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Research on Curriculum Ideological and Political Reform of Data Visualization under Background of New Engineering

Fei Yang[a,*], Fang Wang[b], Zhanhong Wei

Department of Computing, Beijing Institute of Petrochemical Technology, Beijing, China
[a]yangfei@bipt.edu.cn, [b]fangwang@bipt.edu.cn
[*]Corresponding author

Abstract: *Combining the concept of new engineering education with ideological and political education is an important way for science and engineering courses in universities to achieve the goal of coordinated intellectual and moral education. How to achieve value guidance in knowledge transmission and solve the problem of the "two skin" of ideological and political education and professional education in curriculum is a key issue in ideological and political education in curriculum. Based on the characteristics of the data visualization course, this paper summarizes the ideological and educational elements of the course, explores the ways and methods of curriculum ideological and political reform, and further improves the assessment and evaluation system, thereby providing ideas for the reform of curriculum ideological and political education in new engineering majors.*

Keywords: *New Engineering, Course Ideological and Political Education, Course Objectives, Instructional Design, Course Evaluation*

1. Introduction

As an important force of engineering education reform in China, new engineering has become a representative program in the field of higher engineering education in the world[1]. In 2017, the Ministry of Education issued documents such as the Notice on Developing New Engineering Research and Practice to systematically explore advanced engineering education paths and respond to the changes brought about by the development of global science and technology and industry[2]. With the refinement of the division of labor in the university curriculum system, ideological and political education in courses can solve the problem of lack of effective connection between ideological and political education courses and other courses[3]. Personnel cultivation of new engineering is a systematic project, and ideological and political education should be linked with the curriculum that integrates into the major strategic needs of the country in order to achieve the goal of improving the quality of talent cultivation[4].

The Ministry of Education established the major of Data Science and Big Data Technology in 2016 to support the national big data development strategy from the perspective of undergraduate talent training. As one of the key majors in the construction of new engineering in universities, this major aims to cultivate talents who are in urgent need in the big data industry with good data processing and system development capabilities[5]. The cultivation of students' ability cannot be separated from moral education. Without ideals and beliefs, knowledge learning is difficult to sustain. Therefore, how to combine ability cultivation with social development is particularly important[6].

In order to comprehensively promote the construction and practice of " curriculum ideological and political education and give full play to the all-round education function, the experts put forward different construction ideas and implementation paths. Compared with other disciplines, engineering majors are more difficult to combine professional education with ideological and political education simply and directly due to the specialty characteristics. This integration process often has new requirements for teachers' knowledge breadth, teaching methods, moral awareness and other aspects[7]. Reference [8] proposes to construct a new engineering "professional curriculum +" teaching model that integrates multi-dimensional curriculum ideology and politics, which provides ideas and references for the ideological and political teaching of new engineering professional courses. Reference [9] takes the curriculum ideology and politics of engineering courses in universities as the research object, focuses on exploring the implementation strategies of teaching reform, and tries to explore the direction of teaching

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reform of curriculum ideology and politics. Reference [10] developed a path of ideological and political reform including mathematics, technical science, philosophy and ethics, and explored the ideological, political and engineering course practice of machine learning courses.

As a core course for data science and Big Data technology majors, data visualization aims to cultivate students' ability to visualize, interpret, analyze, explore and make decisions on various types of data. Through visual cases, the curriculum ideology and politics are integrated into the teaching, so as to enhance students' awareness of learning innovation, the pursuit of excellence craftsman spirit, and improve national confidence and cultural confidence.

2. The Dilemmas Faced by Ideological and Political Education in Data Visualization Course

(1) Difficulties in Exploring Ideological and Political Elements

Due to the lack of knowledge of ideological and political education, teachers cannot effectively explore rich ideological and political education elements, resulting in rigid or simple implantation of ideological and political elements in the ideological and political course teaching plan, forming professional knowledge and ideological and political culture "two skins", which cannot reach the goal that should be achieved in the ideological and political course teaching.

(2) Difficulties in the Breakpoint of Ideological and Political Infiltration

The ideological and political education in the curriculum is in a breakpoint state, and the duration of ideological and political education cannot be continuous, and students can only carry out invisible ideological and political education at certain specific times. The lack of systematic and continuous ideological education for students in each key period from the beginning, the middle to the end of the course makes it difficult to play a synergistic effect in the construction of ideological and political education in the course.

