

Original Paper

Research on the Teaching Reform Path of Professional Basic Courses in Private Universities from the Perspective of AI Empowerment

Qiuxiang Wang^{1*}, Fuli Wang¹ & Haiying Ji¹

¹ Qingdao City University, Qingdao, China

* Qiuxiang Wang, E-mail: qiuxiang.wang@qdc.edu.cn

Received: March 5, 2026

Accepted: March 19, 2026

Online Published: March 25, 2026

doi:10.22158/grhe.v9n1p132

URL:<http://dx.doi.org/10.22158/grhe.v9n1p132>

Abstract

To address the existing problems in the teaching of Engineering Drawing in private universities, and to promote the digital transformation of education and the cultivation of application-oriented talents, this paper conducts a study on the AI-empowered teaching reform of this course. Firstly, it analyzes the current teaching situation, identifies the core problems in four aspects: students' learning needs, teaching content and methods, faculty and resources, and assessment and competency cultivation, and explores the demand for AI empowerment at both the teacher-student and course levels. Furthermore, it puts forward four major reform objectives: improving teaching quality and efficiency, realizing personalized and precise teaching, innovating teaching models and evaluation systems, and strengthening the cultivation of students' abilities and comprehensive qualities. On this basis, a "five-in-one" AI-empowered reform path is constructed, including the optimization of teaching content, the innovation of teaching methods, the integration of teaching resources, the reform of assessment and evaluation, and the construction of a teaching support system. The research on AI-empowered teaching reform of Engineering Drawing can provide practical experience for improving teaching quality and enhancing the adaptability of application-oriented talent training.

Keywords

AI, Private Universities, Teaching Reform

1. Status Analysis

(1) Analysis of Current Teaching Situation

Based on the orientation of applied talent cultivation in private universities and the characteristics of student groups, the core issues in the current teaching of “Engineering Drawing” course are mainly manifested in the following three aspects:

- ① Student Level: Students demonstrate a deficiency in learning motivation, possess a comparatively weak knowledge base, and exhibit a lack of training in spatial imagination. Additionally, students from private colleges and universities display a relatively weaker grasp of theoretical knowledge, yet they possess strong practical and operational skills.
- ② Teaching Level: The teaching content is heavily theoretical, with practical exercises mainly consisting of drawing copying, lacking engineering thinking training; teaching methods primarily rely on traditional lecture-based approaches, with classroom interaction mainly consisting of question-and-answer sessions, lacking interest.
- ③ The assessment level: the assessment methods of the course are not diversified enough, and the final assessment scores are paid attention to. The assessment of students’ learning process and ability can not be well reflected.

(2) AI enabling demand analysis

Teachers’ needs: teaching efficiency improvement (such as intelligent correction, courseware generation), teaching difficulty breakthrough, personalized teaching implementation.

Students’ needs: personalized learning guidance, learning difficulty answering, practical ability improvement, learning effect feedback.

Curriculum level requirements: optimization of teaching content, rich teaching resources, innovation of assessment methods, and improvement of teaching quality.

2. Goal, Path and Value

2.1 The Goal of AI Empowering Teaching Reform

(1) Improve the quality and efficiency of teaching: With the advantages of AI technology, the content of conceptual theory can be arranged to students, so that students can learn before class. It can also arrange homework, and intelligent correction through AI can reduce the workload of teachers’ review. At the same time, AI can also analyze the academic situation of each student’s answers. Students can clearly know their own shortcomings and repeatedly correct and submit answers until they are qualified.

(2) Strengthen ability and literacy cultivation: through reform, students can skillfully use AI to learn, can cultivate students’ data collection ability, cultivate students’ self-learning ability and practical operation ability, and more adapt to the training objectives of applied talents in private colleges and universities.

2.2 AI-enabled Teaching Reform Path

(1) Optimization Path of Teaching Content Enabled by AI

① AI-based Precise Screening and Gradient Reconstruction of Teaching Content: Relying on an AI-supported academic analysis system, pre-course basic test data of Engineering Drawing for civil engineering students in private universities and survey data on competency requirements of architectural industry positions (e.g., architectural design, construction management, cost consulting) are integrated to establish a three-dimensional matching model of “student foundation – course objectives – industry needs”. The model intelligently identifies key and difficult teaching points such as projection of architectural forms, drawing of architectural plans, elevations and sections, and specifications of architectural details. Outdated theoretical content inconsistent with current architectural standards is abandoned, while cutting-edge and practical content is supplemented, including drawing for prefabricated buildings, application specifications of BIM technology in architectural drawing, and key points of green building design drawing, so as to achieve precise alignment of teaching content with student abilities and architectural industry demands.

