

Research and Construction of the "Four-Element Integration" Thesis Topic Selection Model in Application-Oriented Universities under Industry-Education Collaboration

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Abstract: This paper focuses on the dilemma of graduation project (thesis) topic selection in application-oriented undergraduate institutions, and conducts an in-depth exploration of the "Four-Elements Integration" (industry challenges, academic achievements, innovation and entrepreneurship projects, and employment needs) thesis topic selection model. Based on existing research findings, it deepens the precise investigation methods for industry demands, strengthens the transformation mechanism of academic achievements, and improves the evaluation system for innovation/entrepreneurship and career planning projects. By introducing cutting-edge technologies such as big data and artificial intelligence, and integrating the OBE educational concept, this study constructs a graduation project topic selection model for application-oriented undergraduate institutions. The model not only improves topic selection quality but also enhances students' practical innovation capabilities, achieves deep alignment between talent cultivation and industry needs, and provides a referential practical paradigm for talent development in application-oriented undergraduate institutions.

Keywords: Industry-Education Collaboration; Application-Oriented Universities; Four-Element Integration; Thesis Topic Selection Model; OBE (Outcome-Based Education)

1. Introduction

With the advancement of China's industrial restructuring and high-quality economic development, application-oriented undergraduate institutions have become increasingly important in the talent cultivation system. As a key comprehensive practical component of undergraduate education, graduation projects (theses) serve as a crucial platform for students to transform theoretical knowledge into practical and innovative capabilities. In 2018, the "Ministry of Education's Notice on Implementing the Spirit of the National Conference on Undergraduate Education in the New Era" explicitly emphasized the need to "substantially improve the quality of graduation theses (designs)" and required "strengthening supervisors' responsibilities and enhancing the whole-process management of graduation theses (designs)" [1]. As the logical starting point of graduation projects, the quality of thesis topics directly determines the value of the projects and the effectiveness of talent cultivation. However, current thesis topics in most application-oriented undergraduate institutions often suffer from disconnection with industrial needs, lack of innovation, and weak practical orientation, failing to meet the demand for high-quality application-oriented talents. This study aims to address these challenges by constructing a "Four-Elements Integration" (industry challenges, academic achievements, entrepreneurial projects, and employment needs) thesis topic selection model, thereby promoting educational reform and enhancing the quality of talent cultivation in application-oriented undergraduate institutions.

2. Research Background of the "Four-Elements Integration" Thesis Topic Selection Model

The institutional orientation of application-oriented universities requires not only profound theoretical understanding but, more importantly, practical implementation in educational practice. Its core mission should focus on cultivating application-oriented talents who meet the demands of regional socioeconomic development and industrial transformation, with particular emphasis on the comprehensive development of students' practical abilities, innovative capacities, and professional

competencies [2].

As a crucial component for assessing students' mastery of professional knowledge and comprehensive application skills, graduation projects (theses) should inherently align with this educational objective. However, current thesis topics in application-oriented undergraduate institutions commonly suffer from insufficient practical relevance. Most topics proposed by instructors tend to emphasize fundamental theoretical research, which significantly deviates from the goals of application-oriented talent cultivation and fails to address actual industrial needs [3]. Consequently, students have limited opportunities to engage with authentic industry challenges during their research process, hindering the development of practical problem-solving skills.

Moreover, the prevalent lack of innovation and interdisciplinary integration in topic selection restricts students' innovative thinking, making it difficult to cultivate the interdisciplinary talents increasingly demanded by industries. Additionally, the disconnect between thesis topics and students' personal career development plans undermines the potential guiding role of graduation projects in professional growth.

Given these challenges, there is an urgent need to establish a novel topic selection framework that organically integrates industrial demands, academic achievements, and career development considerations. Such an approach would significantly enhance both the quality of graduation projects and the targeted effectiveness of talent cultivation.

3. Construction of the "Four-Elements Integration" Thesis Topic Selection Model

The "Four-Elements Integration" thesis topic selection model is guided by the OBE (Outcome-Based Education) concept, with data from four dimensions - industry challenges, academic achievements, innovation/entrepreneurship projects, and employment needs - as its core. This model establishes a dynamic, intelligent, and deeply collaborative new topic selection system. By breaking traditional boundaries of topic selection and reconstructing multi-party resources digitally, it achieves synchronization between graduation project topics, industrial upgrading, and students' personalized development.

