Research on the Teaching of "Specialized Innovation and Integration" under the Background of Digital Education

--Take the Identification of Concrete Structure and Calculation of Reinforcement as an Example

Nan Mou*

Shandong Huayu University of Technology, Dezhou, 253034, China

*Corresponding author's email: 1079077164@qq.com

Abstract. Under the background of digital education, new challenges have been raised to the curriculum teaching of "specialized innovation and integration". Taking the course of concrete structure mapping and reinforcement calculation as an example, this paper expounds the course teaching reform plan from the aspects of refining the course teaching objectives, optimizing the teaching design and integrating the course content. It aims to combine professional knowledge with innovation and entrepreneurship education, cultivate students' innovation consciousness and improve students' innovation ability, and has certain significance for cultivating talents with innovation consciousness and innovation ability.

Keywords: digital education; specialized integration; assets; teaching research

1 Introduction

In 2018, the Opinions of The State Council on Promoting High-quality Development of Innovation and Entrepreneurship to Create an upgraded version of "Mass Innovation and Entrepreneurship" pointed out that innovation is the first driving force for leading development and the strategic support for building a modern economic system, and it is necessary to continue to strengthen innovation and entrepreneurship education for college students; In September 2021, The State Council issue <The Guiding Opinions of The General Office of the State Council on Further Supporting College Students' Innovation and Entrepreneurship>,pointed out that college students are the new force of mass entrepreneurship and innovation, innovation and entrepreneurship education should run through the whole process of talent training, enhance the innovative spirit and entrepreneurial consciousness of college students, and encourage teachers to carry out appropriate teaching reform. In the report on the work of the Government in 2024, it is proposed to vigorously develop digital education. Under the background of digital education, it has become an important task for colleges and universities to deeply

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integrate innovative education and professional education, build specialized and innovative integrated demonstration courses, and deepen teaching reform[1-3].

The course of Concrete structure drawing and reinforcement calculation is basic Courses in Discipline for Engineering Management Major. It covers the structure chart reading and reinforcement structure of Frame column, frame beam, shear wall and other structural members; Through the study of this course, students can master the knowledge of reinforcement structure, have the ability to consult the atlas, and cultivate students' innovative consciousness and independent learning ability; But the knowledge points of the course are more, the content is more abstract, the single teaching mode can not meet the requirement of education personnel training in the new era. Therefore, it is necessary to carry out student-centered teaching reform in teaching.

2 Curriculum Teaching Reform Plan

2.1 Refine the Course Teaching Objectives

The teaching goal of this course is to cultivate students' abilities in four aspects: knowledge (theoretical knowledge, practical skills), emotion (sense of mission, responsibility), intention (engineering awareness, communication ability), and action (participation belief, practical experience).And then determine knowledge goals (professional knowledge, professional skills, etc), ability goals (learning methods, working methods, etc), and quality goals (solidarity and cooperation, professional ethics, etc).

Knowledge Object.

Able to consult 22G101 atlas, read concrete structure construction drawings, master the knowledge of steel structure; Applying the knowledge of concrete structure flattening, solving practical engineering problems from multiple angles.

Ability Object.

Cultivate students' ability to read the construction drawing of concrete structure and calculate the amount of steel works; Cultivate students' awareness of "questioning", and improve students' ability to find and solve problems.

Quality Object.

The educational object is to train students to solve practical engineering cases from a new Angle and with new methods, stimulate students' innovative spirit, and put forward solutions with theoretical knowledge. And it cultivates students' habit of strictly observing various standards and norms, enhances the awareness of abiding by discipline and law, and cultivates good professional ethics.

2.2 Optimized the Design of Course Teaching

In the teaching, the existing teaching design is optimized, and the teaching implementation steps of "one three three" are adopted. It closely focuses on the teaching goal of "cultivating students' innovative consciousness and improving students' knowledge application ability", and divides the teaching process into three parts: "Pre-class + Mid-class + Post-class". The teaching process is divided into three steps: "speaking + introducing + practicing"[4] (As shown in Figure 1).

