practicality. Currently, the supply and demand of the power grid are changing rapidly, new technologies and equipment are being promoted rapidly, and the course development is not updated in a timely manner. The limited level of developers and the lack of specialized training simulation systems are various constraints, and the training projects are generally lagging behind the work site, resulting in a disconnect between the course content and job requirements.

2.2 Single Teaching Mode and Lack of Teaching Resources

Currently, training is mainly conducted through theoretical lectures and case analysis, lacking interactivity and specificity, which is not conducive to students' active learning and deep thinking. Moreover, the training materials are single, mainly including courseware, teaching materials and technical standards, which can not meet the learning preferences of learners in the new era and can not meet the needs of Internet teaching in the new era. Construction Approaches for the Power Grid Planning Course Training System

2.3 The Course Evaluation System is Not Perfect

The current training often adopts an evaluation system that combines theoretical exams with daily performance, neglecting aspects such as learning attitude, attendance, and innovation during the training process, making it difficult to fully reflect learning outcomes.

3 Reform Ideas for the Training System of Power Grid Planning Courses

Adhering to the concept of "practical education", by integrating ideological and political education with professional and technical education, we aim to cultivate students' sense of professional identity and craftsmanship spirit[4]. Utilize the advantages of enterprise education to build a dynamic teaching team composed of industry experts and full-time teachers, jointly design and implement course content, and ensure that teaching content closely follows the forefront of industry development and technological innovation[5]. Our core goal is to enhance students' practical operation and problem-solving abilities, and establish a training mode based on real work environments, allowing students to learn and practice in simulated or actual work scenarios[6]. At the same time, develop diverse teaching resources, including digital textbooks, virtual simulation systems, and modern training facilities, to support this learning approach based on real work situations. We will also explore a diversified evaluation system that not only focuses on students' knowledge mastery, but also places more emphasis on evaluating their practical operational ability, innovation ability, and teamwork spirit, in order to comprehensively and multi dimensionally evaluate and promote students' comprehensive professional competence[7]. Through these reform measures, it is expected to cultivate power planning talents who possess both solid professional knowledge and high practical abilities.

3.1 Clearly Define Training Objectives

Power grid planning is a core course in the field of power grid development and economic research. Due to the numerous knowledge points involved in power grid planning, including national energy strategies, company policies, basic knowledge of electricity, CAD software operation, etc., the course focuses on enhancing the professional knowledge, skills, and innovation abilities of planners in order to adapt to the new requirements of power grid development. On the basis of traditional training objectives, we promote ideological and political education by combining knowledge imparting, skill practice, and ideological and political education. We have formulated quality goals to cultivate students' qualities such as dedication to their work, teamwork, and excellence.

3.2 Refactoring the Curriculum System

The ability construction theory in constructivist theory [8] has developed 10 teaching work scenarios based on enterprise job standards, including main network planning, distribution network planning, communication planning, intelligent planning, energy policy interpretation, new technology application, and basic knowledge of electricity. Based on the complexity of each work scenario, tasks are subdivided to achieve a close connection between course content and actual job requirements.

3.3 Innovative Training Methods and Approaches

The workflow of power grid planning is cumbersome and involves a large amount of calculations. Traditional training often adopts theoretical lectures and case analysis, which cannot achieve good training results. In order to improve the training effectiveness, it is necessary to innovate the training mode of the planned courses, and develop a blended learning mode targeted at the learning preferences of students in the new era. Based on the task of curriculum restructuring, combined with the core skills of the position, refine the key points of the task, personalize the design of each course, and organically integrate teaching methods such as role-playing and flipped classroom to enhance classroom interaction. Taking the main grid planning as an example, a task driven teaching method can be used throughout the entire course, and role-playing can be used to present steps such as power grid status analysis, load forecasting, power balance, and grid planning, enhancing classroom fun. At difficult skill points, the teacher can demonstrate the operation first, and the students can practice in groups until they fully master the work task. In the process of implementing the course, each teaching task is also designed with pre class preview, simulation system operation, and post class consolidation and expansion, fully mobilizing students' enthusiasm for extracurricular learning and enhancing teaching effectiveness. At the same time, with the help of the college learning platform, the learning level of students can be analyzed, and intelligent push and expansion of learning resources can be provided to students who have spare capacity, while consolidation of learning resources can be provided to students who have insufficient learning, achieving comprehensive training.

