

Collaborative Education Mechanism of Local Undergraduate Universities Integrating Industry and Education: Based on Actor Network Theory

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Abstract: Integration of industry and education has become the main approach for Local undergraduate universities to cultivate applied talents. However, there are problems such as insufficient motivation for integration, lack of governance mechanisms, and a single mode of collaborative education. This article reinterprets the process of collaborative education through the lens of actor-network theory and formulates corresponding incentive and governance mechanisms. By analyzing the actors involved in the collaborative practice of integrating industry and education, such as government, universities, enterprises, teachers, students, policies, curricula, and practice platforms, their motivations, capabilities, and interests are identified. The process of collaborative education is then analyzed from four aspects: problem identification, benefit attribution, effective mobilization, and sufficient motivation. Based on this, incentive mechanisms based on core actors and governance mechanisms based on all actors are constructed to enhance the motivation of actors, adjust the relationship network among actors, expand the network effect, and explore distinctive and diversified collaborative education models.

Keywords: Local Undergraduate Colleges; Integration of Industry and Education; Collaborative Education; Actor Net Work

1. Introduction

Since 2017, deepening the integration of industry and education, the combination of industry, academia, and research, and the cooperation between schools and enterprises have become necessary for the development of higher education, especially applied higher

education in China. In 2022, it was stated that in China, "coordination and innovation of vocational education, higher education, and continuing education should be promoted, the integration of vocational and general education, industry and education, and science and education should be advanced, and the positioning of vocational education types should be optimized." In recent years, local undergraduate institutions have achieved good results in the integration of industry and education, collaborative education, and other aspects. However, there are issues such as insufficient driving force for industry-education integration, lack of governance mechanisms, and a single collaborative education model [1], which have led to the ongoing contradiction between graduates' abilities and industry demands [2].

Academic understanding of collaborative education-industry integration is based on theories such as cooperation, collaboration, and a community of interests, focusing on school-enterprise cooperation and collaborative mechanisms. In fact, industry-education integration and collaborative education form a multi-party collaborative system consisting of enterprises, schools, teachers, students, and various resources. Clearly, innovative theoretical thinking is needed for exploring and practicing industry-education integration and collaborative education. Actor-Network Theory (ANT), founded by the French sociologist Latour in the 1970s, is a flexible, open, and diverse analytical approach that helps analyze the interactions between individuals and social systems in the operation of education policies, providing insights for educational policy research in China [3]. Actor-Network Theory emphasizes analyzing the behavioral logic and multiple demands of multiple actors to explore

possible pathways to collaboration. Industry-education integration and collaborative education form a collaborative network consisting of enterprises, schools, teachers, students, and various actors, requiring the concerted efforts of multiple parties to enhance educational effectiveness. Given the relevance of theoretical research to practical issues, the introduction of actor-network theory into research on industry-education integration and collaborative education in universities is theoretically applicable [4].

This article, from the perspective of actor-network theory, regards talent as a product constructed by heterogeneous actor networks through translation mechanisms. By reconstructing the core concepts such as actors, translation, networks, and network effects, it redefines the basic concepts of industry-education integration and collaborative education and determines the actors involved. The relationships among the actors are traced and developed into a network through translation. In addition, incentive and governance mechanisms are established to regulate the relationship network of actors, expand network effects, and enhance the effectiveness of industry-education integration and collaborative education.

2. Actors and Processes in Collaborative Education-Industry Integration of Local Undergraduate Colleges

Key human actors in collaborative education-industry integration include: government, enterprises, teaching units of universities, teachers, and students. Non-human actors play a crucial role at a higher level, manifested in the educational philosophy, curriculum, and policies or regulations related to talent cultivation of universities. These actors can influence and interact with each other, directly determining the direction of network construction. Understanding and analyzing the motivations, capabilities, and interests of different actors are the basis for understanding collaborative education-industry integration of local undergraduate colleges, as shown in Table 1.

Different actors interact and cooperate with each other to achieve common goals. The government formulates policies and provides funding, universities provide teaching resources and talent cultivation, enterprises

provide practical platforms and solutions to real-world problems, teachers provide teaching and research capabilities, and students actively learn and practice. The university management department coordinates resources and interests. Through mutual cooperation, different actors can achieve win-win outcomes and promote the development of collaboration between local undergraduate institutions and industry for cultivating talents.