3.1 Industry-Driven: Mining and Intelligent Matching of Industrial Problems Based on Dynamic Topic Database

3.1.1 Construction of Intelligent Dynamic Topic Database

The "National Implementation Plan for Industry-Education Integration Pilot Projects" explicitly encourages using information technology to build industry-education integration information service platforms. Establishing a dynamic topic database is particularly essential for thesis topic selection in application-oriented undergraduate programs. To enhance the foresight and comprehensiveness of the topic database, we actively expand its dimensions. Horizontally, we strengthen resource integration with school-enterprise cooperation platforms of similar institutions, establishing a topic resource sharing alliance. Through regular alliance meetings, we share high-quality topic resources from distinctive majors across institutions, achieving complementary advantages in topic resources. University-industry collaboration plays a vital role in promoting technological innovation, knowledge transfer, and economic development [4]. Vertically, we collaborate with leading enterprises to co-build a "joint topic pool," where enterprises regularly update practical problems (quarterly). Using the Delphi method, we invite industry experts, enterprise technical specialists, and academic scholars to form an expert panel. Through multiple rounds of anonymous feedback and discussion on collected industry demands, consensus is gradually reached to identify research directions with both academic value and practical significance. This enables students to access cutting-edge industry research topics and develop capabilities to solve complex engineering problems.

3.1.2 Precision Topic Matching Based on Industry Needs

We establish a bidirectional "student-topic" matching mechanism. The topic database provides recommendation functions based on multimodal data fusion, integrating students' course learning data, competition awards, career assessment data, etc. Using deep learning algorithms, we build student competency profiles that dynamically evaluate students from dimensions of knowledge base, skill level, and innovation potential. This enables precise alignment between student capabilities and industry challenges. Reinforcement learning technology is employed to continuously optimize matching

strategies and update personalized topic recommendation lists for each student.

3.2 Academic Transformation: Interdisciplinary Upgrade and Topic Incubation of Professional Practice Achievements

3.2.1 Systematic Review and Value Assessment of Academic Achievements

With industry-education integrated courses at the core, we construct a "course-practice-topic" integrated training system. At the course design stage, real enterprise project cases are introduced to closely align teaching content with actual industry needs. Additionally, an academic achievement tracking and incubation mechanism is established to continuously nurture outstanding outcomes generated by students during course practice. A dedicated academic achievement management platform is established up to record the progress, highlights, and challenges of students' course practice projects. Through virtual teaching and research sections for university-enterprise cooperation, university instructors and industry experts provide regular guidance and evaluation of students' academic achievements. For results with research potential, their underlying value is further explored to guide students in transforming them into graduation thesis topics. For example, the project outcome "Optimization Strategies for E-commerce Live Streaming Operations on Short Video Platforms" proposed by marketing majors in the "Digital Marketing" course was refined under the guidance of school and enterprise experts, ultimately becoming a graduation thesis topic and being applied in actual corporate projects.

3.2.2 Cross-Course and Cross-Disciplinary Topic Incubation

Disciplinary barriers are broken by establishing interdisciplinary topic guidance teams composed of instructors from diverse academic backgrounds and enterprise experts from multiple fields. A "joint guidance + thematic seminar" model is adopted during the topic guidance process. For instance, for the topic "Research on Precision Marketing Strategies Based on Big Data," which involves both marketing and data analysis:

- Marketing faculty guide the market analysis and marketing strategy development components;
- Computer science and statistics faculty advise on data collection, processing, and analytical methods;
- Corporate marketing experts provide real-world case studies and industry insights;
- Enterprise technical specialists evaluate the feasibility of data processing techniques.

Through the integration and cross-pollination of multidisciplinary knowledge, students receive comprehensive, multi-perspective guidance that cultivates interdisciplinary thinking and holistic problem-solving skills. Concurrently, interdisciplinary course modules and practical projects are established to encourage students to take cross-disciplinary courses and participate in interdisciplinary practical activities, further enhancing their interdisciplinary literacy and comprehensive practical capabilities.

3.3 Entrepreneurship Empowerment: Full-chain Cultivation and Topic Deepening of Innovation and Entrepreneurship Projects

3.3.1 Transformation Pathway for Innovation and Entrepreneurship Project Topics

This approach closely integrates college students' innovation and entrepreneurship training programs with various innovation competitions and graduation thesis topics. For established innovation and entrepreneurship projects, project teams conduct comprehensive evaluations under faculty guidance, analyzing research progress, existing challenges, and development potential. Projects demonstrating significant research value and alignment with graduation design requirements are transformed into thesis topics, enabling deeper investigation based on the original projects.

