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Integrating Ideological and Political Education into Professional Basic Courses: A Learning-Centered Conceptual Design for Operations Research Course

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Abstract

As an important part of higher education, professional basic courses are the key carrier to implement the fundamental task of moral education. In the past teaching process, teachers in the course group were also actively integrating ideological and political elements. Still, they could not deeply touch students' ideological cognition. In view of the above problems, based on the learning-centered teaching concept, this paper takes the Operations Research course as an example, and presents a conceptual reform proposal that rethinks both its ideological and political integration and its overall teaching mode. The conceptual framework is designed from four aspects: teaching objectives, teaching contents, teaching methods, and evaluation system. It is hoped that through this reform, the teaching effect and education quality of the operations research course can be improved, and the organic unity of knowledge imparting, ability training, and value guidance can be realized.

Keywords

Learning-Centered, Curriculum Politics, Operations Research, BOPPPS, PBL

1. Introduction

Professional basic courses play a connecting and crucial role in the higher education curriculum system. On the one hand, it continues the basic quality of the disciplinary foundation education, and further transforms it into the thinking habits and behavior norms that conform to the professional characteristics. On the other hand, it also provides the necessary theoretical methods and tools for

subsequent training stages, such as professional courses, practical courses, and graduation design. Learning professional basic courses facilitates students to establish a complete knowledge framework of this major, and develop the ability to analyze and solve problems. A solid grasp of such courses lays a solid foundation for in-depth study of professional knowledge, improvement of comprehensive literacy, and future career development.

In June 2020, the Ministry of Education issued the "Guidelines for the Construction of Ideological and Political Education in Higher Education Curriculum", which emphasizes that all types of courses should fulfill the fundamental task of fostering virtue through education. It requires the integration of value guidance throughout the whole process of teaching, so as to realize the synchronous progress of knowledge instruction and ideological cultivation. The professional basic course, as a key component of the higher education curriculum system, should integrate ideological and political education throughout the entire teaching process. It is the inherent requirement for implementing the fundamental task of fostering virtue and cultivating talent. How to effectively integrate ideological and political elements into professional basic courses? And how to realize the organic integration of ideological and political education and knowledge instruction? These issues have become research focuses on the current teaching reform and connotation development of colleges and universities [1]-[3].

Learning-centered approach is grounded in constructivist learning theory, which posits that learners actively construct their own knowledge and meaning. It shifts the primary focus of the educational experience from passive knowledge receiving to active, independent learning. Based on this approach, this paper explores the integration path between curriculum ideological and political education and professional basic education from four aspects: reconstructing teaching objectives, adjusting teaching contents, enriching teaching methods, and improving evaluation methods. It is hoped that the learning-centered teaching plan can not only enhance students' professional skills, but also strengthen value guidance and competency cultivation.

2. Current State of Operations Research

2.1. Introduction for Operations Research

Operations Research (OR) is an interdisciplinary application discipline with modeling and solving, optimization analysis, and scientific decision-making as its core. It aims to provide quantitative solutions for complex problems under limited resource constraints, guided by the principle of whole optimization. Many colleges and universities have offered this course. Economic management, engineering, finance, computer, and other related majors design Operations Research as an important professional basic course [4] [5]. The School of Economics and Management of our university regards it as a professional basic compulsory course for the major of economic statistics and industrial engineering. The prerequisite courses include Higher Mathematics, Linear Algebra, Probability Theory, modern man-

agement, and so on.

For students majoring in industrial engineering, Operations Research course has 48 class hours, all of which are theoretical instruction. This course provides a foundation for subsequent courses, such as production planning and control, higher operations research, system engineering, and so on. The course content of Operations Research includes introduction (2 class hours), linear programming (10 class hours), duality theory (6 class hours), transportation problem (8 class hours), integer programming (8 class hours), graph and network (8 class hours), and decision analysis (6 class hours). The assessment method consists of three parts: in-class tests (10%), after-class assignments (20%), and a final test (70%), covering knowledge objective (35%), ability objective (40%), and quality objective (25%).