3. Translation of the Process of Collaborative Education and Integration of Production and Education in Local Undergraduate Colleges from the Perspective of Actor-network Theory

3.1 Problem Identification: The Starting Point of Constructing the Actor-network in the Collaborative Education and Integration of Production and Education in Local Undergraduate Colleges

By considering the collaborative education and integration of production and education as an interactive network, it is recognized as a network effect. By redefining the roles, functions, and relationships of different actors in the interactive network of collaborative education and integration of production and education, the impact of materials in the process of collaborative education and integration of production and education is enhanced. This helps to bring collaborative education and integration of production and education into real scenarios. as shown in Table 2.

During the problem identification stage, the government identifies the needs of industry-education integration in nurturing talents by recognizing issues related to local economic development, talent demand, and education quality. As an important component of local undergraduate institutions, university teaching units need to analyze and provide feedback on the requirements of industry-education integration in nurturing talents, understanding the demands of industries and enterprises. As the main driving force behind local economic development, enterprises need to provide feedback on talent requirements and industrial development demands. As the implementers of industry-education integration in nurturing talents in universities, teachers need to understand the needs of industries and

enterprises and adjust teaching content accordingly. As beneficiaries of industry-education integration in nurturing talents, students need to understand the demands and development trends of the job market and choose suitable majors based on their interests

and abilities. As the department responsible for overall coordination and organization in universities, university management departments need to clarify the goals and tasks of industry-education integration in nurturing talents.

Table 1. Motivations, Abilities, and Benefits of Stakeholders in Collaborative Education-Industry Integration in Local Undergraduate Institutions.

Stakeholders	Motivations	Abilities	Benefits
Government	Enhancing local economy's innovation capacity and industrial competitiveness	Developing educational policies and regulations, providing funding support	Establishing reasonable policy frameworks and regulatory mechanisms
Academic Units of HEIs	Closely aligning with industry demands and cultivating high-quality talents that meet market needs	Providing academic resources and teaching environment	Gaining access to professional practice resources and opportunities
Enterprises	Collaborating with HEIs to cultivate talents that meet enterprise demands, addressing the talent supply-demand issues of employers	Providing practical opportunities, technical and financial support	Acquiring suitable talents, promoting technological innovation, and enterprise development
Teachers	Enhancing their teaching level and professional competence, imparting knowledge and skills	Teaching and research abilities	Providing students with knowledge and skills that match industrial development
Students	Acquiring knowledge and skills, enhancing employability	Ability for independent learning and problem-solving	Gaining practical experience and job opportunities
Higher Education Management Departments	Improving the quality and influence of HEIs	Management and coordination abilities	Obtaining more financial and resource support, advancing the collaborative education-industry integration work
Philosophy	Promoting educational innovation	Providing guiding ideas for educational innovation	Realizing the organic connection between the educational goals of the school and the development of industries
Policies	Providing policy support and fund allocation, creating a favorable policy environment	Exercising incentive and governance abilities	Effectively implementing and providing feedback
Curricula, textbooks, training programs, etc.	Providing professional knowledge and practical skills that align with industrial development	Cultivating students' professional competence, practical abilities, and innovation and entrepreneurship capabilities, etc.	HEI academic units design relevant courses and develop textbooks based on industry demands and collaborate with enterprises in exploring curriculum reform; attracting stakeholders' active participation and feedback
Teaching facilities, practical platforms, etc.	Providing practical scenarios for collaborative education-industry integration	Enhancing the practical abilities of relevant stakeholders	HEI academic units and enterprises jointly equip and build teaching facilities and practical platforms that align with industry demands

Table 2. Roles, Functions, and Relationships in the Collaboration between Local Undergraduate Institutions and Industry-Education Integration

Actor	Network Role	Node Function	Relationship Links
Government	Core Actor	Formulate relevant policies and plans, provide financial support, create a favorable policy environment, etc.	The interrelationships among the five key actors
University teaching units	Core Actor	Offer relevant courses, develop teaching materials, provide teaching facilities and practical platforms, etc.	
Enterprise	Core Actor	Provide practical positions, participate in the design of teaching content and facilities, offer practical projects, etc.	
Teachers	Core Actor	Teach knowledge and skills, guide students in practical projects, assist students in understanding industry demands, etc.	
Students	Core Actor	Acquire knowledge and skills, engage in practical projects, enhance their professional qualities, etc.	
University management departments	Important Actor	Formulate educational policies and management standards, coordinate cooperation among various parties, provide teaching resources, etc.	Interactions with enterprises, teaching units, teachers, and students
Vision	Important Actor	Lead educational reform in universities, promote a win-win cooperation model between universities and enterprises, advance innovation and entrepreneurship education, cultivate high-quality talents, etc.	One-way relationship with teachers, courses, teaching materials, etc.
Policies	Important Actor	Provide policy guidance and resource guarantees, encourage active participation in industry-education collaboration, promote integration of industry and education, etc.	One-way relationships with teaching units, enterprises, teachers, and students
Courses, Teaching Materials	Supporting Actors	Combine theoretical knowledge with practical skills, cultivate students' professional qualities and abilities, etc.	One-way relationships with teaching units, teachers, enterprises, and students
Teaching Facilities	Supporting Actors	Provide practical training places, create a favorable educational environment, facilitate the implementation of industry-education collaboration, etc.	One-way relationships with teachers, enterprises, students, and courses
Practical Platforms	Supporting Actors	Provide practical opportunities, help students apply theoretical knowledge to practice, cultivate innovative and entrepreneurial spirits and practical abilities, etc.	One-way relationships with enterprises, teaching units, teachers, and students ²

