Higher Education Research
2023; 8(2): 48-55
http://www.sciencepublishinggroup.com/j/her
doi: 10.11648/j.her.20230802.15
ISSN: 2578-9341 (Print); ISSN: 2578-935X (Online)

Teaching Design and Practice of Curriculum Ideology and Politics of Traffic System Engineering Integrating Micro-course

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To cite this article:
Guosheng Ma, Wenxuan Ou, Huahua Liu. Teaching Design and Practice of Curriculum Ideology and Politics of Traffic System Engineering Integrating Micro-course. *Higher Education Research*. Vol. 8, No. 2, 2023, pp. 48-55. doi: 10.11648/j.her.20230802.15

Received: March 19, 2023; **Accepted**: April 20, 2023; **Published**: April 24, 2023

Abstract: In order to promote Curriculum Ideology and Politics construction solidly and continuously, this paper takes traffic system engineering course as example, explores the integration method of theprofessional knowledgeand ideological and political element and proposes the idea of Curriculum Ideology and Politics teaching design. As we know, traffic system engineering is a specialized core course, and the course content focuses on thinking methods. Many professional knowledge points are important and difficult. So Micro-course was recorded. Meanwhile, the characteristic of Micro-coursewas integrated in the Curriculum Ideology and Politics teaching design. And in the teaching design, the spirit of HIT, engineering ethics, and university history are the main ideological and political elements. Scientific and technological figures, the frontier of transportation science and technology and the major projects are carefully selected to tell the Chinese story and teachers should set good example to the student. According to the idea of overall teaching design, two specific design cases are provided in order to make readers understand the implementation process of Curriculum Ideology and Politics teaching design. All of this aim to achieve the teaching objectives of imparting knowledge, cultivating professional competence, and educating student. And it can provide new ideas for the curriculum ideology and politics construction of traffic system engineering course.

Keywords: Micro-course, Teaching Design, Curriculum Ideology and Politics, Engineering Ethics

1. Introduction

System engineering is an organization and management technology that transforms the world in system science [1]. The system engineering studies the system, while the traffic system engineering studies the traffic system. In an all-round view, traffic system engineering studies the various components of the traffic system, analyzes the relationship between them, and seeks the optimal solution [2, 3]. This course focuses on developing students' systematic thinking. Students can apply system engineering methodology to propose, analyze and solve traffic problems.

Now Curriculum Ideology and Politics (CIP) construction of national college is under way [4]. Integration of professional knowledge and ideological and political education is the key and difficult point. In order to integrate ideological and political education into professional knowledge, course team had recorded micro-course considering the character of micro-course. Teaching cases were embedded in course teaching. Meanwhile, micro-course and ideological and political elements were integrated into the teaching case. While students learn the course content repeatedly, they can understand and master the course content. Then students unconsciously accept ideological and political education.

2. Analysis of CIP Elements

2.1. The Spirit of HIT

Harbin Institute of Technology (HIT) has been established for over 100 years and has been closely linked to the fate of the country and the nation since the beginning of its establishment. At the start of the founding of New China, when the Northeast needed to develop heavy industry, a large number of ambitious young people with passions came to the Northeast in large numbers from the four corners of the country and came to HIT.

In the development of HIT, the team of teachers with an average age of only 27.5, which President Li Chang called the "Eight Hundred Warriors" [5]. They were universally known to everyone. They embody the "rooted in the Northeast, patriotic dedication and hard-working" spirit".

HIT has always taken the needs of the country as its mission, never surrender to the technological blockade, and has achieved several key breakthroughs. For example, "Kuai-zhou 1" is an original achievement, the first satellite with fast response capability in China, and has been used in many applications, providing high-quality remote sensing images for many users [6]. After more than ten years of dedicated research, a team from the Space Structure Research Centre of HIT has been immersed in researching for dozens of years to build the 500m aperture spherical radio telescope, known as the FAST [7]. This system is the first of its kind in the world, and all such achievements have been achieved in the spirit of "reform and innovation, striving for excellence".

