Research and Practice of the Course Ideological and Political Education in the Case-Driven "Principles and Applications of Big Data Analysis" Course

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***Abstract*—Taking the case driven "Principles and Applications of Big Data Analysis" course ideological and political education as the research object, we analyze the current problems of ideological and political education in science and engineering courses in universities, and propose an overall design framework for course ideological and political education. The principles and criteria for case selection were provided, while typical cases were provided for the four ideological and political elements of science and technology: Serving the country, scientific thinking, engineering ethics, and craftsmanship spirit. The specific implementation methods of case discussions were also introduced in detail. Through a questionnaire survey, it was found that case driven curriculum ideological and political education has a positive impact on students' learning effectiveness and ideological and political literacy. This study provides new ideas and methods for the ideological and political education of science and engineering courses in universities, and has certain significance for the practice of ideological and political education in science and engineering courses in universities.**

***Keywords*—case driven, serving the country, scientific thinking, engineering ethics, craftsmanship spirit**

I. Introduction

In December 2016, General Secretary Xi Jinping pointed out at the National Conference on Ideological and Political Work in Colleges and Universities [1], "We must make good use of classroom teaching as the main channel. Ideological and political theory courses should be strengthened through improvement, enhancing their affinity and pertinence in order to meet the growth and development needs and expectations of students. Other courses should also fulfill their responsibilities and align with ideological and political theory courses, creating a synergistic effect." In September 2018, General Secretary Xi Jinping stated at the National Education Conference [2], "The cultivation of moral character and nurturing of talent should be integrated into various aspects of ideological and moral education, cultural and knowledge education, and social practice education, spanning across basic education, vocational education, and higher education." In March 2019, General Secretary Xi Jinping emphasized at a symposium for ideological and political theory teachers [3], "We must use the soul-nurturing power of socialist ideology with Chinese characteristics in the new era, implement the Party's educational policy, and fulfill the fundamental task of cultivating moral character." He also stressed, "We must unify explicit education and implicit education, explore ideological and political education resources embedded in other courses and teaching methods, and realize comprehensive and all-round education for all." In April 2021, during a visit to Tsinghua University and delivering a speech [4], General Secretary Xi Jinping stated, "Teachers should be role models for students in their pursuit of knowledge, dealing with matters, and becoming better individuals, facilitating students' all-around development." The aforementioned statements by General Secretary Xi Jinping provide a clear exposition of the relationship between curriculum instruction, the cultivation of moral character, and ideological and political education for students. They also provide guidance to specialized-course teachers on how to effectively integrate ideological and political elements into their courses.

Since November 2018, the Ministry of Education has issued three documents to improve the quality of talent cultivation, namely the "Opinions on Accelerating the Construction of High Level Undergraduate Education and Comprehensively Improving Talent Cultivation Ability" (referred to as the "40 Articles of Higher Education in the New Era") issued in November 2018, the "Deepening Undergraduate Education and Teaching Reform and Comprehensively Improving Talent Cultivation Quality" issued in September 2019 and the Implementation Opinions on the Construction of First Class Undergraduate Courses issued in October 2019. These documents have made specific planning and implementation requirements for universities in the areas

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of "three comprehensive education", teachers in teaching and the course ideological and political education. In May 2020, the Ministry of Education issued the "Guidelines for the Ideological and Political Construction of Curriculum in Higher Education Institutions", emphasizing that the ideological and political construction of curriculum should be comprehensively promoted in all universities and disciplines.

Through the analysis of General Secretary Xi Jinping's important discourse on curriculum ideology and the significant documents issued by the Ministry of Education on curriculum ideology, it can be seen that the proper implementation of curriculum ideology is of great significance in implementing the important speeches and thoughts of General Secretary Xi Jinping, as well as achieving the fundamental task of cultivating virtue and talents and improving the quality of talent development comprehensively. Curriculum ideology even influences and determines the issues of succession, social stability, national rejuvenation, and national rise. For science and engineering courses in higher education institutions, it is widely recognized that it is difficult to integrate curriculum ideology due to their strong professionalism and technical nature. Designing the teaching content and evaluation system of curriculum ideology for science and engineering courses in higher education institutions based on General Secretary Xi Jinping's important discourse on curriculum ideology and the significant documents issued by the Ministry of Education, and applying them in practical teaching, is a significant challenge currently faced by science and engineering teachers.