3.2 Interest Allocation: Core of Constructing a Network of Actors in Local Undergraduate Institutions' Industry-Education Integration to Nurturing Talents

Interest allocation is the second stage in the process of translation. Self-interest is a fundamental characteristic shared by all actors and also an important driving force that brings

various actors together to form a heterogeneous network. Firstly, interest allocation should be combined with the roles, functions, and relationship connections of different actors to clarify their respective interest demands. During the interest allocation stage, the government allocates interests by formulating policies and investing funds to

provide support and guarantees for industry-education integration to nurturing talents. University teaching units need to actively improve teaching standards, enhance teacher training and capacity building, and establish platforms for collaboration with enterprises. Enterprises need to provide practical platforms and technical support, collaborating with university teaching units to carry out industry-academia research cooperation. Teachers need to enhance teaching standards and research capabilities, actively participating in industry-academia research cooperation projects. Students need to actively engage in learning and practical activities to improve their core competitiveness. University management departments need to provide corresponding resources and support, establishing a scientific management system. Secondly, due to different demands from various parties, interest conflicts and disputes may arise during the interest allocation process, and core actors are required to mediate. Lastly, interest allocation aims to satisfy the interest demands of various actors to the maximum extent and achieve an interest alliance [5].

3.3 Effective Recruitment: Foundation of Constructing a Network of Actors in Local Undergraduate Institutions' Industry-Education Integration for Nurturing Talents

Effective recruitment refers to the process of recruiting more connected new members and supporters into the network of actors through various means and methods under an open orientation. It can provide more potential support and new vitality for the network construction, serving as a source of continuous expansion and renewal of the network [6].

Effective recruitment follows the principles of diversity, respect, and effectiveness. Diversity principle means that every core or important actor can be effectively recruited, while the respect principle means respecting the interest demands of each new actor. The effectiveness principle means recruiting new actors based on the urgency of problem-solving within the network, establishing interest alliances, and timely addressing the issues, and then weakening the relationship connection with that actor. For example, the government, as a recruiter, can recruit various actors to participate in industry-education integration

for nurturing talents through promoting and guiding relevant policies. University teaching units need to actively engage in the government's industry-education integration plans. Enterprises need to actively participate in the government and university teaching units' industry-education integration plans. Teachers need to collaborate with the government and enterprises to promote industry-education integration. Students need to actively cooperate with teachers and enterprises, accepting relevant training and practical opportunities. University management departments need to collaborate with the government, teaching units, and enterprises to implement industry-education integration plans.

It is worth mentioning that in the network of actors for industry-education integration in local undergraduate institutions, the relationship between humans and objects, and between subjects and objects is not contradictory. Non-human actors also have an equal subject status and proactive role. Recruitment and subsequent mobilization work for non-human actors can be carried out by appointing qualified "advocates" on their behalf.

3.4 Full Mobilization: Guarantee for Building a Network of Actors in Local Undergraduate Institutions' Industry-Education Integration for Nurturing Talents

Full mobilization refers to the continuous enhancement of actors' enthusiasm and initiative in participating in network construction through various forms of methods and means, thus promoting the vitality, unity, and efficiency of the network operation [7].

During the full mobilization stage, as the core actor in industry-education integration for nurturing talents, university teaching units need to promote active participation of various actors in teaching and practical activities, generate synergy, serve students and enterprises, and improve education quality and employability. Enterprises should actively provide internship and employment opportunities, cultivating students' practical abilities and competitiveness in the job market. Teachers should actively participate in teaching reforms and practical activities, enhancing students' practical skills and

professional qualities. Students should actively engage in both on-campus and off-campus practical activities, broadening their personal development space. University management departments should strengthen the organization and promotion of industry-education integration for nurturing talents, mobilizing the enthusiasm of all parties involved.

