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Original Paper

A Report of the Results Orientation on the Practical Teaching Innovation of the First-Class Applied Course of "Introduction to Civil Engineering"

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Abstract

The core of building first-class applied curriculum is to cultivate first-class applied talents, and the key lies in first-class applied curriculum design. This paper adheres to the concept of results-oriented education (OBE), centering on tasks, main lines, and processes, to meet the needs of application-oriented undergraduate first-class curriculum design and practice. This paper proposes, practices and improves the six-step teaching method based on constructivism, which includes "raising questions (creating situations), discussing problems, introducing hot topics, constructing new knowledge, applying concepts, evaluating effects and reflecting". It reasonably integrates the case elements of "curriculum ideology and politics", making the two main courses of "knowledge imparts" and "value guidance" reach the curriculum objectives.

Keywords

Result-oriented, Application type, First-class courses, Teaching innovation

1. The Background to the Outcome

In the past four years, a total of six rounds of course construction, this course team teaches "Introduction to Civil Engineering" nearly 1,800 freshmen, the teaching mode of this course has changed from teacher-lecturing to teacher-student interactive discussion. The teaching process is no longer confined to "review the old lesson, teach the new lesson and complete the homework", but to practice the six-step teaching method of "raise questions (create the situation), discuss the problem, introduce the hot spot, construct the new knowledge, apply the concept, evaluate the effect and reflect"; The teaching goal has changed from teaching knowledge to imparting knowledge, guiding value and

cultivating morality, fully integrating ideological and political elements into the curriculum; The teaching content has also changed from simple textbook explanation to OBe-based "hot spots + industry trends + professional knowledge", to ensure that the quality of personnel training can serve the needs of regional economic construction and industrial transformation and upgrading.

This result effectively solves the following teaching problems based on the course "Introduction to Civil Engineering":

(1) Solved the problem of disconnection between course content and industry development and job demand;

(2) Solved the embedded problem of "ideological and political education" of professional courses;

(3) Solve the problem of low attractiveness, low participation of students and serious problems of communication and interaction in the past classroom process;

(4) To a certain extent, it solves the problem that students are weak in practical ability and unable to solve practical problems.

2. Main Contents of Achievements

2.1 Design Teaching Objectives Based on Major Graduation Requirements

According to the spirit of the Guiding Outline of Ideological and Political Construction of the Curriculum in Colleges and Universities and other documents, we fully consider the needs of employment positions. Through the index decomposition of graduation requirements in the Talent Cultivation Program for Civil Engineering Majors in our school, seven teaching objectives need to be achieved according to the course nature and course content of the Introduction to Civil Engineering to support the achievement of students' graduation requirements. In the course design, the teaching content is arranged with the teaching objective as the center, and the ideological and political education content is integrated into the teaching content of each part. The ideological and political education is achieved by the way of discipline integration, and the goal of "curriculum education" is achieved through the guidance of value. The curriculum teaching objectives obtained from the analysis are described as follows.

Teaching goal 1: To understand the comprehensiveness, sociality and the unity in technology, economy and management of civil engineering from the perspective of subject introduction, so as to lay a necessary foundation for the study of related follow-up courses.

Teaching goal 2: Understand the principles and methods of using modern instruments, information technology tools, engineering tools and simulation software commonly used in civil engineering, and have the basic ability to distinguish the functions of various tools.

Teaching goal 3: To understand the technical standard system, intellectual property rights, industrial policies and laws and regulations in related fields of civil engineering, to understand the influence of different social cultures on engineering activities, and to understand the basic connotation and characteristics of BIM technology.

Teaching goal 4: Understand the concept and connotation of environmental protection and sustainable development; Be able to think about the sustainability of engineering practice from the perspective of environmental protection and sustainable development.

Teaching goal 5: Guide students to establish and improve the correct values, world outlook and outlook on life, understand the development of domestic and foreign engineering construction field and China's national conditions, initially establish the employment concept of serving the local economy and society.

Teaching goal 6: Understand the core concept of engineering ethics, understand the professional nature and responsibility of civil engineers, consciously abide by professional ethics and norms in engineering practice, and have legal consciousness.

Teaching Objective 7: Master the methods of independent learning, understand the ways to expand knowledge and ability, can adopt appropriate methods according to the needs of personal or professional development, independent learning, adapt to the new development of civil engineering.