II. Related Work

The existing problems in the implementation of curriculum ideology in science and engineering courses in higher education institutions are as follows [5–11]:

A. The Separation of Teaching Philosophy from Ideological and Political Education

The understanding of "curriculum ideology" among science and engineering course teachers is still vague. The concept of comprehensive curriculum and holistic student development is not fully established. There is a lack of educational philosophy incorporating ideological and political elements into professional courses. Most subject teachers believe that ideological and political education is primarily the responsibility of ideology and politics course teachers, counselors, and class teachers. They fail to recognize the relationship between value guidance and knowledge transmission correctly. In teaching philosophy, they often prioritize mastering and applying "technical" skills, neglecting the ideological aspects of the curriculum.

B. The Level of Student Recognition and Acceptance Is Low

Currently, science and engineering students have an individualistic and utilitarian mindset towards ideological education, focusing mainly on its practicality for improving academic performance and employ-ability. They prioritize their professional knowledge and technical skills, largely disregarding ideological education. Some engineering students even consider it unnecessary, believing that the content of ideological education is distinct from their professional courses. They argue that studying it would consume time and increase their academic workload.

C. The Ideological and Political Education Lacks Effective Evaluation

Currently, the evaluation of ideological and political education in science and engineering courses is limited, focusing primarily on professional skills rather than integrating ideological and moral values into the assessment. This approach fails to reflect the effectiveness of ideological education and hampers a comprehensive examination of students' political awareness. Teachers are unable to assess changes in students' thinking or address deficiencies in the curriculum promptly. As a result, students may prioritize completing assignments and passing exams without fully appreciating the significance of ideological education in their professional courses.

III. Overall Design for the Construction of Course Ideological and Political Education

The course "Principles and Applications of Big Data Analysis" focuses on strengthening students' ideals and beliefs, with the themes of loving the Party, the country, socialism, and the people. It is centered around the national strategy of big data, with particular emphasis on engineering ethics education and scientific thinking education. The course aims to cultivate a spirit of excellence and craftsmanship, guiding students in their education, and fostering patriotism through the dedication of science and technology to the nation. The future careers of students who study this course include big data engineers, big data analysts, and big data scientists. In line with these goals, the course incorporates ideological and political education elements from four aspects: engineering ethics, craftsmanship, scientific thinking, and dedicating science and technology to the country. The specific aspects are as follows:

- Big data engineers primarily engage in system engineering development for the management and application of big data. Therefore, it is important to incorporate engineering ethics education to ensure that students understand the ethical principles that need to be followed in future work involving engineering development.
- Big data analysts primarily focus on addressing industry-specific issues and leveraging big data analysis techniques to assist in making industry decisions. In this regard, it is crucial to emphasize the importance of problem understanding and analysis, as well as the accuracy and reliability of data analysis. Therefore, it is considered to cultivate students' craftsmanship spirit of striving for excellence in problem-solving through words and deeds.
- In the process of conducting research based on big data, big data scientists cannot rely solely on

traditional modes of thinking, but rather need to adopt new ways of thinking that are based on big data. Therefore, it is highly necessary to introduce the specific characteristics and practical applications of big data thinking by case studies.

- Big data scientists primarily focus on researching methods for managing and analyzing big data. They represent the advanced stage of careers related to big data and their research outcomes are crucial for implementing the national big data strategy and building a strong technological country. Therefore, it is necessary to utilize case studies to pass on the spirit of perseverance from the older generation of scientists, in order to inspire students with a sense of national pride and a sense of duty to serve their country through science and technology.

The overall design concept for the course ideological and political education is shown in Fig. 1. In the section on "National Big Data Strategy", students will be encouraged to develop a sense of national pride and a sense of duty to serve their country through science and technology by interpreting the key points of important speeches and documents related to the national big data strategy. In the section on "Typical Cases of Big Data Thinking", by case studies, discussions, and analysis, students will be cultivated a sense of duty to promote social progress through scientific thinking. In the section on "Typical Cases of Big Data Security", students will gain an understanding of the ethical rules and professional ethics that need to be followed in engineering development through case studies and discussions. In the section on "Development Case of DataMPI", students will be exposed to case studies that aim to pass on the spirit of continuous improvement from the older generation of scientists and foster a spirit of excellence and craftsmanship in data analysis processes.

In terms of engineering ethics, students will be trained in the correct ethics of big data. They will be encouraged to establish a consciousness for privacy protection and abide by privacy protection laws and regulations. This means both protecting their own private information and refraining from casually disclosing others' private information.

In terms of craftsmanship, students will be introduced to evaluating the rationality and accuracy of data analysis and decision support results. While pointing out the shortcomings of existing methods, they will be encouraged to analyze and organize existing problems, deeply reflect on the methods used, and by words and deeds, guide students to establish a rigorous, pragmatic, and scientific attitude in problem-solving. This will cultivate a spirit of excellence, encourage the discovery of new approaches, and improve the success rate of problem-solving.