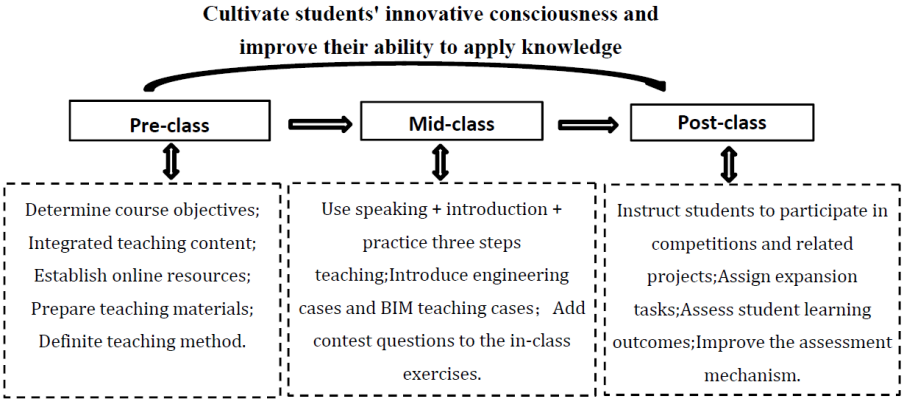

Fig. 1. The teaching implementation steps of "one three three".

Before each class, the teacher first determines the sub-course objectives according to the overall course objectives, and integrates the teaching contents according to different course objectives; Secondly, establish the corresponding online resources and prepare the teaching materials of this lesson; Finally, according to the teaching content to determine the appropriate teaching methods. Introduce engineering cases and BIM teaching cases into classroom teaching, and guide students to consult related atlas; The relevant subject competition questions are integrated into the online practice, and the students' grasp of knowledge is timely counted. In the Post-class stage, by guiding students to participate in relevant discipline competitions, assign expansion tasks, and other activities to cultivate students' innovation ability and evaluate students' learning results.

2.3 Reorganize the Course Content

According to the teaching objectives, the teaching content is integrated, and the course is divided into three parts: concrete structure drawing, concrete structure and reinforcement engineering quantity calculation, and knowledge expansion. And the content of each section supports the teaching objectives of the course (As shown in the Table 1).

Table 1. The supporting relationship between course content and course teaching objectives.

Course content	Course teaching objective
Identification of concrete structure and reinforcement construction	Students can consult the 22G101 atlas, read the flat construction drawings of concrete structures, master the knowledge of steel structure, and solve practical engineering problems from multiple angles.
Case study of concrete structure	Cultivate students' ability to read the construction drawing of concrete structure and calculate the amount of steel works.
	Cultivate students' "question" awareness, improve the ability to find problems and solve problems.
Knowledge extension part, the introduction of cutting-edge engineering knowledge	Train students to solve practical engineering cases from a new Angle and with new methods, stimulate students' innovative spirit, apply theoretical knowledge to propose solutions, and cultivate students' innovative ability.
	Cultivate students' habit of strictly observing various standards and norms, enhance the awareness of abiding by discipline and law, and cultivate good professional ethics.

2.4 Integrated Teaching Method

In the course of teaching, the main use of case method of instruction, situational teaching (Job simulation), group discussion and other teaching methods of integration. By applying these teaching methods, the participation rate of students can be improved. It can also integrate practical engineering cases into the curriculum, cultivate students' innovation awareness, and the ability to adopt new methods to solve engineering problems, and improve professional ability.

The case method of instruction.

The course adopts the teaching method of "one knowledge, one case", links a project case behind each main knowledge point, combines the course knowledge point with the project case, and improves the students' knowledge application ability. In the application of case teaching method, the selection of cases is the foundation and the primary task[5]. Therefore, in the selection of cases, according to the principle of "current, cutting-edge and typical", try to choose relatively novel, representative engineering cases that are in line with the frontier of the discipline as classroom teaching cases. For example, when explaining the knowledge of reinforcement structure, add the latest and typical actual engineering accident cases. In this way, students can think about the causes of engineering accidents in combination with what they have learned, think about the remedial methods of accidents from multiple angles, and cultivate students' innovation awareness and innovation ability. At the same time, the cause of the accident is discussed through the case, the importance of engineering ethics is emphasized, and the students are guided to reflect on their own learning and behavior from the case, and the safety awareness is strengthened.