2.2 Analysis of Teaching Content and Ideological and Political Elements into the Integration of the Establishment of "Curriculum Ideological and Political" Case Base

Based on the development history of civil engineering, the progress made in the field of civil engineering in China and the national conditions, the characteristics and sustainable development needs of students are studied. Based on the advantages of the subject, the teaching team of this course jointly discusses, carefully summarizes, excavates and refines the ideological and political elements in the course. The specific design of the integration points of the ideological and political elements of this course is shown in Table 1 and Table 2.

Table 1. Teaching Content and Integration of Ideological and Political Elements

Serial number	Teaching content	Class hours	Teaching form and teaching method	Support course target point number	Ideological and political elements into the point
1	Overview of civil engineering	4	Theoretical teaching; Teaching method, discussion method	Goal 1, goal 5 and goal 7	Correct career outlook and career choice outlook; The consciousness of serving the people and contributing to society; Scientific understanding of the relationship between common ideal and individual ideal; Guide students to think about building personal ideals, dreams and goals.
2	A brief history of civil	6	Theoretical teaching; Teaching method, discussion method	Goal 1 and goal 2	By understanding the development history of civil engineering, students can strengthen their national pride and arouse patriotism.

	engineering development				Through the detour of the development of civil engineering in China, students can realize the hard-won learning environment and working environment.
3	A brief history of civil engineering development	14	Theoretical teaching; Teaching method, discussion method, extracurricular independent learning method	Goal 5, goal 6 and goal 7	In combination with the technology and application trend of China's civil engineering, especially rail transit engineering, it inspires students' patriotism, encourages them to study hard and look at themselves correctly.
4	Civil engineering construction and decision	2	Theoretical teaching; Teaching method, discussion method, extracurricular independent learning method	Goal 3 and goal 6	Through learning in the process of engineering construction, students can know which behaviors will violate laws and regulations, so that students can consciously abide by professional ethics and norms in engineering practice and have legal awareness.
5	Civil engineering construction and decision	2	Theoretical teaching; Teaching method, discussion method, extracurricular independent learning method	Goal 6	Combined with the earthquake situation in China and the flood, mudslide and other disaster news around the students, inspire students' awareness and enthusiasm to study hard, solve people's problems and serve the society.
6	Green civil engineering and building energy conservation	2	Theoretical teaching; Teaching method, discussion method, extracurricular independent learning method	Goal 4 and goal 5	Combined with examples, students can develop a people-oriented design concept in the design process, guide them to develop a serious and responsible working attitude, and enhance their sense of responsibility, overall situation awareness and core awareness.
7	BIM technology in civil engineering management	2	Theoretical teaching; Teaching method, discussion method, extracurricular independent learning method	Goal 2, goal 3 and goal 7	Through the development of BIM technology in China civil engineering, students are encouraged to pursue hard work and innovation, combine their personal dreams with the Chinese dream, and realize their dreams of life.
Total class hours		32			

Table 2. List of Typical Education Cases of Introduction to Civil Engineering

Serial number	Teaching content	Class hours	Teaching form and teaching method	Ideological and political elements into the point	A typical case of education
1	Overview of civil engineering	4	Theoretical teaching; Teaching method, discussion method	Correct career outlook and career choice outlook; The consciousness of serving the people and contributing to society; Scientific understanding of the relationship between common ideal and individual ideal; Guide students to think about building personal ideals, dreams and goals.	1. Yang Liu, Civil engineering graduate, shared and discussed the stories of China's Top 10 "Moving Traffic" figures in 2020. 2. Share and discuss the stories of all walks of life who stuck to their posts during the epidemic, and the miracle of building Leishenshan and Huoshen Mountain. 3. Interpret "The Night Before" in the film "My Country and Me", and discuss with students the connotation sharing and discussion of craftsman spirit. 4. Sharing and discussing the deeds of Rachel, the British old lady who owns Chengdu Yanyang Handicrafts Shop.
2	A brief history of civil engineering development	6	Theoretical teaching; Teaching method, discussion method	By understanding the development history of civil engineering, students can strengthen their national pride and arouse patriotism. Through the detour of the development of civil engineering in China, students can realize the hard-won learning environment and working environment.	1. Introduction to the history of the development of civil engineering in China. 2. Architect Liang Sicheng's contribution to Chinese civil engineering. 3. Harm to national development brought by China's closed-door policy in the late Qing Dynasty. 4. The comparison between the development process of civil engineering in Western countries and China can enhance students' sense of identity and dedication to the major.
3	A brief history of civil engineering	14	Theoretical teaching; Teaching method,	In combination with the technology and application trend of China's civil	1. Introduce the history and status of ancient Chinese classical architecture in detail, such as Foguang Temple and Xuankong Temple in Shanxi, to arouse students' patriotism.