Through the roles mentioned above, the process of translating industry-education integration for nurturing talents in local undergraduate institutions can achieve the objectives of problem identification, interest endowment, effective recruitment, and full mobilization, ultimately achieving the collective improvement of local economic development and the quality of talent cultivation.

4. Construction of a Network of Actors in Industry-Education Integration for Nurturing Talents in Local Undergraduate Institutions from the Perspective of Actor Network Theory

To build a network of actors in industry-education integration for nurturing talents in local undergraduate institutions, various human and non-human factors, including government, enterprises, universities, teachers, students, training programs, teaching facilities, and practical platforms, should be considered. This network should create an equal, flexible, and open environment, along with incentive and governance mechanisms to ensure the smooth operation of the network. These mechanisms should increase the enthusiasm of participants, encourage breaking existing boundaries, improve resource utilization efficiency, maximize network effects, and discover distinctive models of industry-education integration for nurturing talents.

4.1 Designing an Incentive Mechanism based on Core Actors in Industry-Education Integration for Nurturing Talents in Local Undergraduate Institutions

Based on the translation characteristics and interactive relationship features between the core actors and other actors in industry-education integration for nurturing talents, an incentive mechanism should be designed to stimulate core actors to increase their connections and expand their influence on other actors. This mechanism should ensure

the smooth completion of the effective recruitment and full mobilization stages.

The government, as a core actor guided by social benefits, should design incentive policies to encourage enterprises and universities to participate in industry-education integration for nurturing talents. This can be achieved by selecting and nurturing industry-education integration-oriented enterprises and universities, incentivizing interaction and connections with other actors in the network.

University teaching units, as core actors aiming for talent development, should cooperate with enterprises in curriculum reforms, teaching materials, and talent training programs, encouraging enterprises' participation in various aspects of curriculum reform. They can increase the proportion of industry-education integration in teachers' annual performance evaluations or award "industry-education integration-oriented teachers" for recognition. Additionally, they can increase the weight of enterprise practical activities in students' comprehensive assessments and provide rewards for outstanding students.

Enterprises, as core actors aiming to acquire suitable talents, should design systematic incentive measures for university teaching units, teachers, and students within the network of actors in industry-education integration for nurturing talents. Based on industry development trends, they can collaborate with university teaching units to develop talent growth specialized training programs and provide financial support. Establishing industry-education integration laboratories and inviting teachers to jointly develop implementation plans for talent growth are also effective measures.

4.2 Designing a Governance Mechanism based on All Actors in Industry-Education Integration for Nurturing Talents in Local Undergraduate Institutions

The difficulty in constructing a network of actors in industry-education integration for nurturing talents lies in the translation process of core actors. Core actors continuously translate the problems and interests of other actors into their own language, completing the translation process. This process typically consists of four stages: problem presentation, interest endowment, recruitment, and

mobilization. However, conflicts and struggles often exist between core actors and other actors, making it difficult for core actors to successfully complete the translation process. To address this issue, it is crucial to design a powerful governance mechanism to regulate the translation behavior of all actors, consolidate their positions in the network, enhance network stability, ensure the smooth completion of problem presentations and interest endowment, and maintain a stable and connected state of the network of actors in industry-education integration for nurturing talents.

The government, enterprises, universities, and teachers can establish an equal negotiation mechanism. Following the problem-solving process in the network of actors, which includes problem automation, debate and negotiation of solutions, and problem resolution and implementation stages [8], the initiator of the problem can convene a negotiation meeting to address the problem through the four stages of conceptualization of problems and solutions, balance of viewpoints/social acceptance, institutionalization, and alliance building [9]. However, it is essential to note that government-led interest alliances are guided by social benefits, university-led interest alliances focus on talent development effectiveness, and enterprise-led interest alliances prioritize efficiency in acquiring suitable talents [10].

5. Conclusion

Local undergraduate colleges can create an equal, flexible, and open network of actors for the collaborative education between local undergraduate colleges and industries, based on various factors including governments, enterprises, universities, teachers, students, training programs, teaching facilities, and practical platforms. Following the stages of problem identification, interest allocation, effective recruitment, and full mobilization, complete the translation process of core actors. Furthermore, design an incentive mechanism for collaborative education between local undergraduate colleges and industries based on the five core actors, as well as a governance mechanism for collaborative education between all actors. These mechanisms aim to enhance the enthusiasm of participating entities, encourage breaking existing

boundaries, improve the utilization efficiency of resources, maximize network effects, and promote the emergence of distinctive models for collaborative education between industries and academia in local undergraduate colleges.

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