(3) The Dilemma of Ideological and Political Evaluation System

The assessment mechanism of curriculum ideology and politics is not complete, which results in the assessment of curriculum ideology and politics construction paying more attention to form than content, and only using accumulated statistical data to explain the effect of curriculum ideology and politics, but the research on how to truly reflect the effect of curriculum ideology and politics is still in progress.

3. Implementation Path of Ideological and Political Education in Data Visualization Course

As the main battlefield of curriculum system construction, professional courses are the basic carrier of curriculum ideological and political construction, and an important aspect of showcasing the subtle and silent educational effect. With professional knowledge as the carrier, curriculum ideological and political elements are effectively integrated in combination with curriculum characteristics. Through curriculum design and teaching method reform, professional knowledge is endowed with ideological and political significance, and the effectiveness of curriculum ideological and political teaching is effectively evaluated. Integrating curriculum thinking and politics into data visualization teaching is a top-down systematic project, which needs to explore effective teaching methods in combination with professional training objectives and graduation requirements corresponding to the course, considering students' characteristics, teaching content, curriculum system, teaching evaluation and many other factors.

The ideological and political construction of data visualization course is carried out from four aspects in this article: the orientation of ideological and political objectives from the teaching objectives, excavating ideological and political teaching cases from teaching content, integrate ideological and political elements into teaching design, strengthen the effect of ideological and political teaching through the assessment process.

3.1 Course Objectives of Ideological and Political Education

To meet national and local needs, follow the school's goal of cultivating application-oriented talents, and adhere to the fundamental task of cultivating virtuous people, students are required to master the basic principles and application technologies of data visualization through the study of this course, have the innovative design and realization ability of data visualization, and then establish the four-in-one curriculum goal of "knowledge, ability, quality, ideology and politics", as shown in Figure 1. It provides

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guidance for the design of the following course content, teaching method and course assessment.

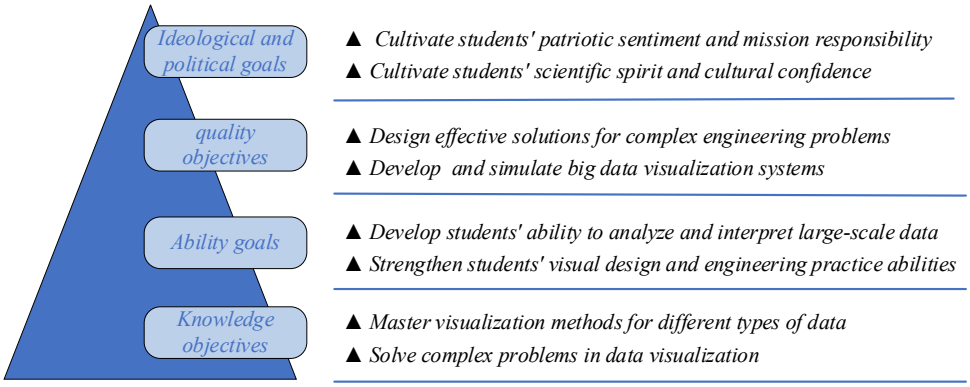

Figure 1: The four-in-one curriculum objectives

Through the above four goals, centering on the ideological and political core of the curriculum, the ideological and political education runs through the whole process of teaching, and the ideological and political elements are implanted in the teaching plan, integrated into teaching and teaching methods, so as to build a four-in-one collaborative system of curriculum and teaching.

3.2 Teaching Content Design for Ideological and Political Education

Table 1: Design of Ideological and Political Education for Data Visualization Course