Situational Teaching Method.

In the teaching, students are asked to play roles and analyze the knowledge goals that need to be achieved in learning from the perspective of different positions in the industry. In teaching, we cooperate with off-campus enterprises and organize students to visit off-campus construction enterprises, so that students can combine theoretical knowledge learned in class with actual work scenes, make abstract concepts concrete, deepen understanding and memory, and cultivate students' career interest and career identity, and enhance career planning awareness; Contact enterprise personnel to record on-site videos, combined with on-site videos in classroom teaching, can intuitively demonstrate engineering operations and processes, so that abstract learning content becomes concrete and vivid, not only can learn new materials and new processes of enterprises, cultivate students' innovation consciousness, but also improve students' learning interest.

Group Discussion Teaching Method.

The course adopts the group discussion method and is divided into two situations in class and after class. First of all, students will be divided into groups in advance. In class teaching, after the teacher finishes teaching the knowledge points, students will carry out exercises such as identifying pictures and consulting atlas. Group members can brainstorm and solve the problems they encounter together to improve students' innovation ability. At the same time, students solve problems through their own thinking, which can improve students' independent initiative[6]. Secondly, teachers assign group tasks after class, which requires division of labor and cooperation among members of the group to complete. The group leader is set as a teaching assistant. In daily communication with classmates, teaching assistants can timely understand students' learning problems and give feedback to teachers[7]. At the same time, the assessment method of group tasks is set up, which is composed of teacher assessment + intra-group assessment + inter-group assessment + self-assessment, which can not only diversify the assessment methods, but also improve the participation rate of students.

2.5 Renew Teaching Methods

The course adopts OTO（Online to Offline）, BIM assisted teaching, teaching assistant mode and other diversified teaching methods.

OTO (Online to Offline).

Most traditional teaching methods adopt a single offline teaching, and students' subjective initiative is poor. The hybrid teaching mode of "online + offline" can give full play to the advantages of both online and offline teaching, and students can change from passive learning to active learning, with rich learning content and diverse learning activities, thus improving the effect of teachers' teaching and students' learning[8].

First of all, according to the characteristics of the course and students' learning situation, teachers integrate knowledge points and establish online resources on the Super Star learning platform; At the same time, the online preview task is issued to check the students' preview situation. Secondly, the classroom teaching adopts the form of offline teaching and online interaction. At the same time, classroom activities such as in-class exercises, quick answer, and selection are distributed to stimulate students' interest in learning and improve their class participation rate. Finally, teachers combine offline classroom teaching to continuously improve online resources, and distribute online group tasks and homework after class.

BIM Assisted Teaching.

BIM technology can realize visual simulation, and quickly optimize design schemes through computer technology analysis and screening[9]. Therefore, adding BIM to the teaching can improve the teaching effect by taking advantage of the visibility of BIM.BIM can establish a three-dimensional model of the engineering structure, reflecting each link of the engineering construction and the reinforcement structure of the component nodes.

The teaching content of the course of Identification of concrete structure and calculation of reinforcement includes many steel bar connections of structural nodes and reinforcement layout in components, which are relatively abstract and cannot be understood by students' imagination alone(As shown in Figure 2).In teaching, according to the needs of the course, BIM virtual simulation technology is introduced into some difficult steel bar structures, BIM models are established, and the steel bar structures of different components are visually displayed to students(As shown in Figure 3).

As can be seen from FIG. 2 and FIG. 3, compared with traditional 2D pictures, the node reinforcement diagram modeled by BIM is more intuitive and easier for students to learn and understand.

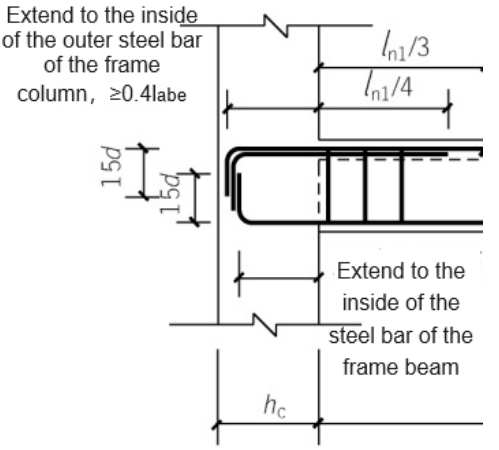

Fig. 2. The Beam and column joint reinforcement structure diagram(2D).

