Research and Construction of Power Communication Transmission Network Operation and Maintenance Training System

Yanheng Zhao(✉), Chunxiao Song, Ran Fang, Zhan Shi, and Xudong Zhang

State Grid E-Learning Service Center, State Grid Technology Institute, Jinan, China
729909623@qq.com

Abstract. Skill training is an effective means to improve the professional skills and comprehensive quality of operation and maintenance personnel, and an important way to cultivate high skilled application-oriented talents. Based on the post capacity analysis and the principle of being close to the production site, design and develop training resources such as training projects, strengthen the construction of training rooms and teachers, and establish a perfect training system, which can effectively guide the development of skills training. Based on the operation and maintenance training system of power communication transmission network, this paper analyzes the post capacity of power communication transmission network, and proposes a construction scheme to provide reference and help for the skill training of power communication operation and maintenance personnel.

Keywords: power communication · transmission network · operation and maintenance · practical training system

1 Introduction

As an important part of the smart grid, the power communication transmission network carries important services such as relay protection, dispatching automation, electric energy measurement, dispatching telephone and multimedia [1, 2]. It is an important means to ensure the safe and stable operation of the power system, meet the requirements of power grid dispatching automation and enterprise management modernization, and provide communication guarantee for the production of the power grid and the normal operation of enterprises [3, 4]. With the deepening of power grid construction, the combination of modern communication technology and power grid technology is getting closer and closer. The safe operation of the power system has higher and higher requirements for the power communication transmission network. The transmission carrier of power communication has also changed greatly, and its operation and maintenance work is more complex, which puts forward higher requirements for the technical skills of the power communication operation and maintenance personnel [5, 6]. In order to improve the overall quality of the power communication operation and maintenance team, it is urgent to build a power communication transmission network operation and maintenance training system. By constantly strengthening the construction of skilled talents,

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improving the operation and maintenance level, we will provide strong talent support for the operation and maintenance of power communication. [7–9].

2 Operation and Maintenance Status of Power Communication Transmission Network

With the rapid development of smart grid, the combination of power technology and communication technology is more and more obvious. The business scope carried by the entire power communication transmission network is continuously expanding, and the types of users are also increasing [10]. For the power communication transmission network, the level of operation and maintenance is also increasing, and the scope of operation and maintenance work is gradually expanding. The gradual application of new technologies such as cloud computing, Internet of things, big data and mobile Internet has transformed the development mode of power grids into informatization, automation and interaction, and the development mode of enterprises into intensification, refinement and standardization. This has posed a challenge to the reliability and effectiveness of power communication transmission networks [11, 12].

With the continuous expansion of the types of services carried by the power communication transmission network and the update of communication equipment, the contents and objects of operation and maintenance are constantly enriched, and the technical skills of operation and maintenance personnel are also constantly improved. Because the operation and maintenance of the power communication transmission network have become more difficult, it is urgent to build a practical training system for the operation and maintenance of the power communication transmission network to meet the practical needs of the increasingly complex operation and maintenance work.

3 Construction of Power Communication Transmission Network Operation and Maintenance Training System

The construction of the operation and maintenance training system of the power communication transmission network should be based on the post capacity requirements, the operation and maintenance system as the traction, the practical skills as the focus. The construction content of the training system is shown in Fig. 1.

3.1 Post Capacity Analysis

According to the job responsibilities and daily work contents of the operation and maintenance personnel of the power communication transmission network, the work flow and operation steps of each task are sorted out. By analyzing the knowledge and skills required by each operation step, and comprehensively decomposing the required knowledge and skills from three aspects of theoretical knowledge, basic skills and professional skills, a post capacity model is formed, as shown in Fig. 2.