2.2. The Current Situation of Ideological and Political Construction of Operations Research Course

The practice of combining ideological guidance with professional teaching in Operations Research aims to integrate social values, civic literacy, professional morality, dialectical thinking and the awareness of overall system optimization into the whole learning process of quantitative modeling and algorithm application. During the teaching process, the teachers of the course group have actively identified and explored the ideological and political elements, such as family and national sentiment, sense of responsibility, and scientific spirit. To achieve the goal of ideological and political education while imparting theoretical knowledge, these elements are integrated into the knowledge points of the course. However, traditional teaching mainly focuses on the unilateral output of teachers, which fails to effectively touch the students' cognitive points and emotional needs, resulting in unsatisfactory results [6]. In short, the challenges of ideological and political education in operations research courses are mainly reflected in the following aspects.

First, the ideological and political element in the teaching process is often fragmented between knowledge points. And most of them are oral expressions from teachers. The ideological and political elements fail to form an internal connection with the modeling ideas and algorithm logic of operations research. Without proper course design, ideological and political education is stiff and unnatural.

Second, the teaching method is still dominated by the traditional teaching mode. Teachers teach, and students passively accept. There are few interactive and inquiry designs, and students are not given the opportunity to transform ideological and political concepts into practice. Students only learn how to solve the optimal solution, but do not think about why and for whom these fundamental problems are calculated.

Third, the course assessment is mainly based on the final examination, focusing on the mastery of theoretical knowledge, modeling, and solving ability. There are no adequate corresponding evaluation dimensions and assessment methods for

the ideological and political objective. Such traditional assessment makes students satisfied with completing the calculation and obtaining the results, and lacks further thinking about the social value, ethical norms, and responsibility significance behind the problem.

3. Ideological and Political Teaching Reform Based on Learning-Centered Approach

Learning-centered is a modern educational concept that emphasizes students' dominant position, active learning, and individualized development. In the operations research course, it shifts traditional teacher-dominated indoctrination to toward a focus on students' knowledge absorption, thinking cultivation, and ability improvement. Based on this approach, this paper explores the teaching path of ideological and political in the operations research course. The aim of this reform is to encourage students to learn actively and think deeply, establish correct values while improving professional quality, thereby realizing the integration of fostering virtue and cultivating talents.

3.1. Reconstructing the Curriculum Objectives of Operations Research

The learning-centered concept emphasizes that students are the primary participants in learning, and teachers are the guides for learning. Therefore, the new curriculum objectives should take the real needs of students as the starting point, the improvement of students' ability as the core, and the all-round development of students as the destination. Based on this approach, this paper constructs a three-in-one objective system, including knowledge, ability, and ideological and political education.

Knowledge objective: Upon completion of the course, students will be able to: 1) Correctly write the general model of each branch in the operations research course, and accurately describe the main characteristics and basic properties of each model. 2) Explain the basic principles, application scope, and key steps of the typical algorithms of each branch. 3) Integrate the knowledge points independently, construct the knowledge system actively, and build a systematic and structured cognitive framework of operations research.

Ability objective: Upon completion of the course, students will be able to: 1) Establish a mathematical model for a specific practical problem. 2) Select appropriate algorithms and tools to solve the proposed model, and correctly interpret the solution results. 3) Implement sensitivity analysis to explore the impact of key parameters on the optimal solution and derive valuable management insights from results. 4) Analyze the limitations of the existing models and put forward future research directions.

Ideological and political objective: Upon completion of the course, students will be able to: 1) Develop good habits of active exploration, independent thinking, and lifelong learning. 2) Strengthen the scientific attitude of rigorous and realistic,

critical questioning, cultivate the innovative spirit of pioneering and enterprising, and establish the logical thinking of overall planning and systematic optimization. Establish a correct outlook on life, values, and the world, enhance the sense of responsibility and mission of serving the country, and abide by professional beliefs and moral ethics.

