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*Research Article*

# Method and Path Selection for Optimization and Promotion of Teaching Quality of Applied Courses-Taking Steel Structure Course as an Example\*

Delei Yang<sup>1</sup>

*University of Huanghuai*

Wenqiang Zhu<sup>2</sup>

*University of Huanghuai*

Yamin Liu<sup>3</sup>

*University of Huanghuai*

Hui Dong<sup>4</sup>

*University of Huanghuai*

## Abstract

With the development of a series of educational reforms in China, transforming to applied colleges and universities has become a hot spot for the development of higher education. Under the background of college and university transformation, the optimization and promotion of the teaching quality of applied courses is the core and difficult point for the connotation construction of applied colleges and universities. Taking the teaching of steel structure course as an example, this paper comprehensively applies the case analysis method, literature analysis method and experiential summary method to determine the nature of the problem speculatively, and puts forward method and path selection for optimizing teaching effect of the course and improving the teaching quality from several aspects of precise course orientation, reconstruct teaching content, innovate teaching mode and strengthen security conditions. The method and path selection for optimization and promotion of the teaching quality of applied courses proposed in this paper have important practical and theoretical significance for improving the quality of talent training in applied colleges and universities.

## Keywords

Applied Colleges and Universities • Course Teaching • Teaching Content • Teaching Mode

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<sup>1</sup>Correspondence to: Delei Yang, Department of Architectural and Civil Engineering, University of Huanghuai, Zhumadian 463600, China. Email: muyi20071001@126.com

<sup>2</sup> Department of Architectural and Civil Engineering, University of Huanghuai, Zhumadian 463600, China. Email: zwqgod@126.com

<sup>3</sup> Department of Architectural and Civil Engineering, University of Huanghuai, Zhumadian 463600, China. Email: wyyjndyq@126.com

<sup>4</sup> Department of Architectural and Civil Engineering, University of Huanghuai, Zhumadian 463600, China. Email: rohameilin@163.com

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With the implementation of a series of education reforms in China, transforming to applied colleges and universities has become a hot spot for the development of higher education in China. In the 2014 *Decision on Accelerating the Development of Modern Vocational Education*, the State Council of China proposed to “guide a batch of common colleges and universities to transform to the applied colleges and universities” (The State Council, 2014). In the work focus of 2016, the Ministry of Education proposed to increase support and encourage qualified common colleges and universities to transform to application-orientation. Li Xiaohong, vice minister of the Chinese Ministry of Education, also clearly pointed out that an important strategic task of the 13th Five-Year Plan for Education is to speed up the structural adjustment of higher education and promote the transformation of common colleges and universities to the application orientation. So far, there are nearly 30 provincial-level administrative regions across the country, and many colleges and universities have officially carried out transformation pilots (Chen, 2016). Under the background of transformation of colleges and universities, the optimization and promotion of course teaching is the core and difficult point for the connotation construction of the application-oriented colleges and universities (Song, 2018). How to better reflect the advantages of applied courses, improve the quality of teaching and optimize course effect have also become key works that colleges and universities should consider in the development of applied colleges and universities. Taking the teaching of steel structure course as an example, this paper comprehensively applies the case analysis method, literature analysis method and experiential summary method to determine the nature of the problem speculatively, and puts forward method and path selection for optimizing teaching effect of the course and improving the teaching quality from several aspects of precise course orientation, reconstruct teaching content, innovate teaching mode and strengthen security conditions. The method and path selection for optimization and promotion of the teaching quality of applied courses proposed in this paper have important practical and theoretical significance for improving the quality of talent cultivation in applied colleges and universities.

### **Precise course orientation**

Course orientation is the starting point for the optimization and promotion of applied course teaching, and it is also the vane for reconstructing teaching content and sublimating teaching mode. For the teaching of the steel structure course in applied colleges and universities, we should comprehensively and precisely consider the course orientation from macroscopic and microscopic aspects.

From the macroscopic perspective, we can consider from three aspects: running orientation, cultivation objectives, and job requirements. The running orientation of the application-oriented colleges and universities conforms to the spirit of the times and the requirements of social development, it adheres to the scientific concept of development, takes practice teaching as the core, and requires all majors to closely combine with the local characteristics and pay attention to students' practical ability, moreover, it also provides talents with strong application and technical skills for civil engineering professional positions such as design companies, construction companies, quality supervision stations, supervision companies, bidding agencies, and real estate development companies. At the same time, the requirements for talents' knowledge and ability are no longer

single, so the teaching of applied courses should be more in line with the needs of different positions for today's talents.