2.2. EngineeringEthics

Modern engineering is becoming more and more complex. They have deeply influenced people's life and natural environment and raise many engineering ethics problem. Throughout international engineering community, it is the first principle that the safety, health and welfare of the public are always in top priority [8, 9]. All of engineers should observe it.

On the one hand, engineer should firmly grasp professional knowledge, on the other hand, engineer should have engineering ethics literacy based on the above characteristics.

These days, China has the advantage and tradition of concentrating its efforts on projects. Moreover, along with the accelerated industrialization and urbanization process, the rapid growth and application of engineering technology, and the excellent performance of large-scale projects such as aerospace projects, high-speed railways, road, and bridge projects show that China is a big engineering country. China is also gradually changing from a large engineering country to a strong engineering country. Strong is not only reflected in China's maturity in engineering technology but also in the attention and practice of engineering ethics. The awareness of engineering ethics is not inherent [9-11]. Talking about engineering ethics can enhance students' ethical literacy, strengthen social responsibility, establish awareness for the protection of natural ecology, puts public safety, health, and well-being in the first place, and promotes harmonious social development.

3. Overall Design of CIP

3.1. Curriculum Ideology and Politics Teaching Objectives

The development of system science has laid a solid theoretical foundation for the research and development of modern traffic science. System engineering takes system as the object of study, while traffic system engineering takes traffic system as the object of study. Traffic system engineering starts from the whole of the traffic system, studies each component of the traffic system, analyses the relationship between the elements, and seeks the optimal solution for the traffic system so that the overall effect of the traffic system can be optimized. The course focuses on cultivating students' system thinking and the ability to apply system engineering methodology to formulate transport problems, analyze them and solve them. Embedded in the teaching of the course, combined with specific professional knowledge points, the teaching of teaching cases or knowledge points can naturally introduce elements of ideology and politics, sometimes teaching cases and ideology and politics cases can be completely unified, and students are easier to understand and master the content learned, but also unknowingly receive ideology and politics education.

The main tasks of CIP are as follows.

1) To complete the requirements of CIP, it is necessary to integrate the history of HIT, its motto and spirit of HIT, the story of leading talents, and engineering ethics into the course. And it is necessary to adjust and optimize the original teaching objectives, teaching contents, and multimedia courseware to form a synergy.
2) According to the different chapters, different elements of Ideology and Politics are introduced when teaching cases and knowledge points, to ensure that the CIP elements are highly relevant to the cases or knowledge points so that the water can be completed.

3.2. CIP Teaching Design

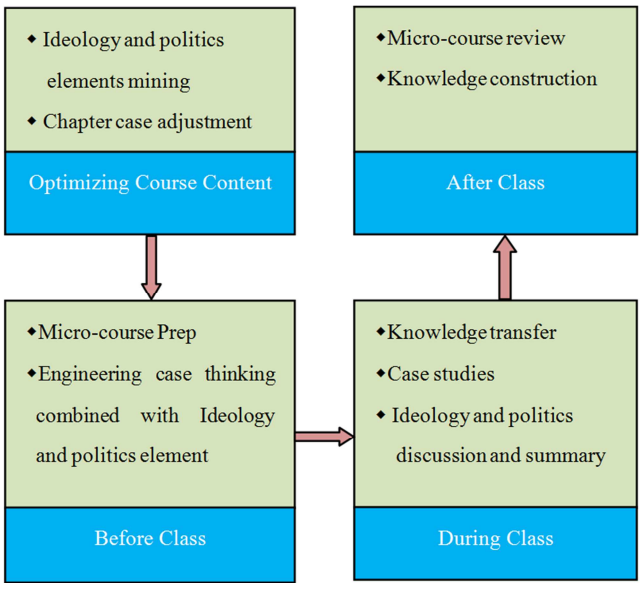

Figure 1. *CIPTeaching Design Ideas.*

The design of this course (as shown in Figure 1) is based on the optimization of the course content by the objectives of the course: the knowledge points or cases of the course are implicitly integrated with the elements of CIP; micro-courses are recorded so that students can preview and review the important knowledge points offline; at the same time,

engineering cases with ideology and politics content are pushed in class, students think about them in advance, discuss them in groups in class and the teacher summaries them.

