



Reform and Exploration of Ideological and Political Education of Construction Technology Course Based on Virtual Simulation Platform

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Abstract. Curriculum Civics is an effective way to cultivate talents of "New Engineering" with Chinese characteristics in the new era. With the continuous reform of the new engineering curriculum and the continuous upgrading of construction technology, the teaching of the "Construction Technology" course by traditional methods can no longer meet the needs of the teaching objectives. This paper is based on the virtual simulation platform, through the combination of virtual simulation technology and course ideology teaching practice, to strengthen students' theoretical learning of construction technology and the cultivation of practical application ability, to learn the latest construction technology, principles and methods in the scenario teaching, to understand the development of the society, to build the spirit of craftsmanship. At the same time, through the introduction of the characteristics and advantages of the virtual simulation platform, in-depth discussion of the improvement of teaching methods, assessment of teaching effects, explore the promotion of the teaching reform of the integration of the course Civics and virtual simulation technology applied in the course of "Construction Technology".

Keywords: course ideology; virtual simulation; teaching reform; construction technology

1 Introduction

The new round of industrial upgrading has put forward higher requirements for the cultivation of civil engineering talents. The talents of "new engineering" adapted to the needs of the new era must have strong practical ability and innovation ability, and should have the spirit of serving the needs of socialist construction with Chinese characteristics. As a core course of civil engineering, Construction Technology is of great significance to cultivate students' practical ability and professionalism. However, the traditional teaching mode has problems such as theory being detached from practice and low acceptance of students. Through the computer virtual simulation platform for forward design, simulation of the construction process can improve students' practical ability, and experimenting and trying new methods in the virtual environment can also

cultivate innovation ability. In this paper, we will explore the reform of the Civics teaching of the course "Construction Technology" based on the virtual simulation platform to meet the demand for high-quality composite talents in the field of engineering in the new era.

2 Analysis of the Current Status of the Teaching of the Course "Construction Technology"

The course "Construction Technology" focuses on the selection and application of construction technology, construction methods and related construction machinery in the construction of buildings, bridges and roads. The teaching objective of the course is to enable students to master the basic knowledge and basic theory of civil engineering construction, and to enable students to have the preliminary ability to analyse and deal with civil engineering construction technology and construction problems.

Problems with the current teaching methods mainly include the following: (1) The traditional Construction Technology course tends to focus on the teaching of theoretical knowledge, while there is relatively little content on practical construction operation and management. This leads to a disconnect between theory and practice, and students lack practical operational skills and need a longer period of time to adapt to the actual work requirements after graduation. (2) The knowledge and technology of civil engineering are constantly updated and developed, but the updating of traditional teaching materials and course content has a certain lag, resulting in the knowledge learnt by students can no longer be adapted to the needs of modern engineering practice. (3) Modern construction management often requires the use of a variety of technical tools, such as project management software, virtual simulation platform, etc., the current curriculum does not adequately teach students how to apply these tools. (4) The traditional teaching mode often focuses on the transfer of knowledge, but ignores the value of leadership, and it is difficult to achieve the fundamental task of "cultivating moral integrity".

3 The Significance of the Application of Virtual Simulation Platform in the Course of Construction Technology

Virtual simulation teaching refers to a new type of teaching mode that adapts traditional teaching to the development of new technologies and cultivates modern talents^[1]. By using computer technology and virtual environments to simulate actual scenes, it makes up for the limitations of the teaching environment and teaching conditions, and allows students to participate in virtual experiments, simulation operations, or interactive tasks in order to achieve teaching goals. The purpose of this teaching method is to provide students with opportunities for practical operation, experimentation, training and learning, to stimulate learning interest, to guide students to use their imagination and to enhance their innovative thinking. It is specifically reflected in the following aspects:

3.1 Virtual Construction Environment

The virtual simulation platform can simulate a variety of construction scenarios, including building construction, bridge construction, road construction, etc., to provide students with a virtual experience of the actual construction environment. At the same time, there is no need to worry about safety risks when simulating dangerous construction operations in the virtual environment. Because there is no need to use actual resources or equipment, virtual simulation also reduces the cost of experiments and practical training.

3.2 Improvement of Instructional Design and Methods

Through the virtual simulation platform, teachers can flexibly design the course content and practical training tasks so that students can carry out practical exploration in the virtual environment. Teaching methods such as case teaching and project simulation are adopted to combine theoretical knowledge with actual engineering projects to stimulate students' learning interest and enthusiasm.

3.3 Developing Practical Decision-making Skills and Improving Overall Quality

The virtual simulation platform allows students to participate in decision-making on construction projects, thus developing their project management and problem-solving skills. Students can simulate different construction scenarios and assess the risks of different scenarios. The platform will provide real-time feedback to help students understand how their decisions and actions affect the construction outcome. Students will be able to better understand the concepts, principles, and methods of construction technology, which will promote learning outcomes and improve overall competence.