3.4 Optimizing Resource Library Construction

Building a comprehensive and dynamically updated resource library is crucial for the training system of power grid planning courses[9]. Based on the characteristics of the power grid planning profession, organize a list of resource libraries, covering the latest industry reports, case studies, software tools, new technology applications, and other aspects. The forms include videos, homework guides, courseware, animations, etc., and organize a course team of full-time and part-time teachers to jointly develop resources. And establish a curriculum development mechanism to ensure synchronization with industry development through regular review and updating of resource content. At the same time, the resources will be uploaded to the college teaching platform, providing students with convenient search functions and personalized recommendation systems to help them quickly find the resources they need.

3.5 Exploring Multiple Evaluation Systems

The training evaluation mechanism is a key link in ensuring the quality and effectiveness of training[10]. A diversified evaluation body should be established that includes process evaluation and outcome evaluation. Process evaluation focuses on the level of participation and interaction during the training process, while outcome evaluation emphasizes the learners' knowledge mastery and skill application abilities. Propose a diversified evaluation approach of "diversified evaluation subjects, multi-dimensional evaluation content, and diversified evaluation methods". The evaluation subject is composed of students themselves, classmates, and teachers, and the evaluation content includes attendance, civilized production, in class testing, practical assessment, and other aspects. The evaluation methods adopt self-evaluation, group mutual evaluation, classroom observation evaluation, homework evaluation, value-added evaluation, etc., changing the situation of only focusing on result evaluation and not on process evaluation, making the evaluation more comprehensive and scientific. In addition, training content and methods are continuously optimized through regular assessments, feedback collection, and effectiveness analysis.

4 Reform and Implementation of the Training System for Power Grid Planning Courses

4.1 Establish a Systematic Goal System

Establish a flexible teaching team composed of on-site experts and professional teachers, based on the needs of enterprise positions, according to the skill standards of power grid planning positions, and based on the work scenarios and new technologies at the work site. New methods were used to select high-frequency work tasks in the work business scenario, and 10 typical work scenarios were constructed, including main network planning, distribution network planning, and intelligent planning. The tasks of each work scenario were sorted out, and 17 typical teaching tasks were developed. The customer level content system of "Power Grid Planning" was reconstructed to make the course content zero distance from the actual work position and solve the problem of disconnection between course content and work position.

4.2 Developing Diversified Teaching Resources

(1) Developing situational teaching materials

Play the role of the team, conduct in-depth research on task driven teaching, and combine the characteristics of students' basic level learning to develop a scenario based textbook for the "Power Grid Planning" course. The textbook is divided into 10 scenarios and 17 teaching tasks according to work scenarios. During the writing process, the starting point is to cultivate professional abilities, and the implementation process of the 17 work tasks is the main line. The focus is on introducing the knowledge points, standards, norms, and key skills used in the task implementation process, and supporting the writing of practical training operation guides and evaluation rules. During the textbook writing process, attention is paid to the combination of graphics and text, with the emphasis on enabling students to master the key elements of planning, calculation methods, and other content.

(2) Developing digital teaching resources

Based on the learning needs of students for pre class preparation and post class knowledge consolidation, and taking into account the limitations of text and graphic displays in the textbook, we recorded 19 videos explaining and demonstrating 21 key and difficult knowledge points and skills from 17 tasks in 10 scenarios of the course. These videos were uploaded to the college's teaching cloud platform for students to learn at any time, meeting their learning habits of watching videos and providing materials for pre class preparation and post class consolidation.

(3) Develop a practical training simulation platform

Due to the particularity of the planning profession and the strong hands-on learning characteristics of students, a supporting simulation platform has been developed with embedded small-scale power grid area scale. Students can conduct full process simulation and simulation of main network planning, distribution network planning, etc. on the software platform.