3.2.1. A Selection of Thought-Provoking Cases Combined with Professional Knowledge Points or Application Cases

Starting with the basic ideas, principles, and methods of system engineering, Trafficsystemengineering explains the development stages of system thinking, the process of transport system analysis, system model construction, system design, system evaluation, and system decision-making. It can be said that the content of the chapters itself contains elements of system thinking, the big picture, cultural confidence, and other elements of thinking and politics. Therefore, by digging deeply and appropriately into the thinking and politics elements, focusing on the value leadership of course teaching in the course lectures, strengthening the orientation of nurturing people, and leading the thinking and values through the whole process of course teaching, a deep integration of professional knowledge and thinking and politics elements can be achieved. That is the integration of the thinking and political elements into the chapters of the course. It is explicitly proposed that students establish a correct outlook on life, values, and worldview through the course and that the goal of ideological and political education is achieved implicitly in the process of teaching the knowledge of professional courses.

The introductory part of this course focuses on the teaching of engineering concepts, system concepts, the formation and development of system ideas, system engineering methodology, and transportation system analysis. For example, when talking about the concept of engineering, the example of the engineering failure was taken, integrating engineering ethics, to strengthen social responsibility and put public safety, health, and welfare in the first place, and promote harmonious social development; when talking about the interaction between systems and elements, the complex system of ballistic missiles and launch vehicles was taken as an example to tell the story of Academician Sun Jiadong, the recipient of the Two Bombs and One Star Medal of Merit of Harbin Institute of Technology and the chief designer of the Moon Exploration Project. When talking about the relationship between natural and man-made systems, the construction and operation of the Tibetan Lalin High-grade Highway and Qinghai-Tibet Railway were taken as examples, integrating engineering ethics into the discussion. The needs of nature and human needs should be combined and considered comprehensively in engineering construction. Engineers should establish the awareness and responsibility of protecting the environment (shown in Table 1).

Table 1. *CIP elements of main chapter.*

Knowledge points	Cases	CIP element
1. Definition of engineering	Engineering failure examples	Engineering ethics: the safety, health and welfare of the public are always in top priority The spirit; dedication, and hard work
2. Interactions between elements	Launch vehicle	The development of a new system embodies the spirit: reform and innovation, striving for excellence
3. System design principle	New system radar	
4. Decision concept and process	Dynamic zeroing policy in China	Engineering ethics: the safety, health and welfare of the public are always in top priority

When it comes to the introduction of gray derivatives in gray system theory, the story of Professor Deng Julong and his pioneering gray system theory is introduced, and through this example, the spirit of the old generation of scientists "reforming and innovating, striving for excellence" is promoted.

System design is different from conventional design in that it requires multiple analyses and syntheses of "goal - function - structure - effect". The system design requires multiple analyses and syntheses to produce the optimal solution. When explaining the principles of system design, take the design of China's first new system radar system for sea detection as an example (shown in Table 1), and tell the story of the development of the new system radar system by academician Liu Yongtan, who won the first prize in the National Science and Technology Progress Award twice and the National Supreme Science and Technology Award in 2018, reflecting the spirit of "reform and innovation, striving for excellence The spirit of "reform and innovation, striving for excellence" is reflected in the story. As a supplement to the teaching cases, students will also be provided with traffic system-related design cases for study.

Depending on the needs, when conducting system evaluation, it is possible to evaluate each alternative individually or comprehensively. When teaching transportation system evaluation cases, engineering ethics is introduced (shown in Table 1), as the evaluation results are related to the personality, talent, and experience of the evaluation subject, etc. The evaluation subject should be honest, and upright and uphold the principles of fairness and impartiality. Traffic system decision-making involves a system decision-making process, classification of decision problems and methods, and correct decision-making produces correct action and good results. When teaching the decision-making process, engineering ethics are incorporated and a case study of "dynamic zero" decision-making in China in 2021 in the face of a new crown epidemic is introduced. 2021 will see a high proportion of asymptomatic infections due to the rampant Omicron BA.2 strain, which spreads rapidly and, if not properly protected, can produce a large number of infections in a short period. Overall, the number of serious illnesses and even deaths caused by the virus will

remain high. The practice has proved that the government's decision of "dynamic zero" is correct and the most economical and effective prevention and control strategy. The case exemplifies the principle of "putting public safety, health, and welfare first" in engineering ethics.