② Intelligent Generation and Adaptation of Hierarchical Digital Teaching Resources: In response to the teaching pain points of abstract knowledge points in Engineering Drawing (such as spatial relationships of buildings and node structures), AI 3D modeling and animation generation technologies are used to build a hierarchical digital resource library.

Basic level: Intelligent generation of dynamic demonstration animations for the projection principles of basic architectural forms and explanatory videos of architectural drawing standards (line width, scale, legends), to help students consolidate their theoretical foundation.

Intermediate level: Automatic generation of disassembly animations for 3D models of typical building components (e.g., beams, slabs, columns, doors and windows) and demonstrations of architectural plan, elevation and section drawing according to teaching progress, to help students break through skill bottlenecks.

Advanced level: AI-assisted generation of virtual simulation drawing resources for practical engineering cases (e.g., residential buildings, public buildings), including the whole-process demonstration from architectural schematic sketches to standard construction drawings, to guide students to establish systematic thinking in architecture.

③ AI-Based Interdisciplinary Content Association and Pre-emptive Integration: With the support of AI knowledge graph technology, a content correlation graph is constructed between Engineering Drawing and follow-up professional courses, to clarify the application scenarios and connection nodes of architectural drawing knowledge in subsequent courses. In the teaching content of Engineering Drawing, interdisciplinary knowledge is integrated in advance through AI pop-up prompts, case embedding and other methods. For example, when explaining dimensioning of architectural plans, the constraints of component stress requirements in building structures on dimensions are correlated; when

introducing the design of architectural elevations, the impacts of door and window selection and wall insulation in building energy-saving design on appearance dimensions are connected. Meanwhile, AI is used to integrate interdisciplinary practical projects and design comprehensive tasks of “from architectural drawing to engineering application”, so as to strengthen the logical connection and knowledge transfer between courses, and support the coherence of application-oriented talent training for civil engineering majors in private universities.

(2) AI empowerment teaching method innovation path

① Build a personalized teaching model: Based on the analysis of AI learning situation, a personalized learning portrait is generated for students’ learning data in the “Engineering Drawing” course, and the weak points of students in architectural shape projection, architectural construction drawing, and standardized application can be located. Differentiated learning programs can be developed for different basic students.

② Create interactive teaching scenarios: with the help of AI voice exercises, aiming at the knowledge of the map reading link, every student can use voice to read the map, break the previous question by question, cannot fully cover the disadvantages of all students, improve classroom interaction and participation in this way.

③ Optimize the flipped classroom model: before class, push the course preview content through the AI system, and test the preview effect before class, sort out the common problems in the students’ answers, and locate the focus of classroom teaching through problem analysis; in the class, the teacher is explaining the common problems in the pre-test. After the content is finished, the AI interactive platform is used for personalized practice and group discussion. After class, according to students’ classroom learning performance and homework completion, targeted review materials are pushed through the AI system to create a closed-loop teaching process of “preview-teaching-review” for the course objectives.

(3) AI empowers the integration path of teaching resources

① Build a course-specific intelligent teaching platform: With the help of AI preparation, AI learning, correction and answering functions, the teaching agent of “Engineering Drawing” course is built. The generation of standard courseware and three-dimensional model materials through the AI lesson preparation function can better cultivate students’ spatial imagination and analysis ability. AI learning supports online browsing and interactive drawing exercises of course drawings. It can truly realize intelligent correction and error analysis by AI correcting whether the line width, dimensioning, legend application and so on in the drawings conform to the specifications.

② Construct a dynamic update and accurate push mechanism of resources: Rely on AI data analysis, track students’ engineering drawing learning behavior data in real time, and identify high-quality and low-efficiency resources; combined with the construction industry standards and BIM technology updates, regularly iterate the content of the resource library; according to the students’ learning

situation, intelligently push personalized learning resources to improve the efficiency of resource utilization.

(4) Reform Path of Assessment and Evaluation Empowered by AI

① Intelligent Upgrading of Process Assessment: Supported by the AI teaching platform, a whole-process learning data tracking system is established to subdivide students' learning process in the Engineering Drawing course into four core dimensions: preparation proficiency, classroom interaction participation, drawing exercise quality, and phased practical achievements. For drawing assignments, detailed problems such as compliance with line weight standards, accuracy of dimensioning, and standardization of legend application are accurately identified. A process assessment report is generated to directly present the trajectory of students' ability development, making up for the deficiency of traditional assessment that emphasizes results over process.