In terms of scientific thinking, the main focus is on introducing the differences between big data thinking and traditional mechanical thinking, as well as the characteristics and specific examples of big data thinking. This aims to train students to think and conduct research with a completely new mode of thinking based on big data.

In terms of serving the country through science and technology, the course incorporates ideological and political content related to the national big data strategy. Starting from the theory and cases of what big data is, it transitions to the historical evolution of the national big data strategy. It clarifies the background and significance of the course, analyzes the era background and future development trends of the national big data strategy, and organically integrates it with the opportunities and challenges faced by contemporary China. This provides students with a clearer understanding of the current situation facing the country. Moreover, it emphasizes the strategic position of big data development in fundamental and overall issues such as national security, social governance, and economic development. Furthermore, by narrating the stories of older generation scientists' struggles, it seeks to inspire students' sense of national pride and mission in serving the country through science and technology.

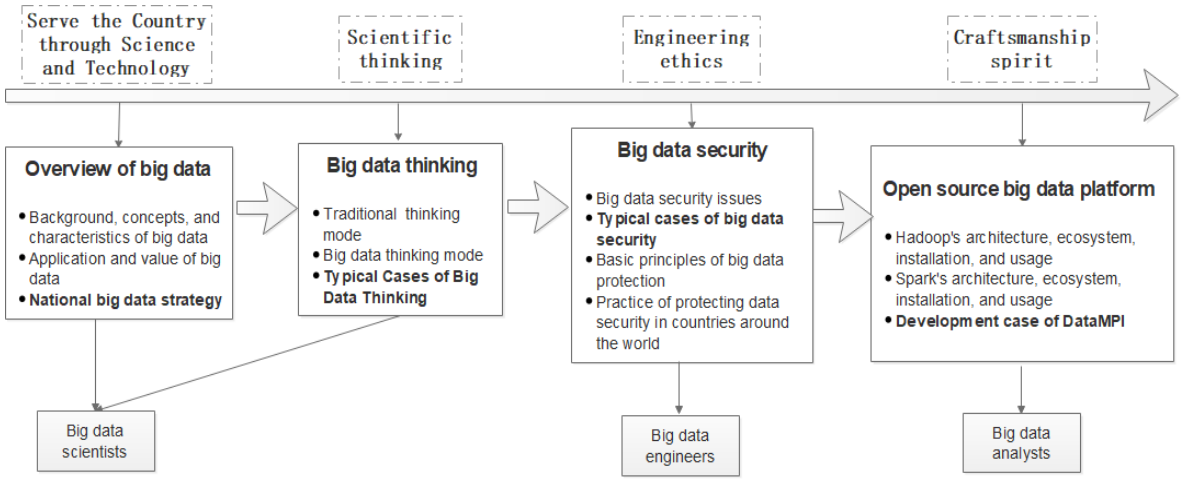

Fig. 1. The overall design for the course ideological and political education.

IV. Case Selection and Analysis

A. Principles and Criteria for Case Selection

1) Adhering to ethical standards

The selection of cases should adhere to ethical standards, respecting personal privacy, protecting data security, and complying with laws and regulations. Cases that infringe upon personal rights, are illegal, or have controversial nature should not be used.

2) Representative

The cases should represent typical problems and challenges in the field of big data analysis, covering applications in different domains and industries. Select cases that can stimulate students' interest and have practical significance, helping them understand and master the core concepts and methods of big data analysis.

3) Considering national needs

Priority should be given to selecting cases that are closely related to national development and social issues, enabling students to realize the importance of using technology to serve the country. The cases should focus on key areas of national development, helping students understand how to apply big data analysis to contribute to national construction and social progress.

4) Diversity and practicality

Selecting different types of cases, including real cases, simulated cases, and hypothetical cases, allows students to analyze and solve problems from different perspectives and levels. Furthermore, the chosen cases should have a certain level of practicality, enabling students to engage in in-depth research and practice through experiments, model building, data analysis, and other methods.

B. Typical Cases

In terms of serving the country with technology, the selected typical cases include the historical development and era background of the national big data strategy in the chapter "Overview of big data".

Regarding scientific thinking, the selected typical cases include a total of 10 cases: bank customer credit evaluation, product comparison website Decide.com, big data-driven drug research and development, Google flu trends prediction, Taobao product retrieval, online shopping platform, personalized recommendations on Netflix, user behavior analysis of Tesco, content recommendation strategy on TikTok and Alipay.