3.2.2. Recording Micro-courses to Enhance the Information of Teaching and Learning

With the introduction of information technology, teaching models are changing. Many online teaching modes, such as MOOC, SPOC, micro-course, and rain classrooms, have been widely adopted [12, 13]. For the time being, there is no MOOC or SPOC course for this course. To achieve the function of highlighting the important and difficult contents of the course and playing the important and difficult contents repeatedly, as well as to ensure the effectiveness of independent pre-study and review by students in class, this course has recorded a micro-course on traffic system engineering by the recording video format and time requirements of the micro-course, to achieve the purpose of teaching basic professional knowledge.

According to the demand of micro-course [14], the content of traffic system engineering course had been divided into many parts. Every part wasn't beyond ten minutes. It was a key or difficult point of one chapter. Before recording course, PPT's page and content of the course should be readjusted. Hardware such as laptop, green cloth, LCD digital screen and page turning pen should be prepared. LCD digital screen is a kind of input device. Using that, Chinese word and formulation are input into the computer easily. It is very helpful for displaying teaching process.

Software such as CourseMaker, Adobe Audition, and Quick Clip should be done too. CourseMaker is a kind of software of making micro-course [15]. Through this software PPT and portrait can be recorded together. Adobe Audition can handle the noise of voice. Because when recording micro-course, good tone quality is not able to be ensured completely. The micro-course-making process is shown in Figure 2.

At the same time, the engineering cases containing the course ideology and politics within the micro-course can be pushed through the micro-course, so that students can watch and think about them in advance, and then discuss them in class to ensure the effect of ideology and politics education.

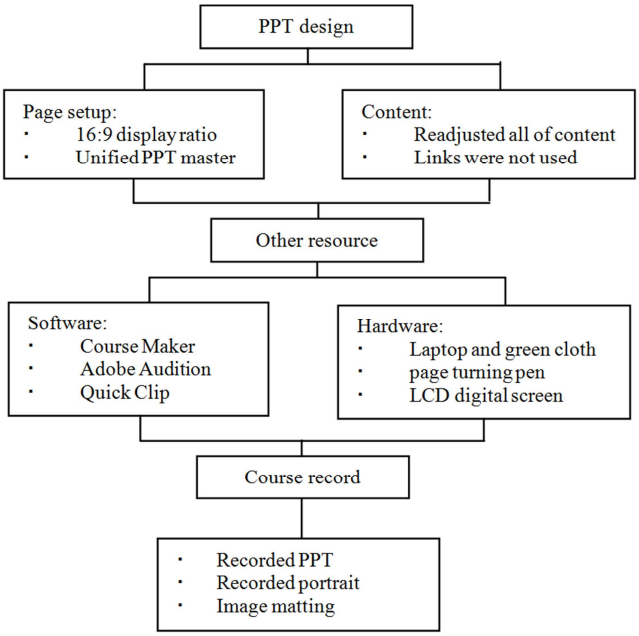

Figure 2. *Recording process of micro-course.*

Table 2. *Basic information of teaching design.*

Basic information	Specification
Teaching content	Engineering & system
Teaching objectives	1. understand the relationship between engineering and technology 2. master the concepts and elements related to system 3. CIP elements: the primary principles of engineering ethics
Education content of CIP	When teaching the concept of engineering, Chinese engineering examples are introduced, with cases of national pride and failures, so focus on engineering ethics.
Teaching methods and measures	The classroom lectures are based on PPT and supplemented by board books. For the engineering cases introduced, heuristic teaching methods are used to guide students to think about the importance of engineering ethics.