3.3.2 Incentive and Feedback Mechanisms for Innovation and Entrepreneurship

A three-tier "Seed-Growth-Incubation" incentive system has been established:

Seed Stage: The "Entrepreneurship Seed Fund" provides initial funding for nascent projects

Growth Stage: University-enterprise collaborative laboratory resources become available to support ongoing thesis research

Incubation Stage: Commercially viable outcomes receive priority access to the university's innovation incubator, benefiting from rent-free workspace and integrated legal/consulting services

The "Entrepreneurship Credit Bank" system allows students to accumulate credits through participation in entrepreneurial lectures, project roadshows, and commercialization activities. These credits may be redeemed for:

- Elective for elective entrepreneurship courses
- One-on-one mentoring sessions with corporate executives
- Partial graduation design credit equivalency

Concurrently, partnerships with local human resources agencies and chambers of commerce facilitate "Graduation-Entrepreneurship" achievement exhibitions, where students directly engage with local enterprises and venture capital institutions.

3.4 Employment Orientation: Precise Alignment with Career Needs and Collaborative Topic Development

3.4.1 Precise Matching with Employer Requirements

The university strengthens collaboration with employers by establishing regular communication mechanisms for employment needs. The career guidance center conducts regular visits to enterprises to understand their talent demands, job skill requirements, and business development directions. Concurrently, through collecting corporate recruitment information, detailed analyses of position requirements are performed to extract essential knowledge, skills, and competency components. Based on these needs, the university collaborates with enterprises to jointly develop graduation project topic guidelines that clarify research directions and requirements.

For students who have signed employment agreements, they are encouraged to communicate with their future employers to determine graduation project topics based on actual job requirements. This ensures the topics closely align with the practical work content of their prospective positions.

3.4.2 Dual-Supervisor Guidance Model with Industry-Academia Collaboration

For employment-oriented graduation projects, a dual-supervisor guidance model is adopted, involving both academic and industry mentors:

Academic Supervisor: Guides students on academic standards, research methodologies, and theoretical applications

Industry Supervisor: Provides practical guidance from professional experience to ensure the applicability and practicability of research outcomes

The dual supervisors hold regular meetings to discuss student progress and jointly address challenges encountered during the research process. During the final evaluation phase, industry supervisors participate in thesis defense reviews, assessing student outcomes from the perspective of real-world industry needs. This approach transforms the graduation project into a genuine transitional bridge from academia to the workplace, significantly enhancing students' employability and job adaptability.

4. Safeguard Measures for Constructing the "Four-Elements Integration" Thesis Topic Selection Model

4.1 Organizational Safeguards: Establishing a Multi-level Collaborative Management Framework

A university-level leadership group for the "Four-Elements Integration" topic selection model will be established, headed by the university president and comprising deans of academic affairs office, deans of schools, core representatives from industry associations, and senior executives of partner enterprises. As the top-level decision-making body, the leadership group will be responsible for overall planning of the model's development direction, coordinating internal and external resources, formulating annual implementation plans and long-term development strategies. It will convene quarterly joint meetings to review major issues and resolve cross-departmental and interdisciplinary challenges.

At the secondary college level, topic selection offices will be established with dedicated management and technical support staff. These offices will implement decisions from the leadership group and organize specific execution of topic selection processes within their colleges, including topic collection, review, allocation, process supervision, and outcome evaluation. Additionally, an enterprise liaison specialist system will be established, with 1-2 specialists assigned per major to maintain daily communication with partner enterprises, promptly feedback enterprise needs and student progress, ensuring timely and accurate information exchange between academia and industry.

Furthermore, university-enterprise collaborative working groups will be formed, consisting of faculty members and enterprise technical experts/management personnel, organized by project or professional field. These groups will hold monthly working meetings to jointly address technical challenges and progress delays encountered during the topic selection process, promoting deep collaboration in areas like topic guidance and practical teaching.

4.2 Institutional Safeguards: Improving the Full-process Regulation System

"Measures for Four-Element Integration Graduation Project Topic Selection" will be formulated, specifying topic sources, review standards, allocation principles, implementation procedures, and evaluation methods. The regulations will require that topics must originate from real industry problems, academic achievement transformation, innovation/entrepreneurship projects, or employer needs, and must undergo three-level review by panels composed of enterprise experts, faculty, and industry representatives to ensure authenticity, feasibility, and educational value. For topic allocation, a combined mechanism of "student self-selection + advisor recommendation" will be adopted to balance student interests and capabilities.