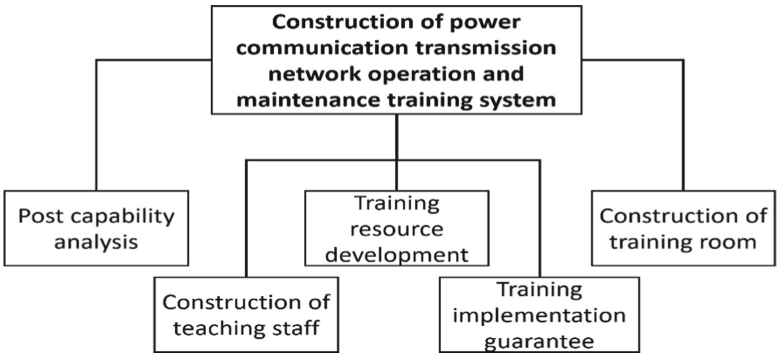

Fig. 1. Construction of power communication transmission network operation and maintenance training system [Owner-draw]

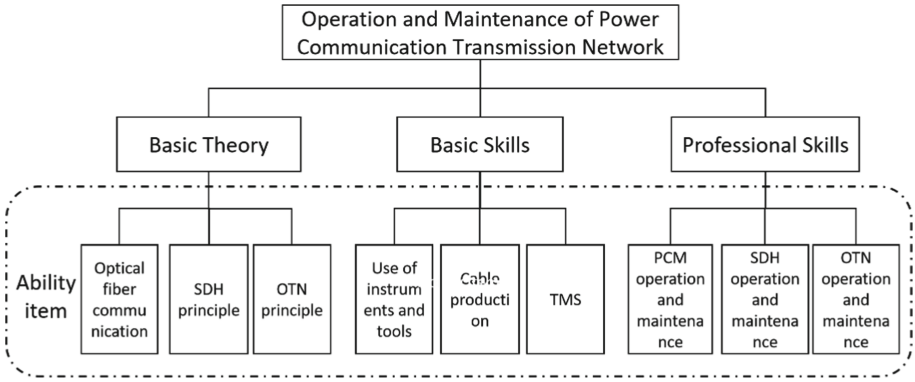

Fig. 2. Capacity analysis of operation and maintenance posts of power communication transmission network [Owner-draw]

3.2 Training Resource Development

Based on the capacity requirements of power communication operation and maintenance posts, the training specifications and training plans are uniformly prepared, and training resources such as training materials, practical training operation instructions and training courseware are developed. The development idea is shown in Fig. 3. According to the post capacity analysis, the ability items are decomposed, the key theoretical knowledge points and operation skill points are highlighted, and the relevant operation skill points are integrated to develop the practical training projects, as shown in Table 1. Each training project includes one or more training tasks, and standardized training operation instructions are prepared for each training task. Develop network courseware for some basic theoretical knowledge, make full use of the network university platform, and facilitate students' fragmented and independent learning. In view of the characteristics of short cycle, quick effect and high efficiency of vocational training, the development of training resources should not only pay attention to updating knowledge, improving skills and enhancing adaptability, but also pay attention to the shaping and training of

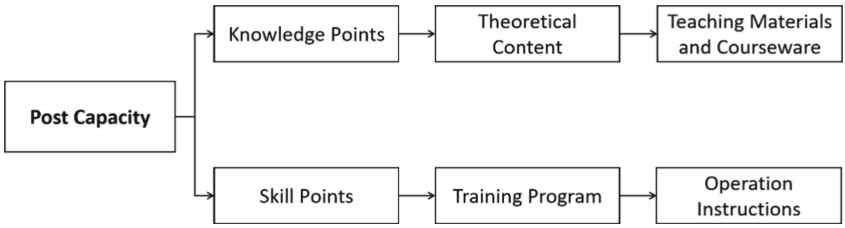

Fig. 3. Development ideas of training resources [Owner-draw]

Table 1. Training project development [Owner-draw]

Ability item		Training items
Basic Skill	Use of instruments and tools	Use of light source and optical power meter
		Use of 2M bit error meter
	Cable production	2M jumper fabrication
	TMS communication resource maintenance	Account data maintenance
		Resource data query statistics
Professional Skills	PCM equipment operation and maintenance	PCM equipment daily inspection
		Maintenance of PCM equipment
	SDH equipment operation and maintenance	SDH equipment daily inspection
		SDH transmission network construction and service opening
		Fault analysis and treatment of SDH transmission network
	OTN equipment operation and maintenance	Daily inspection of OTN equipment
		OTN optical transmission network construction and service configuration
		OTN equipment fault analysis and treatment

employees' innovative ability and pioneering spirit. It is necessary to ensure that the selection of materials is accurate, the topics are flexible, the content is rich and novel, and the unity of scientificity and ideology is emphasized [13].