4.3 Implement a Diversified Evaluation and Feedback Mechanism

Adopting a diversified evaluation approach of "diversified evaluation subjects, multidimensional evaluation content, and diversified evaluation methods". According to 17 teaching tasks, each task is evaluated with a total score of 100 points, divided into 3 dimensions and 10 evaluation indicators. The evaluation subject consists of teacher evaluation and student evaluation. Table 1 shows in detail the content of diversified evaluation.

Table 1. Diversified Evaluation Methods

Dimension	Indicator	Proportion
Teacher evaluation 60%	Preview score	10%
	Attendance	10%
	In class testing	10%
	Civilized production	10%
	Homework completed	10%
	Classroom performance	10%
	Operation score	30%
	Innovative spirit	10%
Student evaluation 40%	Group peer evaluation	60%
	Group self-assessment	40%

The 10 indicators are: teacher evaluation dimensions: preview evaluation, attendance evaluation, in class testing, civilized production, classroom performance, homework completion, innovative spirit, and operational evaluation; Student evaluation dimensions: including two indicators: group peer evaluation and self-evaluation; The pre learning evaluation, attendance evaluation, in class testing, and homework completion in the dimensions of teacher evaluation are conducted online through the vocational education cloud platform; Civilized production and classroom performance are evaluated offline by teaching assistants based on students' classroom performance.

In the dimension of student evaluation, the learning and mastery of each task are evaluated. Each group of students scores all members of the group (including themselves), and then takes the average score to obtain the peer and self-evaluation scores of each person. Each group organizes their own evaluation and submits the task after completion. Each evaluation indicator is based on a 100 point scale, and finally converted and summarized proportionally to obtain the total score of the learning task. The average of 28 total scores is taken to obtain the student's total course score. At the same time, the scores can be used for value-added evaluation, single indicator evaluation, etc., providing basic data for conducting big data analysis.

In addition, establish a feedback mechanism to collect students' opinions or suggestions on course design, resources, teaching methods, and other content through evaluation and assessment at the end of the course, in order to continuously improve course quality through rolling optimization of course design.

5 The Reform Effect of the Training System for 5 Power Grid Planning Courses

5.1 Significant Improvement in Students' Professional Technical Skills

By restructuring the curriculum system, the theoretical knowledge of power grid planning is closely integrated with practical operations, enabling students to systematically master comprehensive knowledge from national energy strategies to specific technical operations. Introduce practical cases of enterprises and the latest technological applications to ensure that students' learning content keeps up with the forefront of the industry and has the ability to solve practical problems. Through evaluation data analysis, the pass rate of theoretical exams for students has increased from 72.1% to 100%, and the excellence rate (over 85) has increased from 65.3% to 92.1%. And the comprehensive evaluation shows that the students' professional qualities such as learning initiative and innovation have also been improved. The sending training unit has provided feedback that the trainees have acquired basic professional skills in power grid planning through learning.

5.2 Significant Improvement in the Level of the Teaching Staff

By introducing high-level technical and skilled talents and industry experts, and forming a flexible teaching team composed of on-site experts and full-time teachers, the teaching quality and practical guidance ability of students and teachers have been effectively improved, and the overall teaching level has been significantly enhanced.

5.3 Significant Enhancement of Social Service Capabilities

The reformed training system for power grid planning courses focuses on cultivating students' awareness of social service, enabling them to better serve society and the people. These graduates have played an important role in power grid planning, construction, and management, making positive contributions to ensuring power supply, promoting economic development, and social progress.

6 Summary

This article proposes innovative reform ideas for the training system of power grid planning courses, focusing on the current situation and problems of the training system. And proposed measures such as clarifying training objectives, restructuring curriculum systems, innovating training methods and approaches, optimizing resource library construction, and exploring diversified evaluation systems, aiming to cultivate power planning talents with solid professional knowledge and high practical abilities, providing useful references and inspirations for the construction of curriculum training systems in related fields.

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