4. The Specific Case of Teaching Design

4.1. Case One

The basic information of the first case of teaching design is shown in Table 2. The teaching time is about 20 minutes.

The teaching process is as follows:

1. Pre-class micro-course push

Course preview and review after class.

2. Engineering and technology

1) Engineering concepts

Engineering in a broad sense: It is the process of collaborative activities carried out by a group of people to achieve a particular purpose over an extended period cycle. The example is shown in Figure 2 and Figure 3. Pictures are from internet.

Engineering in a narrow sense: It specifically is the process of bringing together and constructing some existing entities (natural or man-made) into man-made products of expected use value by applying various relevant knowledge and technical means, mobilizing multiple natural and social resources, and through the mutual collaboration of a group of people, to satisfy human needs as the point. Generally, the engineering we discuss is the engineering in a narrow sense.

China moves from a large engineering country to a strong engineering country. The successful examples are shown in Figure 5. The picture is from internet.

Figure 3. *Aerospace engineering.*

Figure 4. *Hydraulic engineering.*

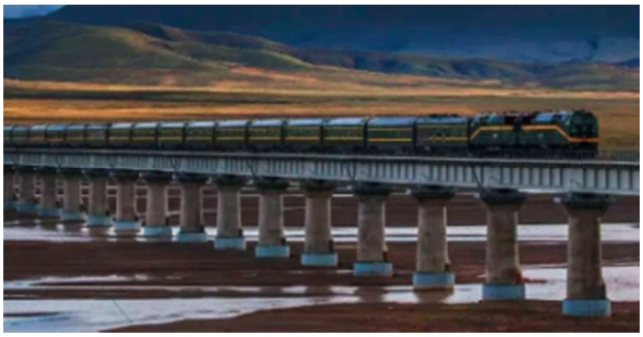

Figure 5. *Qinghai-Tibet Railway.*

Figure 6. *Bridge crunch.*

After giving the example, the question is that whether an engineering always "works". Then the answer is that it depends on whether the project itself is by the principle of things, whether it is scientific, and whether it can complete the complex engineering process.

The failure example is shown in Figure 6. The picture is from internet.

After giving the example, the question is that why there is such a consequence of the project and what can be done to ensure the quality of engineering.

Then the answer is that respect life, observe public order and morals, practice engineering ethics, and consciously assume responsibility for human safety, health, and welfare.

2) Technology concept

3) Relationship between them

a) Different content and nature

b) The nature or type of "results" are different

c) Different subjects or protagonists

d) Different tasks, objects, and ways of thinking

3. System concept

1) Source

The word system in English is derived from the ancient Greek word meaning "a whole composed of parts".

The term "system" was first used in The Great System of the World by the ancient Greek philosopher Democritus. In real life, "system" is a word that is widely used.

2) Definition

a) Founder Bertalanffy

b) Weberster's Dictionary

c) Prof. QianXuesen

3) Commonalities

The commonalities of the system are as follows.

a) A system is a whole composed of two or more elements.

b) There is a certain organic connection between the elements of the system, between the elements and the whole, and between the whole and the environment.

c) The connection and action between the elements of the system must produce a certain function.

d) To sum up, a system is an organic whole with specific functions that are made up of several components (units or elements) that interact, depend on each other, and are distinct from each other.

The teaching reflection is as follows.

a) Talking with students after the lesson, we learned that students felt that some knowledge points were too abstract and not easy to understand. It is necessary to provide more concrete examples that can visualize and vividly show the content of the knowledge points so that students can easily accept and grasp them.

b) After the lesson, students also agreed that engineering ethics is important.

4.2. Case Two

The basic information of the second case of teaching design is shown in Table 3.

Table 3. *Basic information of teaching design.*

Basic information	Specification
Teaching content	System design
Teaching objectives	1. Master the concept of system design, system design principles 2. Understand the basic principles of system design 3. CIP element: the spirit of "reform and innovation, striving for excellence".
Education content of CIP	When teaching the system design case, he introduced the story of the new system radar and the research and development of academician Liu Yongtan to inspire the students to be innovative, work hard, and pursue excellence.
Teaching methods and measures	Classroom lectures are based on PPT and supplemented by board books. For the engineering cases introduced, heuristic teaching methods are used to guide students to think, and in terms of scientific research, to be innovative, work hard and pursue excellence.

