Exploring AI-Empowered Teaching Reform of the "Communication Engineering Drawing" Course in Higher Vocational Colleges

Huangmo Li
Chongqing Telecommunication Polytechnic College

Abstract: With the rapid development of artificial intelligence technology, the communication industry is accelerating its transformation toward digitalization and intelligence. Against this background, new requirements have been raised for the teaching of the Communication Engineering Drawing course in higher vocational colleges. Targeting the existing problems in course teaching, including the misalignment between teaching objectives and post requirements, the delayed updating of teaching content, relatively monotonous teaching methods and insufficient process-oriented evaluation, this paper explores practical paths for the AI-empowered teaching reform of this course. By adopting artificial intelligence technologies to upgrade teaching objectives, optimize teaching content, innovate teaching modes and improve the evaluation system, the course can shift its focus from drawing-skill-oriented training to engineering-competency-oriented cultivation. This research provides references for improving the talent training quality of communication engineering majors in higher vocational colleges.
Key words: communication engineering drawing; artificial intelligence; teaching reform

Introduction

The Outline for the Construction of an Education-Strong Country (2024–2035) clearly states that "we shall promote AI-enabled educational transformation and integrate intelligent technologies into the teaching content of specialized courses". In April 2026, the Ministry of Education issued the Action Guide for "Artificial Intelligence + Education", which further clarifies the implementation paths for the deep integration of artificial intelligence and specialized courses, and provides a systematic framework for AI technology to empower vocational education.

In the field of communication industry, the commercial deployment of 5G-A is being accelerated, and the research and development of 6G technology has been fully laid out. Industrial transformation has put forward new competency requirements for engineering and technical personnel, who are expected to be proficient in using digital tools to solve complex engineering problems in real work. At the same time, the rapid popularization of AI tools provides new technical possibilities for teaching reform. Against this background, exploring the integrated teaching of artificial intelligence and specialized courses in higher vocational colleges not only responds to the national policy orientation for building an education-strong country, but also meets the urgent need to improve the talent training quality of communication engineering majors.

1. Current Teaching Status of Communication Engineering Drawing

1.1 Course Characteristics

As a specialized technical course for communication technology majors in higher vocational colleges, Communication Engineering Drawing mainly cultivates students' ability to read and draw communication engineering drawings. The core of the course is based on engineering drawing theory, industrial standards and specifications, and common knowledge of communication engineering line design, and takes Auto-CAD computer drawing software as the basic skill training means, so as to improve students' basic ability to read and draw drawings. On the basis of imaginative thinking ability, students can use creative thinking methods to carry out structural design, and finally possess the abilities required by posts such as optical cable line engineering drawing draftsman and communication base station engineering designer.

1.1.1 Abundant knowledge points

Learning communication engineering drawing requires a great deal of knowledge, such as engineering drawing standards, common graphic symbols of communication engineering, the use of Auto-CAD drawing software, site survey of communication engineering and sketch drawing of indoor distribution of communication base stations. Some of the knowledge is rather boring, and the use of Auto-CAD software requires memorizing a large number of drawing commands, which directly affects students' interest in learning.

1.1.2 Strong practicality

At present, the class hours of the Communication Engineering Drawing course are arranged as 64 hours, including 24 hours of theory classes and 40 hours of practical training classes, so the practice time is sufficient. Only through a large number of drawing-reading and drawing exercises can students effectively improve their imaginative thinking ability, and only after long-term exercise and accumulation can they proficiently use Auto-CAD software to complete the drawing of communication engineering drawings.

1.1.3 Wide application scope

In communication engineering construction, drawings occupy an important position and are the main means of expression and communication for designers and constructors. Moreover, Auto-CAD software is used very frequently in communication engineering design and construction. In order to comply with the development of an information-based society, students majoring in communication technology must master good drawing techniques.

1.2 Existing Problems

1.2.1 Misalignment between objectives and requirements

With the digital and intelligent transformation and upgrading of the communication field, theoretical knowledge and practical applications are constantly updated. Enterprises need more composite talents with human-machine collaboration ability, engineering review thinking and proactive problem-solving ability, rather than simple draftsmen. Traditional teaching of the Communication Engineering Drawing course lays emphasis on Auto-CAD command memorization and imitative drawing of drawings, and large-class teaching makes it difficult to take into account the individual differences of students, resulting in students who can draw but do not understand engineering, and thus have a low degree of post adaptability.