Teaching chapter	Teaching focus	Cases of ideological and political education	Ideological and political education
Introduction to Data Visualization	Overview of data visualization; Data Visualization	Baidu Echarts	ECharts was developed by Baidu team and later donated to the Apache Foundation. It has become a top-level project of Apache, which guide students to learn Baidu's innovative scientific spirit and enhance national pride and confidence.
Data analysis and exploration	Data foundation; Visual channel; Visual data exploration; Visual Data Mining and Visual Analysis	Visualization of the seventh national census	Based on the seventh national population census, students can learn the characteristics, generation methods, and visualization exploration methods of big data so that they may dialectically view the new situation of population development in China, and enhance their patriotism and love for the people
Data visualization framework	Data visualization process; Data processing and transformation; Visual coding; Visual design	Visualization of party history	Viewing Party history through big data, guiding students through Party history data collection, historical data analysis and professional skills application, presenting the visual process of the century-old development of the Communist Party of China, guiding students to establish a correct outlook on life and values
Geographic data visualization	Map projection; Point data visualization; Visualization of new data; Regional data visualization	Lu Xun's life journey trajectory visualization	With the map of China as the base map, the typical provincial features as the landmark, with pictures and words to show Mr. Lu Xun's travel track, highlight his perseverance, guide students to think independently and promote the spirit of patriotism.
Time-varying data visualization	Time attribute visualization; Multivariate time-variant data visualization	Visualization of epidemic data	Through the dynamic time series chart of epidemic data, the changes of the number of infected people in China during the epidemic are shown based on the time axis, so that students can intuitively see the response measures and achievements of China and the people in the fight against the epidemic, and stimulate students' feelings of home and country and sense of mission
Hierarchy and network data visualization	Tree and graph visualization; Hierarchical data visualization; Network data visualization	Visualization of the relationship between characters in a dream of Red Mansions	Through the presentation of the lives, relatives and social relationships of many characters in the Dream of Red Mansions, students will be helped to appreciate the charm of traditional Chinese culture and enhance their understanding of traditional Chinese culture.
Cross-media data visualization	Text and document visualization; Social network visualization	Visualization of the 20th National Congress Report	Based on the report of the 20th National Congress of the Communist Party of China, we will showcase the great changes China has made in the new era, guide students to strengthen their confidence in the system, and create a new chapter in China's development.

Course ideological and political construction is an in-depth analysis and optimization design of the course content system and teaching processes, aiming to identify and cultivate the growth points of

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students' knowledge, abilities, and qualities. It permeates the cultivation of students' comprehensive qualities and values into various aspects of the course teaching process, transforming professional course teaching from knowledge transmission to a "four in one" led by knowledge, abilities, qualities, and values, achieving curriculum education.

Based on the knowledge points in the course teaching, we can search for ideological and political elements in professional knowledge learning, explore the best combination of ideological and political education and knowledge points, and achieve the unity of "knowledge transmission" and "value guidance". For example, based on the characteristics of each knowledge point and the requirements of the course objectives, we can explore ideological and political elements from several aspects such as scientific spirit, traditional culture, patriotism, and mission responsibility, as shown in Table 1.

3.3 Teaching Design of Course Ideological and Political Education

This course adopts the combination of online and offline teaching, theory and practice to carry out ideological and political teaching. The teaching process integrates teacher teaching, teacher-student interaction, student discussion and other teaching methods. It adheres to the problem-oriented approach, from raising problems to solving problems, to truly stimulate the love of learning and thirst for knowledge. We integrate thematic and penetrative teaching methods into ideological and political elements, improve the classroom teaching effect, and start the ideological and political education function of classroom teaching. The teaching process includes preparation before class, lecture, topic discussion, feedback after class, online homework and project report.

(1) Preparation before class

Relying on the cloud class to establish the course homepage, we arrange pre-class teaching tasks online, publish teaching objectives, upload teaching materials and "time-varying data visualization" micro-class videos, provide pre-class preview for students, and complete the creation of self-test question bank. In addition, we use the MOOCs resources provided by Peking University, Zhejiang University and other universities to guide students to complete the task of preview in a "personalized, independent and discussion style", and encourage students to understand the ideological and political cases involved in this section by consulting literature, so as to establish patriotic sentiment and mission responsibility.

(2) Classroom teaching

In the visualization of time-varying data, we take Corona Virus Disease 2019 (COVID-19) data as an example, introducing the concept and characteristics of time-varying sequence, so that students can fully understand the three involved dimensions of expression, scale and layout, and further understand the connotation of the visualization of time-varying data by teaching linear and periodic time visualization methods. By using a dynamic trend chart of epidemic data, the number of infected individuals in China during the epidemic period is displayed based on the timeline, allowing students to intuitively see the changes in the number of infected individuals, thereby demonstrating the response measures and achievements of the Chinese people in fighting the epidemic and inspiring students to have a sense of patriotism and mission. By giving anti-epidemic examples, we guide students to pay attention to the role models of scientists, healthcare workers, and other industries who selflessly contribute to the people of the country, and guide students to establish the correct outlook on life and values.