	development		discussion method, extracurricular independent learning method	engineering, especially rail transit engineering, it inspires students' patriotism, encourages them to study hard and look at themselves correctly.	2. Introduce the current development of super tall buildings in China, such as Shanghai Tower, Jinmao Tower and Gaoyin 117 in Tianjin, compare with the development of foreign buildings, and draw out students' thinking about the responsibility of their major. 3. The fact and difficult process of the high-speed development of railway in China after the founding of the People's Republic of China, focusing on interpreting the development process of transportation in the western region, the construction process of "Chengkun Line" and "Qingzang Line" as the top priority, so that students can understand the contribution of industry predecessors to the development of the country and society. 4.The detailed introduction of the high-speed development of China's high-speed railway enables students to understand the development trend of contemporary cutting-edge industries and technologies. Meanwhile, the development history of Southwest Jiaotong University is introduced according to the campus situation of Southwest Jiaotong University, so as to improve students' cognition and identity of the university and to look at themselves in a correct way.
4	Civil engineering construction and decision	2	Theoretical teaching; Teaching method, discussion method, extracurricular independent learning method	Through learning in the process of engineering construction, students can know which behaviors will violate laws and regulations, so that students can consciously abide by professional ethics and norms in engineering	1. Interpret the Wenzhou bullet train accident from beginning to end, so that students can understand the insurmountability of professional ethics and laws and regulations in engineering practice. 2. Analyze the work content and process of supervision engineers to deepen students' awareness of awe of law.

				practice and have legal awareness.	
5	Civil engineering construction and decision	2	Theoretical teaching; Teaching method, discussion method, extracurricular independent learning method	Combined with the earthquake situation in China and the flood, mudslide and other disaster news around the students, inspire students' awareness and enthusiasm to study hard, solve people's problems and serve the society.	1. Analyze the serious consequences of "5.12" and multiple earthquakes in Sichuan on local economy and development, cultivate students' ability to solve problems with engineering consciousness, and stimulate students' enthusiasm to study hard and serve the society. 2. In combination with three major flood disasters in Jintang County in 2013, 2018 and 2020, let students understand the importance of civil engineering to the people and society, and enhance their professional recognition. 3. Combined with the recent events such as the high-speed mudslide and collapse in Yaxi, cultivate students' ability to solve problems with engineering consciousness, and stimulate students' enthusiasm to study hard and serve the society.
6	Green civil engineering and building energy conservation	2	Theoretical teaching; Teaching method, discussion method, extracurricular independent learning method	Combined with examples, students can develop a people-oriented design concept in the design process, guide them to develop a serious and responsible working attitude, and enhance their sense of responsibility, overall situation awareness and core awareness.	1. Discuss with the students the development direction of the future architecture, guide the students to develop the people-oriented design concept in the design process through the description of the students' future living and working environment, and at the same time plant the concept of green and energy saving in the hearts of the students. 2. Taking "Sichuan West Green Science and Technology Co., LTD." as an example, to broaden students' vision and employment concept, and guide students to develop a serious and responsible working attitude.
7	BIM technology in civil engineering	2	Theoretical teaching; Teaching method,	Through the development of BIM technology in China civil engineering,	1. Taking the development history of the "Digital Architecture Application Research Center" of the University and the employment development track of the staff as an example,

management	discussion method, extracurricular independent learning method	students are encouraged to pursue hard work and innovation, combine their personal dreams with the Chinese dream, and realize their dreams of life.	students can understand the development process of BIM technology in China's civil engineering. 2. Taking the employment situation of previous graduates as an example, students are encouraged to pursue hard work and innovation, combine their personal dreams with the Chinese dream, and realize their dreams in life.