1.2.2 Relatively lagging content updating

At present, the content of the Communication Engineering Drawing course in most higher vocational colleges is still dominated by traditional drawing theory and two-dimensional drawing skill training. The knowledge focus is still on projection principles, basic Auto-CAD command operations, and traditional drawing methods of communication line

and equipment installation drawings, lacking dynamic updating that follows the iteration of communication technology. Moreover, some colleges still use textbooks and case libraries from several years ago, which leads to a generation gap between the knowledge students learn and the current industry standards, and the knowledge system is relatively lagging.

1.2.3 Relatively monotonous teaching methods

Traditional classroom teaching lays emphasis on basic theoretical knowledge and uses relatively fixed teaching methods. Students are usually in a listening state, fail to deeply explore relevant knowledge, and their learning enthusiasm cannot be fully mobilized, resulting in low classroom participation. In addition, course teaching is also limited by practical training venues and lacks reasonable practical teaching time and class hour arrangements, so students cannot apply the knowledge they have learned to specific equipment operations, which restricts the development of students' comprehensive ability.

1.2.4 Relatively weak process evaluation

At present, the Communication Engineering Drawing course generally adopts large-class teaching. Teachers have limited energy and find it difficult to observe and record each student's drawing process one by one, so they can only shift the focus to the standardization of the finished drawings and adopt summative evaluation. However, each student has a different foundation, a different learning progress and a different degree of understanding and mastery of knowledge. Without process evaluation, it is impossible to truly measure students' engineering thinking and problem-solving ability.

2. Exploration of Teaching Reform of Communication Engineering Drawing

2.1 Upgrading Teaching Objectives

The original teaching objectives of the Communication Engineering Drawing course are as follows: through the study of the overall requirements and drawing standards of communication engineering drawing, the operation of Auto-CAD software, and the engineering drawing methods of communication line construction drawings and equipment installation drawings, students can master the drawing and reading of various commonly used communication engineering drawings, cultivate students' teamwork ability, and improve their ability to proactively raise, analyze and solve problems.

Artificial intelligence technology can empower the upgrading of teaching objectives of Communication Engineering Drawing from three dimensions: knowledge imparting, ability cultivation and literacy improvement. In terms of knowledge objectives, AI can build a dedicated knowledge graph and standard library for communication drawing. When students input keywords, they can quickly retrieve the clauses and graphic examples of YD/GB standards. AI technology can also be used to automatically verify whether the line types, annotations and drawing frame formats of drawings conform to industry standards. At the same time, AI assistants support the generation of command sequences from natural language and intelligently recommend communication professional blocks, greatly lowering the threshold for students to learn Auto-CAD software.

In terms of ability objectives, AI can automatically generate a line construction drawing framework based on site photos or sketches, intelligently check the completeness of engineering drawings, and provide a large number of real engineering drawings to guide students to read them step by step. For equipment installation drawings of communication engineering, AI can identify legends and automatically associate equipment function descriptions, and can also combine digital twin technology to help students understand the spatial layout of equipment rooms.

In terms of literacy objectives, through a project-driven approach, AI acts as an "intelligent consultant" to help students retrieve relevant cases, review drawings and generate problem lists, so as to cultivate students' engineering review thinking of proactively discovering problems. At the same time, it records the contribution of each group member and gives timely feedback, so as to improve the efficiency of team collaboration.

Artificial intelligence technology is used to liberate students from tedious software operations and standard memorization, so that they can focus on higher-order abilities such as engineering thinking, spatial understanding and problem solving, realizing the leap of ability from "being able to draw" to "understanding engineering".

2.2 Optimizing Teaching Content

The teaching content of the Communication Engineering Drawing course needs to shift from the traditional mode of "knowledge imparting + skill training" to an intelligent teaching content system that integrates "cognitive construction + tool collaboration + engineering application", so as to cultivate students' engineering ability adapted to the era of artificial intelligence.

First, the original linear content of "theory–software–drawing" is reconstructed into a progressive structure of "cognitive layer–tool layer–application layer". At the cognitive layer, the relevant standards of communication engineering drawing are transformed into an AI knowledge graph that can be interactively retrieved, so that students can immediately obtain legends, annotation specifications and related clauses by asking questions. At the tool layer, the teaching content of artificial intelligence tools such as DeepSeek, Kimi and Doubao is integrated, so that students can master human-machine collaboration rather than simple command memorization. At the application layer, full-process training of AI-assisted engineering drawing is set up, and engineering practice content such as AI tools' review of drawing completeness and automatic statistics of engineering quantities is added, so as to connect with real post requirements.