3.3 Construction of Training Room

Adhere to the integrated training and teaching mode of "teaching and doing", build the power communication transmission network operation and maintenance training room, with teaching area, communication area and operation area. The teaching area is used

to teach professional theoretical knowledge and demonstrate the operation process of network management; The communication area is used for the group or team to discuss the problems encountered in the training process and propose solutions; The operation area is used for trainees' operation training, which should be consistent with the actual situation on the production site as far as possible to form a good training environment. In order to integrate the teaching and training activities with the actual work process in a real environment as much as possible, so that the trainees can complete each project task in a typical work situation, the equipment configured is the brand and model commonly used on the site, and the number of equipment is reasonable, which is convenient for the group to carry out practical training activities and skills evaluation. Based on this, the training room is equipped with 2 sets of PCM equipment to simulate the dispatching telephone of the master station and the substation; 12 SDH devices are used to simulate the transmission network structures such as ring network, tangent ring and intersection ring; Three OTN devices are used to simulate the inter provincial backbone network.

3.4 Construction of Teaching Staff

On the basis of full-time trainers, famous experts, university professors, manufacturer engineers and high-level technical personnel in the industry are employed as part-time trainers to enrich the training team and establish a teacher pool. At the same time, full-time trainers are required to regularly go to the front line of the production site to understand the actual situation of the post, professional development and new technology application; For part-time trainers, strengthen the training and training in training and teaching skills and practical training guidance methods, and strive to build a team of trainers with deep theoretical foundation, high skill level and strong teaching ability to ensure the quality of training and teaching.

3.5 Training Assessment Method

After the training of the trainees, the trainer shall conduct objective and fair assessment and evaluation on the trainees, avoid the situation of passing through the training, enhance the enthusiasm of the trainees to participate in the training teaching and practical training, and effectively promote learning through training and examination. Training assessment includes daily performance, theoretical examination and practical training examination. Daily performance includes attendance, learning attitude, etc.; On the last day of the training, the theoretical and practical training examinations will be organized in a unified way. The practical training examinations will highlight the assessment of standardized and standardized operation.

4 Training Effect Guarantee

4.1 Diversified Teaching Methods and Means

Diversified and innovative learning methods have become the theme of education and training. Training and teaching should return the subject status of learning to the students,

so that the students can acquire knowledge and improve skills through various ways, give full play to the subjective initiative of the students, mobilize the enthusiasm of the students, and become the master of training and learning. In the training process, situational teaching is adopted to create a working atmosphere by setting a practical training environment similar to the production site, and role-playing mode is used to make the trainees feel the work content for the actual position; The use of case teaching enables students to have a more intuitive understanding of the application of knowledge and skills in practical work, which is conducive to the development of students' future work; The flipped class is adopted to strengthen the communication between the students and enhance the students' understanding of the application of transmission equipment and new technologies in different regions.

4.2 Evaluate the Training Effect

Correct and reasonable judgment on the training effect can effectively understand the effect of training implementation and provide guidance for the next training. The mixed use of different evaluation methods can more accurately understand the training effect. Evaluate the training content, trainer's teaching skills, training process organization and other aspects through questionnaires to fully understand the response of trainees to the training and learning process; By means of test comparison, the trainees are tested at the beginning and end of the training, and the results of the two tests are compared to fully understand the degree of knowledge and skills improvement of the trainees through the training [3]; Three months after the training, telephone, we chat interview, questionnaire survey, etc. will be conducted to the trainees, so as to master the degree of application of the training contents in the work.

5 Conclusions

Through the practice of the training system, it is proved that the targeted training for the operation and maintenance personnel of the power communication transmission network has effectively improved the skill level and professional quality of the operation and maintenance personnel, which is recognized and welcomed by the operation and maintenance personnel. In order to better adapt to the rapid development of society and meet the growing demand of the industry, it is necessary to continuously improve the training system, guide the training of operation and maintenance personnel, and provide strong talent support for the development of the power industry.

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