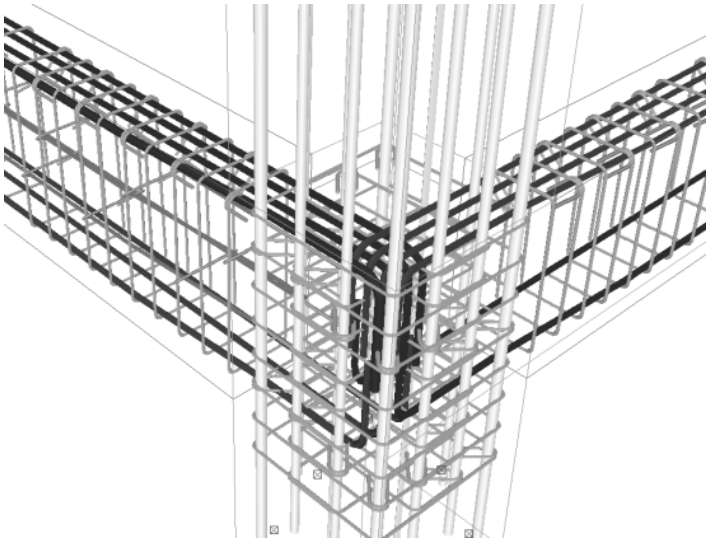

Fig. 3. The Beam and column joint reinforcement structure diagram(3D).

The effect of BIM assisted teaching is not only reflected in students' passive absorption of classroom knowledge, but also in stimulating students' initiative and initiative. Some students in their spare time, combined with other related courses, use BIM software to model the components not explained in class, and use Revit software for visual display to help them expand extracurricular knowledge.

2.6 Refine the Course Assessment Mechanism

Course assessment is the test of the teaching effect of the course. The traditional assessment focuses on the final assessment, and the assessment mode is fixed and single[10]. On the basis of the traditional assessment, according to the teaching objectives, the specialized and integrated course is evaluated from the three aspects of "Knowledge(K) + Ability(A) + Quality(Q)" to form a multiple assessment mechanism(As shown in Figure 4).In the assessment, the use of modern educational means to mobilize the participation of students. For example, through the online platform to distribute homework, complete the online "teacher issue homework-student answer-student evaluation-teacher comments" link, not only can save teachers' time, but also can mobilize the enthusiasm of students, students can also learn from each other, improve the sense of teamwork; At the same time, the results of students participating in relevant discipline competitions and innovative projects are introduced into the quality assessment; Finally, open questions such as engineering design are introduced into the final assessment to test students' innovative consciousness, knowledge application ability and problem-solving ability.

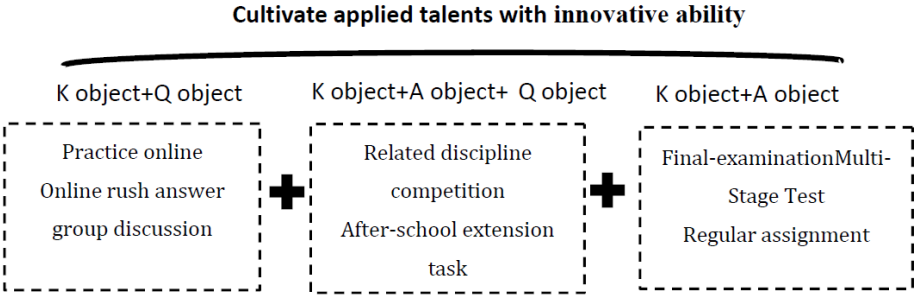

Fig. 4. The main correspondence between multiple assessment and curriculum objectives.