The teaching time is about 20 minutes. The teaching process is as follows:

1. Pre-class micro-course push

Course preview and review after class.

2. Basic concept

1) System design

Based on system analysis, system thinking is used to synthesize and apply knowledge, technology, and experience from various disciplines to implement the system into a specific project or program through design aspects such as overall study and detailed design to create a man-made system that meets the design objectives. The successful example is shown in Figure 7. The picture is from internet.

Figure 7. *AG600.*

After giving the example, the question isthat what the reason is for the success of AG600. Then the answer is that it is the inevitable result of the engineers' use in exploration and scientific design, which fully demonstrates the creative thinking of the engineers.

2) Results provided by SA for SD

a) Necessity, possibility, and feasibility of a new or modified system.

b) The objectives of the system and the constraints of the system (analysis of the objectives of the system and analysis of the environment of the system). The successful example is shown in Figure 8. The picture is from internet. Eco-environmental protection during the construction of the Lalin high-grade highway in Tibet: nearly 400 million yuan was invested in ecological restoration, and internationally advanced flexible ecological slope protection technologies such as ecological bags, ecological blankets, and ecological microporous substrates were applied for the first time in the construction of highway traffic in the region.

Figure 8. *LalinHigh-Grade highway.*

c) Framework structure and evaluation basis of new or modified system: system evaluation

d) Several valuable system solutions for further implementation (processing), etc.

3. Basic principles of system design

1) Pursuit of the overall optimal principle

a) The optimal state and optimal output within the system

b) The overall and link or local optimization to the overall priority

2) Principle of dominant event

From the perspective of probability theory and mathematical statistics, the influence of small probability events can be disregarded or considered less when determining the basic objectives of the system design.

For example, a research organization organizes data files, and after investigation and analysis, classifies the data according to the usage rate. Category A: the number of documents accounted for 10% of the total number of documents, the use rate of 75%; Category B: the number of documents accounted for 25%, the use rate of 20%; Category C is not related to scientific research, some are disposable materials, the number of 35%, the use rate of 5%; Category D: the number of documents accounted for 30%, the use rate is very low, belong to no reference value of waste information.

After giving the example, the question is how to classify. Then the answer is that A and B categories should be focused on.

3) Information classification should be adapted to the needs of decision-making

The system design involves a wide range of materials and information, and the information should be classified according to various design needs, and the general information and decision-making information should be separated.

4) Comprehensive application of knowledge and technology of various disciplines

System design involves many disciplines knowledge areas and engineering technology ranges.

For example, Intelligent Transportation System (ITS) involves communication, information, computer technology, artificial intelligence, management science, behavioral science, control science, transportation, system science, etc.

4. System Design Cases

If radar is the eyes of ordinary people, then the new system radar is a pair of fire eyes, which represents the development of modern radar. 1983, academician Liu Yongtan submitted a demonstration report of more than 200,000 words on the overall design plan of the new system radar. Theoretically and from practical experience, the feasibility of China's development of this radar was multiply argued and finally approved.

After giving the example, the question is that what the successful development of the new radar system tells us. Then the answer is that the scientists' spirit is reform and innovation, the pursuit of excellence.

The teaching reflection is as follows.

a) System design involves large projects, which students find difficult to understand, and may need to provide a more specific system design process to help students digest and master the knowledge points.
b) The story of the academician makes students feel inspired and proud of China.

5. Effectiveness of CIP Teaching Reform

When the course had finished, students evaluated the course. Most of students were satisfied with the course. Students thought that they understood the social responsibilities of engineer and the contents of the engineer's practice charter, mastered the rational evaluation criteria for right and wrong behavior, improved their sensitivity to ethical issuesand abided by the charter specifications through this course.