Second, key content is transformed intelligently. For example, the teaching of Auto-CAD software shifts from "explanation of menu commands" to "human-machine collaborative operation": students are taught to describe requirements in natural language, and AI tools generate the corresponding command sequences, while the teaching focus shifts to the correct selection and engineering combination of blocks. For the teaching of communication line construction drawings, the mode shifts from "imitative drawing with given data" to "drawing generation driven by engineering data": real survey data are introduced, AI first generates a preliminary routing framework, and then students further improve the details and use AI tools to check the completeness of as-built drawings such as the overall routing drawing, pole position details and obstacle point annotations.

Third, a dynamic support mechanism is established to ensure that teaching content is iterated in sync with industry development. AI technology is used to integrate YD/GB standards, professional legends and real engineering cases to form a structured knowledge graph, supporting intelligent retrieval and dynamic updating of teaching content. At the same time, AI is used to automatically monitor the latest developments in the communication engineering field, so that teaching content is iterated and updated in real time with industry standards, solving the problem of lagging textbooks.

Thus, with the help of AI technology, the teaching content is reconstructed, the course is upgraded from skill training to engineering ability cultivation, and talent training and industry needs are brought into resonance.

2.3 Empowering Teaching Methods

Artificial intelligence technology can systematically optimize the teaching implementation path of the Communication Engineering Drawing course and realize the paradigm shift from "teacher-centered" to "student-centered".

2.3.1 Problem-based teaching method

Before class, personalized question chains can be generated based on learning situation analysis to activate students' thinking starting point. During class, a hierarchical question-and-answer mechanism is adopted: students ask basic questions to AI teaching assistants, while teachers focus on high-order engineering questions that AI cannot answer and guide students to carry out critical thinking. After class, an extended question bank is generated according to students' classroom performance, so as to cultivate students' awareness of proactively raising engineering questions.

2.3.2 Inquiry-based teaching method

Project-driven inquiry is carried out around real communication engineering tasks. After teachers release tasks, AI can dynamically generate sub-tasks at different levels according to students' ability profiles, and provide intelligent

assistance such as alternative schemes, parameter comparison and specification retrieval at key nodes, so as to support the deep learning process.

2.3.3 Online-offline blended teaching method

Through online and offline teaching methods, a closed loop of "intelligent pre-class guidance—precise in-class interaction—personalized after-class expansion" is constructed. AI provides real-time feedback throughout the whole process, giving consideration to students at different levels and with different needs to the greatest extent, and motivating each student to improve their autonomous learning and practical ability.

2.4 Improving the Evaluation System

In order to comprehensively evaluate students' mastery of knowledge in the Communication Engineering Drawing course, it is necessary to build a multi-level evaluation system that matches the post ability requirements of the communication industry, so as to more accurately reflect students' practical ability and technical application level.

2.4.1 Strengthening process evaluation

Previous course evaluation only carried out summative evaluation on students' learning results and ignored the evaluation of students' learning process in communication engineering drawing. Process evaluation, on the other hand, can track and record students' daily learning process and evaluate the learning effect in a timely manner. With the help of AI technology, the learning situation of each student in software application and drawing standards can be diagnosed, so that teachers can dynamically grasp students' situation in the teaching process, thereby correctly evaluating students and identifying teaching concerns in a targeted manner.

2.4.2 Perfecting summative evaluation

Summative evaluation no longer simply examines students' memorization of knowledge, but takes the form of displaying completed communication engineering drawing projects in groups. AI tools are used to carry out image recognition and specification verification on the communication line construction drawings and equipment installation drawings submitted by students, and generate standardization scores and error analysis reports. Teachers then comprehensively evaluate students' application level in combination with their innovative design ability and engineering logical thinking.

2.4.3 Introducing multi-dimensional evaluation

In the evaluation process, student self-evaluation and peer evaluation are added. Students can conduct periodic self-reflection and summary against the personal ability profiles generated by AI, or use AI tools to review other students' project results, so as to improve students' comprehensive ability and team collaboration ability.

Conclusion

In summary, the current teaching of the Communication Engineering Drawing course in higher vocational colleges still has certain limitations in terms of objective positioning, content updating, teaching methods and evaluation methods. The arrival of the era of artificial intelligence also provides an important empowering role for the reform of the Communication Engineering Drawing course. AI technology can not only optimize teaching links, but also support the in-depth reform of teaching methods and promote the transformation of the evaluation system toward diversification. Therefore, teachers in higher vocational colleges should strengthen the learning and application of artificial intelligence technology, so as to better promote the reform and innovation of specialized courses.

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