From the microscopic perspective, we can consider the nature of the course, the status of the course, and the objectives of the course, etc. The steel structure course is a civil engineering course. The school should also provide pre-requisite courses such as engineering mechanics, advanced mathematics, engineering drawings, etc. to provide basic knowledge for the steel structure course, so that the connections between the courses are closer. The teaching objective of steel structure course is to cultivate students' ability in steel structure design, map identifying, analyzing, innovation and team cooperation, which consolidates the talents' professional knowledge of steel structures, so that they can work as construction engineers, supervisors, structural engineers or cost engineers with relevant qualifications. It aims to make students pay more attention to the cultivation of their own abilities and qualities while learning knowledge, students should be able to design simple structures, have organization and coordination skills and teamwork spirit in their lives, as well as possess innovative ideas, awareness of the law, the spirit of internet, and a good sense of responsibility for work and concept for quality.

### **Reconstruct teaching content**

The educational role of teaching content is not only a kind of knowledge system, but also includes scientific spirit and thinking attitude. Therefore, the choice of teaching content will be influenced by social development requirements and subject knowledge structures (Li, 2006). The applied courses can reconstruct the teaching content according to the following principles: arrange the teaching content closely around the teaching objectives of the major and the course; meet the knowledge, ability and quality requirements of the job position; conduct the level-by-level teaching of the course content according to the learning situations; meanwhile, in the context of applied teaching, the content of the steel structure course must have sufficient theoretical knowledge, as well as content that can cultivate students' practical abilities; it should pay attention to traditional technology and experience, as well as the new ideas, new theories, and new technologies required by current job positions.

The reconstruction of teaching content can be started from three perspectives - job position, work process, and professional ability. By analyzing the characteristics of job positions we can know that, course teaching of the application-oriented steel structure course should be conducted centered on connection calculation, component design, map identifying, and structural construction drawing. Based on the working process of steel structure, the work process teaching method can be introduced properly. The curriculum development takes work process as the base point, students learn professional knowledge and master practical skills around typical cases of steel structure; the curriculum implementation relies on the action system, teachers conduct teaching activities by constructing "steel structure stage projects" according to the professional ability cultivation and the individual requirements of the students; the curriculum innovation takes cooperative learning as the objective to further realize school-enterprise cooperation and industry-education integration (Jiang, 2004). The teaching content is roughly divided into four teaching items: basic knowledge of steel structure, steel structure connection design, steel structure component design and single-storey factory structure design. In order to cultivate students' professional ability in steel structure engineering, the corresponding teaching content and student learning tasks are formulated based on teaching items, so as to improve students' understandings in steel

structure materials, design principles and structural limit state design expressions, as well as promote students' mastery of welding joints, bolted joints, and rivet joint design principles and methods, enhance their grasp of the design principles and methods of steel structure beam-column components, and cultivate their abilities to design and calculate simple steel structures and to identify and plot structural construction drawings. When selecting teaching content, it is also necessary to pay attention to the focus points, difficult points and key points.

### **Innovate teaching mode**

To improve the quality of education and cultivate diversified talents, we should start with the reform and innovation of the curriculum teaching mode (Li *et al.*, 2018). Improving and perfecting the teaching mode of the steel structure course according to the needs of the application-orientated curriculum construction is the only way for us to explore the application-oriented courses. On this basis, teachers should pay attention to the ideological, practical, open and applied nature of the teaching process, and comprehensively enhance students' abilities and qualities.

### **Integration of academic atmosphere inspirational education and professional cultivation**

General Secretary Xi Jinping mentioned in the National Conference on Ideological and Political Work in Colleges and Universities that "like the sun and the air determine the growth of plants, the spirit and academic atmosphere of a school directly influence the studying and growing of students". A good academic atmosphere can drive everyone around to establish firm beliefs and form good habits. Therefore, in the teaching process of applied courses, we must not only emphasize the importance of professional cultivation, but also focus on the construction of academic atmosphere.