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(3) Topic discussion

Questions are released in the cloud class to further train students' ability and improve their literacy: ① How to visualize the timeline when the information contained in the temporal variable data contains

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multiple branch structures? ② How to design appropriate interaction methods to represent important areas when the scale of temporal variable data is large and it is difficult to present all details? While examining students' ability to master theoretical knowledge and use them flexibly, it also cultivates their careful and rigorous craftsman spirit and innovative consciousness.

(4) Post class feedback

Students can review classroom teaching content through cloud class classes, and interact with teachers to provide feedback. Teachers can promptly complete online Q&A through enterprise WeChat, cloud class network platforms, and other platforms. In view of common problems, live Q&A is conducted through Tencent meetings or Dingding to solve the confusion for students.

(5) Online homework

In order to ensure the teaching effect and urge students to realize the internalization and transfer of what they have learned in a timely manner, the teacher selects a verification project that incorporates ideological and political elements and requires students to complete it after class, and sets a deadline for completion and submission. In addition, in order to give full play to students' autonomy and innovation, cultivate their independent thinking, and flexibly apply their knowledge of visualization theory to practice, small development projects are also set up, and students with ability can further expand their visual project design and development abilities.

(6) Project report

Students should follow the software development specifications, write project reports, and accurately describe the development environment, design ideas and implementation effects of the project. Through project practice, students are guided to realize their responsibilities and to solve problems, so as to cultivate their sense of responsibility and innovative spirit.

4. Curriculum Evaluation under Ideological and Political Construction

The evaluation of curriculum ideological and political effect does not reward or punish teachers or students with results, but seeks to explore whether students' professional knowledge and value concepts are added, to insight into the rationality of the design and implementation of curriculum ideological and political teaching, to encourage teacher to constantly reflect on and improve the teaching effect of ideological and political education in the curriculum, to constantly promote and strengthen the development and improvement of students' ideological and political literacy, to promote the completeness of the system mechanism of ideological and political education in the curriculum, so as to achieve the goal of promoting construction, reform and development by evaluation.

(1) Evaluation of student learning. The evaluation includes target indicator and process indicators. The former indicator reflects the student's value-added degree and the latter reflects the student's distance from the preset goal. The evaluation step is pre-test, classroom test and post-test. The pre-test is to understand students' development level and needs. The classroom test is to collect students' performance materials in the course implementation process, such as students' opinions, attitude tendencies and behaviors containing value choices, so as to reflect the degree of ideological enlightenment and value guidance of curriculum ideology and politics.

(2) Evaluation of course teaching. The evaluation is realized through teaching plans, teaching materials, student performance materials, teaching reflection, combining curriculum characteristics, thinking mode and value concept. From the aspect of teaching objectives, we evaluate whether the objectives are clear and specific, whether they fully consider the learning situation, whether they are conducive to the advanced development of students' ideological and political literacy, and whether they are closely related to the curriculum. In terms of teaching materials, we evaluate whether the materials meet the requirements of content supply, whether the materials are systematic, and whether the ideological and political elements meet the requirements of the curriculum ideological and political objectives. From the aspect of teaching organization and implementation, we evaluate whether the classroom teaching interaction helps ideological and political education to integrate into the students' spiritual world, whether the teaching mode and method are warm, amiable and appealing, so as to make the learning process of ideological and political education more pleasant and the classroom more educative.

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5. Conclusion

The foundation of curriculum ideological and political construction lies in the curriculum, the fundamental lies in ideological and political construction, the key lies in the classroom, the key lies in the teacher, and the effect lies in the students. How to connect each key link of curriculum ideological and political construction organically and grasp the focus point is the key to improve the effectiveness of curriculum ideological and political. Driven by the task of strengthening curriculum ideological and political construction, we should keep the "main battlefield" of curriculum construction and make good use of the "main channel" of classroom teaching. Data visualization is an important core course to achieve the goal of training big data professionals in universities. Guided by the ideological and political awareness of the course, we have based on the teaching content in teaching practice, dug deeply into the ideological and political elements, led students to enhance their sense of home and country and mission, enhanced their professional identity and social responsibility, and achieved good results in course teaching.

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