Through the implementation of curriculum thinking and government teaching reform, students have significantly improved their moral cultivation and family sentiment, mainly in the following two aspects.

a) Recognize that it is very important to learn professional knowledge. And that in the future, when you step into the workplace, as an engineer, you should have respect for life. We must abide by public order and practice engineering ethics, and consciously assume our responsibility for the safety, health, and well-being of mankind.
b) It raises national pride to serve the country with the dream. The advanced examples inspired the students to study hard. Insist on science and education to develop the country. It is important to keep the core technology in your hands. Only through self-reliance and self-independent can we not be controlled by others. This part makes a brief summaryof the whole paper. Usually, there should be one paragraph in this part.

6. Conclusion

The traffic system is a complex system. The teaching objective of the course called traffic system engineering is to enable students to have the ability to apply the theories and methods of system engineering to analyze and solve traffic system problems. In order to make students grasp professional knowledge solidly, the micro-course were recorded. And system engineering contains many philosophical ideas, and traffic system engineering draws on the nutrients of system engineering. Therefore, with a little analysis, it is easy to find the combination of the ideological and political elements - the spirit of Hershey, engineering ethics, and professional knowledge. With the efforts of the course team, good teaching results have been achieved. In summary, in this paper, through exploring the ideas of integrating the ideological and political elements into the course of traffic system engineering, teachers are required to infect students with practical cases and lead them with their own actions when teaching the course, so that students can establish anawareness of engineering ethics and cultivate their patriotic sentiments and continuous innovation spirit.

References

[1] HUANG Jingru, LU Weimin, ZHAO Ruyan, ZENG Liang, LU Weiwei, Exploration and practice of imperceptible curriculum ideologicalandpolitical education, Education and Teaching Forum, 2021, pp. 87-90.

[2] FENG Shumin, Traffic system engineering, Intellectual Property Publishing House, 2009.

[3] LIU Lan, WANG Lin, LIU Haixu, Analysis of transportation system, Southwest Jiaotong University Press, 2022.

[4] HUANG Suoming, Li Lijuan, Problems and Solutions of IPTTIAC Teaching in New Engineering, Theory and Practice of Education, vol. 42 (36), 2022, pp. 39-42.

[5] XU Yin, HU Hang, Reform and practice of curriculum ideology and politics of concrete and masonry structure design, Industrial & Science Tribune, vol. 22 (1), 2023, pp. 178-180.

[6] ZHANG Manqian, Domestic trends, International Space, 2019, pp. 58-59.

[7] ZHANG Chengmin, CUI Xianghan, WANG Dehua, 55 years after pulsar discovery: Future of FAST telescope, Science & Technology Review, vol. 40 (24), 2022, pp. 72-77.

[8] LI Yingshuai, WANG Weijie, Exploration of teaching reform path of engineering ethics education, China Journal of Multimedia & Network Teaching, 2022, pp. 82-85.

[9] LI Zhengfeng, CONG Hangqing, WANG Qian, Engineering ethics, Tsinghua University Press, 2019.

[10] YANG Yi, KONG Weining, YANG Bo, Research on engineering ethics education and teaching under professional background, Journal of Guangxi College of Education, 2022, pp. 199-203.

[11] JIANG Yi, ZHENG Kai, Exploration of ideological and political case teaching in engineering ethics course, China Modern Education Equipment, 2022, pp. 100-102.

[12] QIAN Fangbin, DING Haiyang, Research on the construction of effectiveness evaluation system of open online courses based on factor analysis, Shanghai Journal of Educational Evaluation, 2020, pp. 32-36.

[13] LIU Fen, Reform and practice of information security case teaching based on rain classroom, China Management Informationization, vol. 24 (5), 2021, pp. 212-213.

[14] WANG Guoqing, LIU Huimin, XIONG Fei, Research on the application of micro class in college mathematics, The Theory and Practice of Innovation and Entrepremeurship, 2021, pp. 93-95.

[15] CHEN Shujun, WANG Yan, SUN Dunyan, Inquiry into interactive experimental teaching based on CourseMaker, Wireless Internet Technology, 2020, pp. 111-112.