Through the teaching mode which integrates academic atmosphere inspirational education with the professional cultivation, we can strengthen the connection between ideological education and professional cultivation, and cultivate high-quality talents with both good morality and skills. Taking the method which uses celebrities, classics, famous companies and architectures for teaching as an example, teachers can add introductions and analysis of steel structure masters, classical steel structure theory works, excellent steel structure enterprises and famous steel structure buildings in the teaching content, familiar students with the excellent industrial talents and take them as role models, so as to simulate students' interest in learning and implement theoretical study of steel structure. Through the modern civilization carrier of steel structure buildings, this teaching method can enhance students' recognition and belongingness to their future work in steel structure field. In the teaching process, we should intentionally guide students to establish correct values, improve professional literacy, and achieve the unity of theory and practice. For example, Professor Shen Zuyan, a master in steel structure field, has conducted structural theoretical analysis and experimental research on more than 30 major projects throughout his life, provided key technical support for the National Center for the Performing Arts, Shanghai World Financial Center, Oriental Pearl Radio & TV Tower, etc., and he left an outstanding academic team of steel structure disciplines for Tongji University (Zhang, 2014). Through the study of Professor Shen's deeds, students are encouraged to actively participate in steel structure learning, their

scientific spirit, innovative consciousness and practical abilities are cultivated so that they can inherit and carry forward the dedication spirit of pursuing excellency.

### **Integration of teaching content and professional qualification standards**

Professional qualifications are the basic requirements for the knowledge, skills and abilities necessary for one to pursue a career. At the legal level, professional qualifications also have mandatory standards for the professional knowledge and professional ethics of practitioners. The professional qualifications are divided into different grades. According to the professional qualification level, the teaching content is integrated with the corresponding standard to conduct teaching activities, so that professional talents who meet the needs of the society can be cultivated.

The training objective of the applied steel structure course is to enable students to have the ability to work in the relevant work areas such as steel structure design, construction, supervision, etc. This is also the standard for measuring the professional qualification of steel structure talents. The case method can be used to carry out theoretical teaching, and the actual steel structure professional qualification cases can be introduced into classroom. The teaching idea which takes typical cases as guidance and steel structure theories as supplement can effectively improve the practical effect of teaching, and it has important practical and reference significance for cultivating qualified steel structure talents.

### **Integration of student works and enterprise products**

In 2017, the State Council pointed out in the *Several Opinions on Deepening the Integration of Industry and Education* that, we need to deepen the integration of industry and education, construct a comprehensive development pattern of education and industry integration, promote the construction of disciplines to adapt to industrial transformation and upgrading, perfect the demand-oriented talent cultivation structural adjustment mechanism, intensify the reform of "introducing enterprises into education", carry out productive internship training, and promote the reform of talent cultivation of industry-education integration. Through the school-enterprise cooperation, the project-oriented teaching mode is carried out, which is in line with the development concept of integration of industry and education, it further promotes the zero-distance docking between professional education and enterprise production practice, actively catches up with the rapid development of modern production technology, and cultivates students' ability to carry out practical engineering design.

After schools and teachers receive the design projects from the cooperative enterprises, they can bring the projects to the classroom and directly arranged them to the students in the form of assignments, and students are divided into groups according to the project plan and conduct design works. We can use the flipped classroom method to encourage students to learn interactively, organize them to study in groups. With group collaboration as the primary role and teacher guidance as the secondary role, it guides students to analyze technical difficulties and key points, perform calculation and design, so as to improve students' interest in learning. We can also adopt the task-driven teaching method, combine with actual project tasks to conduct

teaching, stimulate students' interest and initiative, use CDIO four-step method for project driven, quality integration, etc., students conduct design independently, and teachers would look over and give guidance. In the project evaluation section, students give reports and presentations, after the reports, students are required to give mutual evaluation and self-evaluation, and then teachers will give their evaluation and summarize the experiences.

### **Integration of classroom and training base**

The training base can promote the integration of industry and education. The integration of classroom and training base can effectively combine theoretical knowledge with practical operation, so as to achieve a high-degree integration of teaching, learning, practicing and other teaching links (Sun, 2017). This kind of teaching mode enhances students' enthusiasm for classroom participation and guarantees the practical needs of students in professional improvement. Teachers should arrange students to conduct professional practices in experimental teaching demonstration centers, engineering technology research centers, master studios and other off-campus training bases in the school according to the teaching plan, and introduce the course teaching from the classroom to the training base, so as to realize the integration of classroom and training base. In this way, students can fit into society and enterprises more quickly after graduation, and improve their employment competitiveness.