2.3 Reasonable Use of Six-Step Teaching Method, Make Good Use of Teaching Evaluation Mechanism

This course adopts the six-step teaching model of "raising questions (creating situations), discussing problems, introducing hot topics, constructing new knowledge, applying concepts and evaluating and reflecting on effects". It introduces a large number of real-time, hot topics and familiar surrounding news and facts to enhance students' sense of involvement and desire for inquiry in the form of pictures and videos.

The teaching activities in the introduction stage are dominated by interactive discussion between teachers and students, while the construction stage is dominated by lecturing, heuristic and interactive, so as to ensure students' high participation and enthusiasm in the whole teaching process.

2.4 Analysis of Teaching Content and Ideological and Political Elements into the Integration of the Establishment of "Curriculum Ideological and Political" Case Base

The "N+1" whole process teaching evaluation mechanism is adopted, where "N" represents each chapter homework and small papers. Such assessment will be conducted no less than 5 times in a semester, accounting for 70% of the final grade. "1" represents the study report at the end of the term, which cancellations the previous unreasonable assessment method of "one final year fixed for half a year". The setting of teaching evaluation is based on the teaching objectives and content of this chapter, combined with the personal situation of students, the learning results are submitted in the form of small papers and submitted to the network teaching platform as part of the final evaluation of the course.

3. The Promotion and Application Effect of the Results

(1) The degree of classroom activity and academic challenge has been significantly improved, and the students' independent thinking ability and competitiveness have been comprehensively enhanced. The teacher-student interaction throughout the class has greatly enhanced the students' participation in class. According to the data of the supervision departments at all levels of the college, the students' participation in this course has reached more than 90%. The self-confidence cultivated in class greatly increases the enthusiasm of students to participate in various sports and professional competitions. During the freshman year, students of this major participated in the National Mathematics Competition for College students, the National Mathematical Contest in Modeling for College students, the National

English Competition for College students, the “Internet +” Innovation and Entrepreneurship Competition for college students and various kinds of university-level competitions.

(2) The teacher team focuses on curriculum construction and classroom reform and innovation, and has achieved a lot. In December 2020, this course was successfully applied for the demonstration course of “Curriculum Ideology and Politics” in universities of Sichuan Province in 2020. According to the construction method of this course, the teachers of this course team built another course, “Principles of Concrete Structure Design”, and successfully won the first prize in the school lecture competition. The teachers of this course successfully applied for Sichuan Provincial First-class Social Practice Course in 2020 by virtue of BIM Advanced Engineering Application Analysis; In recent three years, members of the faculty team have successfully applied for 6 vertical projects of the provincial Department of Education (including 1 first-class major in Sichuan Province), 6 provincial central projects, led the students to successfully set up 3 national big innovation projects and 9 provincial projects, and actively guided the students’ teams to participate in the “Internet +” college students Innovation and entrepreneurship competition.

(3) The curriculum reform and innovation is of high extensibility and value, and has been widely promoted in the university. The construction idea of this course has been unanimously approved by the academic Affairs Office of our school and all departments, and has been widely extended to other majors in our school. Team members and teachers have participated in the course construction sharing meetings organized by the school for many times to share their experiences in course construction, and have been to other universities for exchange and sharing on behalf of our school for many times.

4. Conclusion

The construction of first-class application-oriented curriculum should take the output as the guidance to design the curriculum teaching objectives, arrange the curriculum teaching content according to the teaching objectives, design the curriculum evaluation system, complete the concrete realization of the teaching contents through scientific and reasonable teaching methods and teaching means, and fully integrate the ideological and political education objectives of “educating people for the Party and educating talents for the country” into the whole process of curriculum design. Only in order to achieve the training goal of applied talents.

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Introduction to Civil Engineering, (Project No. YLKC2022035).

References

Bin, Z.-Y., Zhou, J. H., Li, W., & Chen, Y. (2019). Teaching Design and Practice of Practical Courses Based on CDIO Concept under the Background of new engineering. *Education Modernization*.

Chen S.-M. et al. (2011). Simulation and analytical techniques for construction resource planning and scheduling. *Automation in Construction*. https://doi.org/10.1016/j.autcon.2011.05.018

He, Z. M., & Liu, J. H. (2011). Discussion on Teaching Reform of Introduction to Civil Engineering in Universities. *Science and Technology Information*.

Zhang, X.-S. (2020). *Research on the achievement of Graduation Requirements for Engineering Education Certification*. Nanjing: Southeast University.