3 Teaching Effect

This course is mainly offered in the engineering management major. After a round of teaching, the participation rate of the students in the two classes of the engineering management major has made obvious progress in the competition. First of all, through the course learning, students' innovation awareness and innovation ability have been improved, and some students have actively applied for the comprehensive practice and innovation projects of college students organized by the school; At the same time, the students' knowledge level and teamwork ability have also been improved, and they have successively participated in the National Digital Innovation Application Competition, the 10th National College BIM Graduation Design Innovation Competition and other relevant discipline competitions. Among them, the number of participants in the 10th National College BIM graduation Design Innovation Competition (on-campus selection competition) reached 100% of the number of courses; Secondly, through the recorded attendance, the number of speeches, participation in group discussions and other aspects, students' attendance can reach almost 100%.In addition, after class, I would consult relevant literature, watch online supplementary videos, take the initiative to find additional learning resources, form the consciousness of independent learning, and find that students' enthusiasm to participate in course activities has been improved.

4 Conclusions

The essence of "Specialized Innovation and Integration" is the organic integration of professional education and innovation and entrepreneurship education. Taking the course of concrete structure drawing and reinforcement calculation as an example, this paper expounds how to improve the teaching mode of "specialized innovation and integration" under the background of digital education. First of all, the object is divided into knowledge object + ability object + quality object, and then according to different teaching objects, the teaching content is integrated, the teaching design is optimized, different teaching methods and teaching means are adopted, and diversified assessment is carried out, and finally, professional talents with innovative ability

are cultivated. Through the teaching and research of "specialized innovation and integration" course, the aim is to promote the docking of college education and social needs, cultivate talents with creativity and innovation ability, and provide talents support for social innovation and development. It is hoped that it has certain significance for the curriculum construction of related majors and promoting the innovation and development of higher education.

Fund Project

Shandong Huayu University of Technology "specialized innovation and integration" course.

References

1. Optimization of education model in application-oriented colleges and universities from the perspective of innovation and integration [J]. Zhao Chunyu, Wu Yujing, Fan Kesheng, Tang Yan, Song Ningning. Journal of Dezhou University.2022, 38 (06).107-110.
2. Exploration on the Mode, Path and Method of the Integration of Specialty and Innovation in Application --oriented Universities--Taking the College of Biochemical Engineering of Beijing Union University as an Example[J]. Duan Huiqin, Shen Xiaoping. Journal of Beijing Union University.2020,34(4):7-13.
3. Practical Research on the Cultivation of Innovation and Entrepreneurship Ability of Computer Majors from the Perspective of “Integration of Specialty and Innovation” [J]. Hou Rong xua, Liu Yongb, Zhang Pi-zhena, Tian Feng, Hao Xueyan. Journal of Shenyang Institute of Engineering (Social Sciences).2023,19(3):133-137.
4. Exploration and application of teaching method of "Plain Law reading and reinforcement calculation"[J]. Guo Chunhong, Science and technology style, 2022(26):115-117.
5. Study on the application of case teaching method in "Controlled detailed planning" under OBE concept[J].Gou Nana,Liang Xinbin,Zhou Baojuan, Ma Keli, Wang Qiudi. Education Science & Culture Magazine. 2024(09): 99-102.
6. Farimani Nasser Motahari, Parsafar Pedram, Mohammadi Shiva. Evaluation performance of time series methods in demand forecasting: Box-Jenkins vs artificial neural network (Case study: Automotive Parts industry) [J]. Journal of Statistical Computation and Simulation, 2022, 92(17).
7. The Exploration of Student Assistant Teaching in Higher Vocational Class of New Energy Vehicle [J]. Zhou Xiaohong, Wang Xiaolan. Times Automobile. 2023(13): 73-75.
8. The auxiliary function of college online teaching resources from the perspective of learning psychology [J]. Li Yuexian, Chen Xiaopu, Liang Ruiming. Journal of Yan'an Vocational & Technical College. 2023,37(06): 23-27.
9. The Auxiliary Role of BIM in the Course Teaching of “Concrete and Masonry Structure Design” [J]. Chen Xudong Ou Weibing. Science and technology style. 2022(19): 34-36.
10. Curriculum Reform of Data Visualization Technology and Application Course Based on the “Integration of Specialization and Innovation” [J]. Yu XiaoDong, Wang Yuefei, Zeng Yu. The Theory and Practice of Innovation and Entrepreneurship. 2024, 7(02): 28-32.