## **Strengthen guarantee conditions**

A handy tool makes a handy man. In order to improve the quality of course teaching, it is necessary to strengthen the guarantee conditions, in which the teaching teams and teaching resources are the most important conditions for improving the quality of teaching. In the course construction of applied colleges and universities, it is necessary to have a high-level teaching team and good teaching resources for support, so as to improve and develop the teaching guarantee system and cultivate talents of the new era with both ability and quality.

### **Teaching team**

The key to the applied course teaching is the transformation of the teaching team. In order to better guide the pilot work of transformation and reform, in 2015 *Instructions on Guiding the Transformation of Common Colleges and Universities to Application Orientation in Some Local Areas*, the Ministry of Education of China clearly proposed to strengthen the construction of teaching teams with "double-qualifications & double-abilities" in order to emphasize the construction of teaching teams in pilot schools. Not only should we pay attention to the teacher's "double qualifications", we should also pay attention to the teacher's "double abilities", thereby ensuring that the transformation pilot reform can achieve the goal. The connotation of teachers with "double-qualifications & double-abilities" is that teachers should have both the "two kinds of qualifications" and the "two kinds of abilities". The so-called "double qualifications" means that the teacher has both the qualification of the lecturer and the qualification of the engineer. This "double-qualifications" requirement

highlights the external characteristics of teachers in the applied colleges and universities (Feng and Zhang, 2017). The so-called "double abilities" means the teacher should have both the professional theoretical teaching ability and the professional practical teaching ability. When strengthening the guarantee conditions, the members of the teaching team are required to be transformed into teachers with "double-qualifications and double-abilities". The specific measures are as follows: first, promote professionalism, create an atmosphere of relying on professional knowledge to start a business, and vigorously advocate the professional humanistic spirit of "universities are not a group of buildings, but a group of masters"; second, according to the actual situation in school running, we should closely follow the demands of applied, local colleges and universities in school running, accelerate professional transformation and optimization, develop the good and discard the bad, achieve professional differentiated development, measure, select and train the professional leaders with goals, plans and steps, cultivate high-level and scarce talents, so that the talent introduction policy should be inclined to the main characteristic disciplines, dominant disciplines, and the formation of superior teaching teams; third, combined with applied school conditions and local economic and social development needs, team members can combine professional teachers with part-time teachers, and combine teachers inside the school with teachers outside the school (Yang *et al.*, 2013).

### **Teaching resources**

During the teaching of applied courses, we must choose the best teaching resources. At first, we need to optimize the syllabus and teaching content, select good teaching materials, teaching plans and assessment requirements, and provide students with large amount of resources such as test questions library, engineering library, video library, PPT class and other resources, so as to consolidate and improve their design abilities and computing skills. We should also prepare internship guidance for students, familiar them with professional qualification standards, regularly invite well-known experts to school lectures, and provide materials of latest discipline progress to help students further become application-oriented talents. In the teaching process, the *Steel Structure Design Code* enables students to better understand the latest norms of curriculum design, learn application guidance, practice demonstration examples, and introduce the revision of the latest norms in combination with the teaching content, so that they can have a better understanding of the new norms, which will help them to be more proficient in future works. Second, students can use websites and forums such as Baidu Wenku, Docin, co188 (Civil Engineering Online), civilcn (Civil Engineering Network), okok.org (China Steel Structure Forum), zhulong, etc. to grasp latest techniques, comprehend the latest developments in steel structure field, and use internet to analyze engineering problems and accident handling, so as to lay a solid foundation for their future works. At the same time, in order to guarantee the quality of applied courses, the school should establish off-campus internship training bases, provide hardware and software conditions for improving the actual teaching effect, and realize the integration of classroom and training base to effectively combine theoretical knowledge with practical operations, so as to achieve a high degree of integration of teaching, learning, practicing and other links to enhance the ability of students to combine theory with practice.

### **Conclusion**

Accelerating the structural adjustment of higher education and promoting the transformation of common

colleges and universities to application-orientation is a strategic deployment of China's national development. Optimizing the teaching effect of the course and improving the teaching quality have also become the key tasks that colleges and universities should consider in the development of applied colleges and universities. In the optimization and promotion of the teaching quality of applied courses, it is necessary to fully promote from the four aspects of precise course orientation, reconstruct teaching content, innovate teaching mode and strengthen security conditions, so as to improve the quality of teaching in applied colleges and universities, raise talent cultivation level, and cultivate excellent applied talents with innovative ideas, legal spirit and social responsibility.

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