Empirical Analysis on the Integration of Data Science Major into Ideological and Political Education under the OBE Concept—A Case Study of Anhui University of Finance and Economics

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Abstract: *Based on the outcome-based education concept, specific measures are proposed for integrating the data science major into the reform. These measures include curriculum construction, faculty development, practical teaching, and the integration of industry, academia, and research. A multiple regression model is constructed using factor analysis, and empirical analysis is conducted to evaluate the teaching effectiveness. The research findings indicate that curriculum construction, faculty development, practical teaching, and the integration of industry, academia, and research all have a positive and significant impact on learning outcomes. The research findings indicate that curriculum construction, faculty development, practical teaching, and the integration of industry, academia, and research all have a positive and significant impact on learning outcomes. The degree of influence, in descending order, is curriculum construction, faculty development, practical teaching, and the integration of industry, academia, and research.*

Keywords: *Outcome-based education; Data science; Ideological and political education*

1. Introduction

On May 28, 2020, the Ministry of Education issued the "Guidelines for the Construction of Ideological and Political Education in Higher Education Curriculum"[1,] aiming to comprehensively promote the construction of ideological and political education in university courses, harnessing the educative role of each course to enhance the quality of talent cultivation in higher education. Subsequently, the construction of ideological and political education in university majors entered a period of rapid development. Data science majors possess characteristics such as interdisciplinary, comprehensiveness, and cutting-edge nature. Effectively conducting ideological and political education in this field, guiding students to establish correct life outlooks, values, and worldviews, enhancing students' comprehensive qualities and innovation abilities, and cultivating high-quality talents with good moral qualities and social responsibilities have become urgent issues.

In recent years, Outcome-Based Education (OBE) has emerged as one of the trends in global educational reform[2-4]. OBE is an educational concept centered on student learning outcomes, emphasizing the cultivation of practical skills and knowledge with real-world application value. Currently, OBE has become the direction of educational reform in many countries and regions, including China, the United States, Canada, and Australia. In China, the concept of OBE has been widely applied. For example, in higher education, a competency-based OBE model has gradually been implemented as the primary objective. Additionally, in vocational education and secondary vocational education, an outcome-oriented education model focusing on abilities and outputs has been advocated.

Taking Anhui University of Finance and Economics' Data Science and Big Data Technology major as an example, this article first introduces the talent cultivation objectives of integrating ideological and political education into the data science major under the OBE concept. It then discusses the reforms and practices in ideological and political education in the major, and finally conducts empirical analysis of teaching effectiveness using multiple regression analysis.

2. Talent development objectives of professional ideological and political education

Under the OBE concept, the data science major should organically integrate professional and ideological goals, and formulate new talent cultivation objectives, see Table 1. Society demands individuals with a solid foundation in mathematics, computer science, and statistics, proficient in basic methods and skills of data analysis and processing, capable of proficiently using various data analysis tools and technologies. Additionally, they should possess a spirit of technological innovation and awareness, a profound understanding of national laws and regulations, and societal moral concepts. They should have a strong sense of social responsibility and civic consciousness, along with good humanistic care and personal cultivation. Furthermore, talents in the data science field should also possess excellent communication skills, teamwork spirit, and adaptability to diverse work environments and complex data application scenarios.

Table 1: Talent cultivation objectives integrating ideological and political education into the data science and big data technology major

Professional Objectives	Ideological and Political Objectives	Main Integration Methods
Solid foundation in mathematics, computer science, and statistics	Understanding of national laws, regulations, and societal moral concepts	Course instruction, Extracurricular reading
Proficient computer programming	Spirit of technological innovation and innovation awareness	Practical teaching, Internship training
Professional knowledge	Consciousness of innovation	Market research, Risk assessment
Basic methods and skills of data analysis and processing	Sense of social responsibility, civic consciousness	Course instruction, Competitions
Data analysis, analysis tools	Humanistic care, personal cultivation	Social practice, Reading, Public welfare activities

3. Professional ideological and political education reforms and practices

This paper explores the ideological and political education in the Data Science and Big Data Technology program at Anhui University of Finance and Economics, focusing on three main aspects:

(1) Construction of Ideological and Political Education in Courses

Using the course "Introduction to Data Science" as an example, this study integrates ideological and political education into course objectives, content, teaching methods, educational concepts, and evaluation criteria within the framework of outcome-based education. Emphasis is placed on setting clear course objectives to ensure that students grasp concepts, understand various applications in different domains, and cultivate self-learning and communication skills, while also fostering a sense of social responsibility and innovation. Various teaching methods, such as case studies, practical exercises, and group discussions, are employed to enhance student engagement and learning outcomes, along with the establishment of a comprehensive assessment system to evaluate student learning achievements and provide feedback.

(2) Enhancement of the Teaching Staff's Ideological and Political Education

The importance of the teaching staff in ideological and political education is highlighted, and structured programs such as the "May Day Model" are proposed to enhance the overall ideological and political teaching and research capabilities of the faculty. These programs include designing teaching cases, publishing papers, applying for teaching projects, participating in teaching competitions, and attending collective discussions.

(3) Integration of Ideological and Political Education into Practical Teaching and Industry-University-Research Integration

Ideological and political education is integrated into practical teaching and industry-university-research activities, incorporating ideological and political elements into activities such as experiments, competitions, and projects to deepen students' understanding and application of data science knowledge. Students are encouraged to focus on social issues, apply data science knowledge to real-world situations, contribute to social development, and promote cooperation with industries to cultivate talents with innovation and practical capabilities.