4 Implementation of Civic and Political Teaching Reform for the Course "Construction Technology" Based on the Virtual Simulation Platform

The reform of the Civic and Political teaching of the construction technology course based on the virtual simulation platform mainly includes the steps of clarifying the teaching objectives, selecting the appropriate virtual simulation platform, designing the teaching cases, implementing the interactive teaching, and establishing the evaluation feedback. Through the introduction of virtual simulation technology, it can not only enhance students' professional skills, but also make the course Civic and political education more vivid and intuitive, and help students establish correct values and social responsibility [2].

4.1 Clarifying Teaching Objectives and Points of Integration of the Curriculum's Ideology and Politics

Integration of Knowledge Objectives and Civics: To master the basic theories, methods and skills of building construction, and to understand the development trend of new construction technologies, techniques and materials. When explaining the history of the development of construction technology, integrate the brilliant achievements made by China in the field of building construction, such as the construction of high-speed railway, the Hong Kong-Zhuhai-Macao Bridge and other super projects, to guide the students to feel the speed of China, the power of China, and to enhance the sense of national pride and confidence in the road. When introducing new technologies, techniques and materials, students are guided to pay attention to the development trend of the industry and set up an ambitious ideal of serving the country with science and technology by combining the requirements for the transformation and upgrading of the construction industry in the National Fourteenth Five-Year Plan and the Vision 2035 Outline [3].

Integration of competence objectives and ideology and politics: to have the ability to use the virtual simulation platform to carry out construction programme design, construction process simulation and construction problem analysis, and to improve the ability to solve practical engineering problems. Real engineering cases, such as earthquake relief and post-disaster reconstruction, are set up in the virtual simulation platform to guide students to apply their knowledge to solve practical problems and cultivate their sense of social responsibility and mission. In the process of construction plan design and problem analysis, the importance of teamwork is emphasised to guide students to establish the spirit of collectivism, cultivate communication and coordination ability and teamwork consciousness.

Integration of quality objectives and ideology and politics: Cultivate students' engineering literacy, professional ethics, teamwork spirit and sense of social responsibility, and set up correct values and professional views. Through the virtual simulation platform to simulate the safety hazards and quality problems in the construction process, students are guided to establish the awareness of "safety first, quality first", and cultivate students' sense of professional ethics and engineering ethics. In the course, the ideological essence of honesty and justice in Chinese traditional culture is integrated into the course to guide students to establish the craftsmanship of honesty, trustworthiness and excellence.

4.2 Selection of a Suitable Virtual Simulation Platform

At present, there are a wide variety of virtual simulation platforms that can be applied in the course of Construction Technology, covering a variety of aspects such as BIM, construction process simulation, safety management, etc., as shown in Table 1. In the teaching process, a suitable virtual simulation platform should be selected according to the content of the course unit to ensure that the platform has sufficient functional support, such as the possibility of construction simulation, quality inspection, safety management, etc. At the same time, it can be embedded in the Civic and Political

Teaching Module, such as engineering ethics, social responsibility, and environmental protection awareness, etc^[4].

Table 1. Types of virtual simulation platforms

Form	Platform name	Key function	Applicable Scenarios
BIM-type virtual simulation platform	Autodesk Revit + Navisworks	Building information modelling, construction process simulation, collision detection	Construction process, construction conflict resolution
Comprehensive virtual simulation platform	PKPM Construction Simulation System	Construction programme optimisation, construction schedule control	Construction process simulation and management
Construction Safety and Quality Management Category	Luban Software Virtual Simulation Platform	Construction process simulation, safety management module	Construction risk modelling, quality control
Construction process simulation platform	Midas Virtual Simulation Platform	Infrastructure construction simulation	Bridge construction process simulation

4.3 Designing Cases of Integration of Civics into Classroom Teaching

Actual engineering cases are introduced according to the teaching content, and specific Civic and political education tasks and virtual simulation tasks are designed to allow students to practise in a simulated construction environment, so that they can better understand the relationship between construction technology and social responsibility, environmental awareness, laws and regulations, etc. ^[5]. The teaching content, teaching cases, and the integration points of ideological and political elements are shown in Table 2.

4.4 Implementation of Classroom Teaching and Virtual Simulation Interaction

In the classroom teaching of Construction Technology, virtual simulation technology helps students to improve their practical ability by simulating the teaching contents of waterproofing, concrete engineering, formwork engineering and green building construction. In the task design, it is integrated into the ideology and politics of the course, such as social responsibility, professional ethics, safe construction, environmental protection, innovation and sustainable development concepts, so as to cultivate students' professional skills and vocational literacy. The design of virtual simulation tasks and Civics integration points in combination with teaching content are shown in Table 3.