3.2. Adjusting the Teaching Contents

At present, scholars have identified and explored the ideological and political elements in operations research course from different perspectives, mainly focusing on national feelings, cultural self-confidence, overall situation consciousness, responsibility, exploration spirit, dialectical thinking, and so on [7]-[9]. Drawing on the research findings of these scholars, the course team can update the teaching content. In the theoretical teaching, appropriate cases and materials reflecting the development of the new era should be introduced. Furthermore, teachers should collect teaching feedback from each round and constantly optimize and revise the teaching design. This allows for the natural and deep integration of ideological and political elements into professional knowledge points. For example, in the chapter on the general model of linear programming and the simplex method, the classic production planning cases are usually introduced. In addition to the existing resource constraints (raw materials, working hours, equipment, etc.), teachers can take the initiative to introduce low-carbon restrictions, such as carbon emissions and carbon quotas. The ideological and political elements, such as green development, dual-carbon strategy, and corporate social responsibility, are naturally embedded in the modeling, solving, and sensitivity analysis links. As a result, students can foster a mindset of low-carbon development while mastering the professional methods of operations research. Throughout this process, organic unity of knowledge transfer, ability training, and value guidance is achieved.

On the basis of 48 class hours of theoretical teaching, it is advised to add a practical experiment module with 8 class hours to the operations research course. It increases the total course hours from 48 to 56. In the revised syllabus, the module is designated as a required component for all students. The integrated teaching system, combining theoretical teaching (48 class hours) with practical training (8 class hours), is constructed. This construction completes the closed-loop talent cultivation process for the operations research course. During experimental teaching, teachers can combine the industry reality and the national development strategy to design ideological and political practice cases. Several cases are listed here: UAV emergency material dispatching, optimal allocation of agricultural water and soil resources under the background of rural revitalization, low-carbon production plan optimization of enterprises under the dual carbon goal, new energy power station layout, and power load optimization scheduling. Throughout the experiment, students are the primary participants. They can experience a complete process, including the analysis of ideological and political cases, model construction, algorithm solving, and management insights extraction. Relying on

these ideological and political practice cases, students consolidate theoretical knowledge and cultivate their ability to solve practical problems. At the same time, it enables students to contact and understand the major national development deployments such as rural revitalization, dual-carbon strategy, and green development. Students can deeply perceive the mission of the times, social responsibility, and professional responsibility behind professional learning. It further guides students to establish the correct professional outlook and values.

3.3. Enriching Teaching Methods

The course team has adopted diverse teaching methods, such as case studies, group discussions, comparative teaching, and game-based learning, to help students better understand the models, theorems, properties, and algorithms of the operations research course. To better achieve the course objectives, BOPPPS and PBL teaching methods are introduced on top of existing methods, as both approaches put students at the center of learning. BOPPPS gives each class session a clear structure and pushes for active participation. PBL turns a real problem into the thing that drives student exploration. Adoption of the two methods is beneficial to shift the classroom from a teaching-centered to a learning-centered approach, thereby improving teaching effectiveness and the quality of education.

During the theoretical teaching process, the BOPPPS model is employed to embed ideological and political elements across its six stages, ensuring that value-shaping permeates the entire teaching cycle. Taking the Goal Programming model as a case study, the specific implementation is as follows: In the bridge-in stage, a case concerning the optimization of low-carbon logistics transportation is introduced. By reviewing key knowledge points about transportation issues, students are encouraged to think about multi-objective decision-making problems, while naturally integrating the values of green development and low-carbon environmental protection. The objective stage explicitly outlines the learning goals of the session, ensuring students are fully aware of both the academic focus and the value orientation. The pre-assessment stage utilizes a brief quiz to gauge students' cognitive baseline, allowing the instructor to dynamically adjust the teaching pace. During the participatory learning stage, the delivery of key knowledge is coupled with complex and professional questions. For instance, "How to make trade-offs among the minimization of enterprise transportation costs, the maximization of delivery efficiency, and the minimization of carbon emissions?" Through case analyses and group discussions, students can deepen their cognitive understanding and cultivate their moral character via profound reflection and peer exchange. The post-assessment stage incorporates test questions imbued with ideological elements. For example, "Discuss the application of goal planning in reducing logistics costs and increasing efficiency, reducing carbon emissions, and ensuring the stability of the supply chain". These tests can not only examine students' mastery of theoretical knowledge, but also improve their ideological and political literacy. Ultimately, the summary stage reviews the knowledge points while emphasizing

green development strategies, thereby inspiring students to realize their professional worth and internalize their civic and contemporary responsibilities.