4. Empirical analysis of teaching effectiveness

4.1 Survey questionnaire

Drawing on the research findings of other scholars [5-6], this study designed an end-of-course questionnaire consisting of four parts with a total of 15 items. These parts include Construction of Ideological and Political Education in Courses, Enhancement of the Teaching Staff's Ideological and Political Education, Integration of Ideological and Political Education into Practical Teaching and Industry-University-Research, and Learning Effectiveness. All items were measured on a scale of 1 (disagree), 2 (neutral), to 3 (agree). The questionnaire was distributed to teachers and students majoring in Data Science and Big Data at Anhui University of Finance and Economics via Chaoxing Learning. A total of 204 questionnaires were collected, all of which were deemed valid, resulting in a 100% valid response rate.

4.2 Scale, reliability, and validity testing

This study designed a questionnaire with 15 items across four dimensions: Construction of Ideological and Political Education in Courses, Enhancement of the Teaching Staff's Ideological and Political Education, Integration of Ideological and Political Education into Practical Teaching and Industry-University-Research, and Learning Effectiveness, to measure the process and effectiveness of integrating ideological and political education into Data Science education, see Table 2 for details.

Table 2: Survey questionnaire

Variable	Sub-dimension	Factor Loading	Reliability
Construction of Ideological and Political Education in Courses	The teaching enables students to grasp big data concepts and its societal applications.	0.688	0.844
	Teachers effectively use real-world cases to stimulate social issue discussions.	0.795	
	Student-participatory teaching fosters innovative thinking and problem-solving skills.	0.802	
	Emphasis on professional knowledge alongside moral and social responsibility cultivation.	0.808	
	Evaluation methods accurately assess learning outcomes and abilities.	0.832	
Enhancement of the Teaching Staff's Ideological and Political Education	Teachers' qualifications meet teaching requirements and student needs.	0.840	0.804
	Teachers integrate ideological education with professional knowledge, fostering deep thinking.	0.864	
	School values staff's ideological education, offering training and support for development.	0.843	
Integration of Ideological and Political Education into Practical Teaching and Industry-University-Research	Practical teaching allows real-world application of data science in projects.	0.810	0.898
	High cooperation and resource sharing between school and enterprises.	0.909	
	School assists students in arranging internships and offers employment guidance.	0.879	
	Collaboration projects meet students' learning and job market needs.	0.901	
Learning Effectiveness	Enhancements in self-learning and design skills.	0.808	0.923
	Improved abilities in data collection, processing, and analysis.	0.863	
	Enhanced communication, interpersonal, and teamwork skills.	0.884	
	Development of comprehensive qualities and innovation abilities.	0.896	
	Cultivation of moral values and social responsibility.	0.829	
	Strengthened awareness of professional ethics and legal consciousness.	0.834	

4.3 Regression analysis

Regression analysis was conducted after factor analysis to calculate scores for each dimension. The dependent variable was learning effectiveness, while the explanatory variables were the integration of ideological education into the profession, with key indicators being the construction of ideological and political education in courses, enhancement of the teaching staff, and integration of practical teaching

with industry-university-research. The regression results are shown in Picture 1.

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                                      Variable     B     SE   Beta
    0                                 Constant  0.000  0.026     -
    1  Construction of Ideological and Political Educ...  0.380  0.060  0.394
    2  Enhancement of the Teaching Staff's Ideologica...  0.415  0.061  0.415
    3  Integration of Ideological and Political Educa...  0.116  0.051   0.12


          t      p    VIF  Tolerance
    0  0.000  1.000     -         -
    1  6.340  0.000  2.763     0.362
    2  6.819  0.000  2.656     0.377
    3  2.255  0.025  2.014     0.496
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Figure 1: The regression results

From Figure 1, it can be observed that the three indicators significantly explain the variance of the dependent variable. The effects of Construction of Ideological and Political Education in Courses, Enhancement of the Teaching Staff's Ideological and Political Education, and Integration of Ideological and Political Education into Practical Teaching and Industry-University-Research on learning effectiveness are all positively correlated. The magnitude of their effects decreases in the following order: Construction of Ideological and Political Education in Courses, Enhancement of the Teaching Staff's Ideological and Political Education, and Integration of Ideological and Political Education into Practical Teaching and Industry-University-Research.

5. Conclusion

This paper verifies through multiple regression analysis that the effects of construction of ideological and political education in courses, enhancement of the teaching staff's ideological and political education, and integration of ideological and political education into practical teaching and industry-university-research on learning effectiveness are all positively significant. Specifically, the impact of construction of ideological and political education in courses is the most influential, followed by enhancement of the teaching staff's ideological and political education, and then integration of ideological and political education into practical teaching and Industry-University-Research. Therefore, under the OBE concept, to enhance the effectiveness of ideological and political education in the data science major, it is essential to prioritize the construction of ideological and political education in courses, followed by continuous enhancement of ideological and political education for teachers, and emphasis on cultivating students' practical and innovative abilities, guiding them to master data analysis techniques and methods through practice. Moreover, it is important to focus on cultivating students' professional ethics and sense of social responsibility, encouraging them to pay attention to social issues, actively participate in public welfare activities, and contribute to social development.

In practice, schools should utilize various teaching methods and educational resources to broaden the depth and breadth of education and teaching. Through practical teaching, research projects, and cooperation with enterprises, students can master theoretical knowledge, enhance practical and innovative abilities. Additionally, organizing data science competitions and practical activities can help students improve their professional ethics and sense of social responsibility.

In conclusion, ideological and political education in the data science major under the concept of outcome-oriented education needs to be comprehensively promoted, focusing on aspects such as ideological and political education in courses, enhancement of the teaching staff, and integration of industry, university, and research. The goal is to cultivate high-quality data science professionals and contribute to the development of the national data science industry.

Acknowledgements

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