For engineering ethics, typical cases selected include a total of 10 cases: big data price discrimination, excessive collection of personal information by mobile apps, the misuse incident of Facebook data, JD.com data breach incident, personalized recommendations, Prism event, probe boxes collecting personal privacy information, free WiFi stealing user information, 12306 ticket hoarding incident and Wiki leaks incident.

Regarding the spirit of craftsmanship, a selected typical case includes the development background and process of the DataMPI open-source big data platform in the chapter "Open-source big data platforms".

C. Case Discussion

Students form small groups to collectively analyze cases and discuss questions. The teacher guides students in engaging in case debates, encouraging them to consider and solve problems from different perspectives and standpoints. The teacher also prompts students to propose questions, share viewpoints and experiences, and facilitates communication and collaboration among students. Through critical thinking, students can understand the complexity and diversity of problems. During the case discussions, students are encouraged to propose innovative solutions and implementation plans, and they are also encouraged to integrate their own experiences and knowledge to consider how to apply new technologies and methods to solve real-world problems. Case discussions should guide students to reflect on the significance and value of serving the country with technology, and inspire their interest and concern for national development and social issues. Through case discussions, students develop a sense of social responsibility.

V. Evaluation of the Improvement of Student Learning Effectiveness of Ideological and Political Literacy

Case-based ideological and political teaching can effectively enhance students' learning outcomes. Through case-based teaching, students can integrate abstract theoretical knowledge with practical problems, fostering their analytical and problem-solving abilities. Case-based teaching can stimulate students' interests in learning, improve their motivation, and encourage them to actively participate in the learning process. Additionally, case-based ideological and political teaching contributes to the development of students' ideological and political literacy. In case-based teaching, teachers guide students to analyze ethical, moral, and social responsibility issues present in the cases, cultivating their core values and sense of social responsibility. Through case-based thinking, students can better understand and identify with societal values, strengthening their sense of social responsibility. Furthermore, case-based teaching also cultivates students' critical thinking and innovative abilities, enabling them to think independently, express their viewpoints confidently, and make reasonable judgments and evaluations of societal phenomena.

In order to evaluate the learning effectiveness and improvement of ideological and political literacy of students, we conducted a questionnaire survey on a total of 70 students who studied this course in the 2021 and 2022 grades. The survey results are shown in Table I. It can be observed that approximately 93% of the students expressed satisfaction or overall satisfaction with the effectiveness of the ideological and political teaching in the course. All students expressed satisfaction or overall satisfaction with the teaching effectiveness in enhancing their ideological and political literacy, the quality of the teaching materials and learning resources used in the ideological and political teaching, the teaching

effectiveness of helping them better understand the relationship between national development, social progress, and big data technology, as well as the selection of relevant social issues and real-world problems in the ideological and political teaching. However, four students rated the teaching effectiveness in cultivating innovative thinking and problem-solving abilities as average, while two students considered the teaching level and methods of the teachers in ideological and political teaching as average.

TABLE I. SURVEY QUESTIONNAIRE RESULTS (%)

Questions	Options			
	Satisfaction	Basically satisfied	Average	Dissatisfied
Overall evaluation of the teaching effectiveness	62	3	5	0
Evaluation of improving ideological and political literacy	64	6	0	0
Evaluation of teacher's teaching level and methods	61	7	2	0
Evaluation of the quality of textbooks and learning materials	62	8	0	0
Evaluation of improving knowledge of big data	63	6	1	0
Evaluation of cultivating innovative thinking	61	5	4	0
Evaluation of understanding the relationship between national development and big data technology	66	4	0	0
Evaluation of selected social hotspots and practical issues	68	2	0	0
Evaluation of improving team collaboration	61	8	1	0

Based on the survey results, future efforts should be focused on strengthening the cultivation of innovative thinking and problem-solving abilities in the ideological and political teaching of the course. Additionally, there is a need to enhance the teaching level and methods of the teachers in ideological and political teaching.

VI. CONCLUSION

The implementation of case-based ideological and political education in the course "Principles and Applications of Big Data Analysis" has a positive influence on students' learning outcomes and ideological and political literacy. Through case teaching, students are able to better understand and apply the knowledge they have learned, improving their learning effectiveness. Additionally, case teaching also fosters students' ethical and moral qualities and innovation abilities, making them outstanding talents with a sense of social responsibility and innovation spirit. Therefore, case-based ideological and political education should be widely promoted and applied in practice.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Mo Hai conducted the research; Mo Hai and Haifeng Li wrote the paper; both authors had approved the final version.

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