Table 2. Cases of Civic and Political Elements Integrated into Classroom Teaching

teaching case	Integration point of Civic and Political Elements	Teaching content	Virtual simulation task design
Fuzhou Metro "Worker's Fall"	safe production	Construction safety management norms	Students use a virtual simulation platform to simulate construction site safety inspections, identify potential safety hazards and propose improvement measures.
Beijing Daxing International Airport	Green construction and sustainable development	Green construction technology	Students design a green construction programme in the virtual simulation platform, which requires the use of energy-saving materials, renewable energy sources .
Hong Kong-Zhuhai-Macao Bridge (HZMB)	The spirit of innovation and national engineering	Construction management in complex environment	Students simulate the construction process of a cross-sea bridge in a virtual simulation platform to solve technical problems in a complex environment.

Table 3. Virtual Simulation Task Design and Civic Integration Points

Teaching content	virtual simulation tasks	Civic Integration Point
waterproofing	Simulate waterproof construction, select waterproof material and observe the construction effect.	Social responsibility, professional ethics
Concrete works	Simulation of the concrete pouring process, selection of proportions and construction techniques	Construction quality, safe construction, environmental protection
Formwork	Simulate the process of formwork installation and removal, select the appropriate type of formwork and observe the installation.	Construction safety, quality control, innovation
Green Building Construction	Simulate green building design and construction, select energy-efficient materials and technologies, and calculate carbon emissions.	Ecological civilisation building, sustainable development concept

4.5 Conducting Teaching Evaluations

In the course of Construction Technology, the student evaluation mechanism based on the virtual simulation platform can comprehensively assess the students' technical ability and civic and political literacy, and achieve the optimisation of teaching content through feedback [6]. Teaching evaluation specifically includes three parts: (1) Process evaluation, which monitors students' operation process through background data, for example, paying attention to the construction process and quality control in concrete construction, and giving immediate feedback. (2) Result evaluation, which

requires students to submit an experimental report after the task is completed, stating the task, process data, and conclusions of the virtual construction, etc. (3) Teacher evaluation, which is formulated in advance by the teacher of the class to set up a grading standard. According to the students' performance in the virtual simulation task, give evaluation and give students suggestions for improvement.

5 Conclusion

In the exploration of the Civics teaching reform of the Construction Technology course, the in-depth integration of the virtual simulation platform and the traditional classroom has achieved remarkable results. Through simulation tasks, students practise hands-on exercises, and integrate the civic and political elements such as engineering ethics and social responsibility into technical learning. For example, in waterproofing and concrete construction tasks, students deeply understand the impact of construction technology on society and the environment through the selection of materials and process optimisation, and improve environmental awareness and social responsibility. The process evaluation, result evaluation and feedback mechanism based on the virtual simulation platform comprehensively assessed students' technical ability and civic and political literacy. Teachers provide personalised feedback through data monitoring and task reports to help students reflect on ethical issues in construction and strengthen the concepts of "safety first" and "life first". In addition, students demonstrated their innovative spirit and teamwork ability in green building and post-disaster reconstruction tasks. The reform of the curriculum not only improves students' professional skills, but also cultivates professional ethics and social responsibility, laying a foundation for cultivating high-quality construction talents. In the future, we can further optimise the function of the simulation platform, deepen the integration of Civic and Political elements, and promote the teaching reform to a higher level.

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References

1. Nie Lei: Research on teaching reform of practical training course of garden engineering construction technology based on virtual reality simulation technology. *China Journal of Multimedia and Network Teaching*(11),19-21(2021)
2. Lu Li, Xie Qiang, Zhu Zhengwei:Exploration and Practice of Civic Teaching Programme Design for Engineering Professional Course Curriculum---Taking Geotechnics Course as an Example. *Higher Construction Education*30(3),108-113(2021)
3. Han Shi, Zhang Chao: Reform of Civics Teaching in Construction Organisation Design Course Based on BIM Technology. *Western quality education*10(07):68-72(2024)

4. Yin Huanhuan, Yuan Hongsheng: Research on teaching reform of assembly structure construction course based on BIM and VR technology. *Journal of Langfang Normal College (Natural Science Edition)*24(04),56-58(2024)
5. Chen Zhihua, Xu Xun, Fan Xiaochun: Exploration and Practice of Civic Teaching in Civil Engineering Construction Course. *Higher Construction Education*32(3),146-152(2023)
6. PENG Lijuan, ZHU Xiaoli: Exploration on the Reform and Implementation of Civic Teaching in Civil Engineering Construction Technology. *Residential and Real Estate*(21),244-245(2021)

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