During experimental sessions, a Problem-Based Learning (PBL) approach is adopted to guide students in researching and collaborating on ideological-political cases, integrating value-shaping objectives into the entire process of problem design and solving. In the case of "UAV emergency material dispatch", a scenario is set in an earthquake-stricken area where roads are blocked, and communications are disrupted. Drones are needed to deliver emergency supplies, such as medical supplies, food, and water, to multiple disaster-stricken areas. Different disaster-stricken areas have varying population densities, degrees of damage, and urgency of material needs. Furthermore, the number of drones is limited, as are their payload and range. The students are organized to study the following problems in groups. "Under given resource constraints, try to formulate the optimal drone dispatch plan based on different decision criteria, such as maximizing the efficiency of material delivery, optimizing the coverage, and ensuring fair response to disaster victims' needs." "Compare the optimal plans under different decision criteria." And "Are there any conflicts among these objectives, and if so, how should they be weighed?" Guided by specific problems, students are led to complete the process of problem analysis, model design, solution and result analysis, and sensitivity analysis. They are encouraged to summarize the management insights derived from sensitivity analysis. Finally, they reflect on their learning and organize the results into a complete experimental report according to the specifications. This teaching process deepens students' understanding of theoretical knowledge and strengthens their ability to build models and solve software problems. At the same time, their comprehensive qualities in solving practical problems and teamwork are effectively cultivated. Moreover, by immersing themselves in emergency decision-making scenarios, students are able to genuinely appreciate the core value of putting life first. Besides, they can gain a deep understanding of the specific application pathways of professional courses in emergency management contexts, and ultimately achieve a profound integration of professional competency development and the shaping of ideological values.

3.4. Refining the Evaluation System

At present, the evaluation of the operations research course is dominated by a final written exam (70%), comprising multiple-choice, fill-in-the-blank, computational, and applied questions. While this format heavily emphasizes the mastery of theoretical knowledge and familiarity with algorithms, it falls short in assessing the course's broader moral and educational impact. Grounded in a student-centered philosophy, this paper centers on the learning process to establish a multidimensional and diversified assessment system that equally weighs professional competence and ideological literacy.

The evaluation of operations research courses can be restructured around four dimensions. First is the knowledge comprehension dimension, which assesses stu-

dents' mastery of core concepts, models, and algorithms. Second is the application ability dimension, which evaluates students' practical skills in translating theoretical knowledge into mathematical models, operating software, and interpreting results. Third is the value cognition dimension, which examines the students' understanding of the value concepts embedded in the course, such as green development, patriotism and social responsibility, scientific spirit, and systems thinking. Fourth is the behavioral manifestation dimension, which assesses students' manifestation of fairness, ethical responsibility, teamwork, and innovative thinking during collaborative tasks, case discussions, and simulated decision-making.

To ensure continuous assessment, the evaluation methods span the pre-class, in-class, and post-class stages. First, in-class quizzes (accounting for 10%), mainly consisting of multiple-choice and short-answer questions, are used to quickly check knowledge retention. Second, class performance records (accounting for 10%) document the quality of students' contributions during class discussions, and assess their logical reasoning, oral expression, and ability to understand and articulate value concepts. Third, homework assignments (accounting for 15%), primarily featuring calculation and modeling questions, evaluate students' ability to apply basic knowledge, model real-world problems, and analyze solutions. Fourth is the experimental report (accounting for 20%), which includes modeling, solving, interpreting results, and reflecting on cases of practical problems. It comprehensively assesses students from four core dimensions. Fifth is the final comprehensive assessment (accounting for 45%), which sets open-ended case analysis questions while retaining the traditional question type. These questions provide real decision-making scenarios, requiring students to complete the entire process of modeling and analysis, and explain the value orientation and ethical considerations contained in the modeling and decision-making process.

4. Conclusion

There are some problems in the ideological and political teaching of Operations Research, including the rigid incorporation of ideological elements, slogan-style instructional methods, teacher-centered one-way instruction, and the lack of student participation. To address these problems, this paper investigates integration pathways rooted in a learning-centered approach. Ultimately, it hopes that this research can provide a valuable reference for the teaching reform of ideological and political education in operations research course and similar fundamental disciplinary courses.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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