A faculty guidance evaluation system will be established, incorporating topic guidance work into faculty performance assessments. Clear evaluation metrics will be set, including number of students guided, topic quality improvement rate, student achievement awards, and enterprise satisfaction. Outstanding faculty will receive incentives such as promotion points and teaching bonuses, while underperforming faculty will receive improvement guidance or task adjustments, thereby motivating active and responsible participation in topic guidance.

To enhance enterprise participation, an enterprise engagement incentive system will be developed. Enterprises providing high-quality topics, deeply participating in guidance, or opening practice venues will receive benefits like tax incentives, honorary awards (e.g., titles of "Model Enterprise for Industry-Education Integration"), and priority for industry-academia-research collaboration projects. An enterprise feedback mechanism will collect regular input to optimize collaboration models and incentives, forming a virtuous cycle of university-enterprise cooperation.

4.3 Resource Safeguards: Integrating Internal and External Resources

Special funds for "Four-Element Integration" topics will be established within the university's annual budget, supporting the development and maintenance of the dynamic topic database, interdisciplinary topic incubation funds, entrepreneurship seed funds, faculty training, and student practice awards. This ensures continuous database updates, smooth implementation of student innovation projects, and faculty teaching capacity building. External funding sources such as government special funds, corporate sponsorships, and social donations will also be pursued to diversify financial channels.

The construction of practical teaching bases will be strengthened through deeper enterprise collaboration. Partnerships with leading enterprises will establish industry-academia-research bases and internship training bases, providing authentic industry practice environments. On-campus innovation and entrepreneurship incubators will be equipped with comprehensive office facilities, laboratory equipment, and startup support teams to nurture student projects. Additionally, university resources like library collections, electronic databases, and advanced laboratory equipment will be integrated into a unified sharing platform for efficient utilization. Collaboration with industry associations and enterprises will establish external resource platforms, introducing cutting-edge technical materials and enterprise case databases to enrich student research resources.

4.4 Quality Safeguards: Establishing a Full-process Quality Monitoring Mechanism

A comprehensive quality control system covering "topic determination - research process - outcome

evaluation" will be implemented. During topic determination, review panels will rigorously evaluate topics based on alignment with the "Four-Elements Integration" model, research value, feasibility, and innovativeness, requiring revisions or rejecting non-compliant topics.

During the research process, fortnightly progress reports will be submitted by students to advisors for targeted guidance. College topic offices will conduct mid-term checks each semester through document reviews, interviews, and presentations to identify and resolve challenges, ensuring research stays on track.

Outcome evaluation will employ diversified assessment methods, with defense committees composed of enterprise mentors, industry experts, and professors. Committees will comprehensively evaluate student work based on academic rigor, practical application value, innovation, and teamwork, ensuring objective and professional assessments. A quality feedback mechanism will promptly communicate evaluation results to students, faculty, and relevant departments, providing improvement suggestions to continuously optimize the topic selection model and enhance graduation project quality.

5. Conclusions

This study proposes the innovative "Four-Element Integration" thesis topic selection model, which systematically combines industry challenges, academic achievements, innovation/entrepreneurship projects, and employment needs to address the critical challenges in application-oriented undergraduate education. The model establishes a dynamic topic database for real-time industry alignment, implements mechanisms to transform academic outcomes into research topics, fosters innovation through entrepreneurship-project integration, and enhances career readiness via employment-focused customization. Supported by comprehensive organizational, institutional, resource, and quality assurance measures, the model demonstrates strong potential for improving graduation project relevance and student competencies. However, challenges remain in implementation, necessitating further expansion of industry-academia collaboration, technological upgrades to intelligent platforms, and continuous faculty development to ensure broader adoption across disciplines and institutions. Future research should focus on optimizing these aspects while maintaining the model's core integration principles to maximize its impact on applied talent cultivation.

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2) Research outcome of the August 2024 Project Batch of the Ministry of Education Industry-Academia Collaborative Education Program "Research on the Construction of Financial Big Data Resource Database for Cultural Tourism Industries"(241104978140828).

3) Research outcome of the Second Batch of Curriculum Ideology and Politics Demonstration Course and Teaching Team Development Project at Heilongjiang Institute of Technology Kunlun College of Tourism—"Digital Marketing".

4) Research outcome of the Heilongjiang Higher Education Association Special Topic "Research on Talent Cultivation Strategies for Tourism Management Vocational Education Under the Industry-Education Integration Model" (24GJZXE023)—A Special Topic Aligned with the Third Plenary Session of the 20th CPC Central Committee and the 2024 National Education Conference.

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