② Diversified Innovation of Assessment Methods: Introduce AI-assisted automatic test paper generation and online assessment. A question bank is established based on the core knowledge points of Engineering Drawing, such as the drawing standards of architectural plans, elevations and sections, specifications of detailed drawings, fundamentals of BIM drafting, etc. The system supports automatic grading of objective questions and preliminary screening of subjective drawing questions. Virtual practical assessment is carried out; with the support of an AI virtual simulation platform, tasks of drawing residential construction drawings are assigned to evaluate students' practical skills and engineering application thinking.

③ Construction of Diversified Evaluation Subjects and Standards: A three-dimensional evaluation system is constructed, featuring AI-based evaluation + teacher professional evaluation + student mutual evaluation and correction. AI conducts objective scoring focusing on quantitative indicators such as drawing standardization and completion efficiency. Teachers focus on qualitative indicators including students' drawing logic, engineering thinking, and innovative design, and provide targeted improvement suggestions combined with AI evaluation results. In the student mutual evaluation stage, with AI assistance, clear evaluation criteria are defined (such as drawing aesthetics, compliance with specifications, precision of detail processing, etc.). Students deepen their understanding of drawing standards through mutual evaluation and correction.

(5) The construction path of AI-enabled teaching guarantee system

① Precision-Oriented Teaching Staff Construction: A two-dimensional training system of "AI Technology + Engineering Drawing Specialty" is constructed. In response to the weakness of AI teaching ability among teachers in private colleges and universities, hierarchical and classified training is carried out. Focusing on practical skills such as the operation of the AI teaching platform and the use of intelligent grading tools, an on-campus AI teaching research group is established to regularly conduct exchanges and reviews of AI teaching cases for Engineering Drawing, so as to improve teachers' ability in technology-integrated instruction.

② The construction of a systematic institutional system: formulate AI teaching application specifications, clarify the implementation standards, resource use specifications, assessment and evaluation rules of AI teaching in the “Engineering Drawing” course, and ensure the orderly advancement of teaching reform; improve the quality monitoring system, rely on the AI teaching platform data, monitor the quality of the teaching process in real time, regularly carry out teacher and student satisfaction surveys, and form a closed-loop management of “data monitoring-problem feedback-optimization and improvement” to ensure that the AI-enabled teaching reform is effective.

2.3 The Application Value of AI Empowering Teaching Reform

(1) Optimize the teaching content and improve the quality of teaching

For the theoretical content that is difficult to understand in the teaching, as well as the drawings involved, the difficulty of understanding can be reduced by AI three-dimensional modeling. With the help of AI intelligent correction function instead of repetitive correction, the efficiency is improved, and the personalized analysis for each student can be generated, which is helpful to improve students’ drawing skills. Through the analysis of the students’ pre-class preview report, the teaching focus is adjusted in time in the classroom teaching, so as to carry out accurate teaching and improve the efficiency and quality of classroom teaching.

(2) Connecting the development needs of the industry and highlighting the training objectives of applied talents

According to the development needs of BIM technology and prefabricated building in the construction industry, the frontier teaching content is added, the virtual practical assessment is introduced, the follow-up professional courses are connected, and the students’ system engineering thinking is cultivated. Introduce enterprise evaluation standards, strengthen students’ professional quality, and adapt to the needs of industry positions.

3. Conclusion

AI empowers the teaching reform of “Engineering Drawing” and promotes the digital transformation of higher education. Through the reform, the classroom teaching mode has been improved, and the focus of classroom teaching can be adjusted in time according to the differentiation of students’ learning. It truly conforms to the teaching concept of people-oriented and student-centered classroom teaching, and truly realizes the goal of cultivating applied talents in private colleges and universities.

References

- Guo, J., Yang, R., & Gao, F. (2021). Curriculum Reform and Practice of Engineering Drawing Based on Ideological and Political Case Library. *Heilongjiang Education*, 2021(1).
- Sha, S., Zhang, P., & Zhang, J. (2021). Exploration and Research on SPOC-based Blended Teaching Mode in the Internet+ Era. *Journal of Higher Education*, 2021(21).
- Wang, B., Zheng, F. L., & Wen, Y. H. (2022). Innovation of Teaching Mode of Engineering Drawing Course under the Background of Industry-Education Integration. *China Modern Educational Equipment*, 2022(19).
- Zhang, X. C., Yang, H. M., & Xu, S. F. (2021). Construction and Practice of Graphics Curriculum System Based on Emerging Engineering Education. *University Education*, 2021(5).