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Innovative Research on the Talent Cultivation Model for Big Data Innovation and Entrepreneurship through Industry-Education Integration and University-Enterprise Collaboration

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Abstract: With the rapid development of the digital economy, the big data industry faces a prominent imbalance between talent supply and demand, as traditional education models struggle to meet industry requirements for innovation and entrepreneurship talent. This paper focuses on the collaborative mechanisms of industry-education integration and university-enterprise partnerships, systematically analyzing four core issues in current big data talent cultivation: the disconnection between curriculum systems and industrial needs, insufficient depth in university-enterprise collaboration, lagging innovation in teaching methods, and weak practical capabilities of faculty. To address these challenges, the study proposes a "Four-Chain Integration" collaborative education ecosystem. This model includes reconstructing curricula through industry chain alignment, empowering teaching with research achievements via innovation chains, optimizing blended digital teaching modes through education chains, and establishing industry-education evaluation mechanisms via talent chain closure. The research further proposes safeguard systems, including a quaternary governance ecosystem, dual-cycle resource pools, and dynamic adjustment mechanisms, to deepen the integration of education and industry chains. Future efforts should expand international cooperation, integrate generative AI and metaverse technologies, and strengthen interdisciplinary collaboration to build a more adaptive big data talent cultivation ecosystem. This paper provides theoretical and practical insights for addressing industry-education integration challenges and enhancing innovation and entrepreneurship education quality.

Keywords: Industry-Education Integration; School-Enterprise Collaboration; Big Data; Innovation; Entrepreneurship

1. Introduction

With the in-depth implementation of national policies such as the "Action Outline for Promoting Big Data Development," the big data industry has become a key force in driving economic and social development. However, the contradiction between the supply and demand of talent in the big data field is becoming increasingly prominent, and traditional education models are struggling to cultivate high-quality innovative and entrepreneurial talents that meet industry needs. Industry-education integration and university-enterprise collaboration, as critical pathways to address this challenge, are gradually becoming a consensus in both the education and industry sectors.

Currently, successful cases such as the "Hundred Schools Project" of Data China and the "Campus Cloud Warehouse" jointly established by JD Logistics and related universities provide practical examples for industry-education integration and university-enterprise collaboration [1]. However, the cultivation of innovative and entrepreneurial talents in big data still faces numerous challenges. Issues such as the disconnection between the curriculum system and industry needs, insufficient depth in university-enterprise collaboration, lagging innovation in

teaching methods, and the lack of practical capabilities among faculty severely constrain the quality and efficiency of talent cultivation. Therefore, it is particularly important to deeply analyze the main problems and factors in the process of cultivating innovative and entrepreneurial talents in big data, propose targeted countermeasures and model innovations, and construct relevant support systems.

2. Analysis of Main Problems and Factors in Cultivating Innovative and Entrepreneurial Talents in Big Data

Under the background of industry-education integration, the main problems in cultivating innovative and entrepreneurial talents in big data are concentrated in the curriculum system, faculty, teaching methods, and cultivation models.

2.1 Disconnection between Curriculum System and Industry Needs

Traditional university course designs do not incorporate the "Technology Readiness Level" theory, leading to teaching content lagging behind technological iteration cycles, a lack of practical teaching on cutting-edge tools, and an overemphasis on theoretical courses [2]. For example, tools like Spark and Flink have entered the production maturity stage, but some universities still focus on basic Hadoop teaching. The traditional computer course framework cannot form a modular course system tailored to the big data industry chain (data collection, cleaning, modeling, visualization), making it difficult for students to master data processing and analysis capabilities in real-world scenarios [3].

2.2 Insufficient Depth in University-Enterprise Collaboration

The main title (on the first page) should begin University-enterprise cooperation often remains at the level of internship base construction, lacking mechanisms for joint technical research and project cultivation. Approximately 60% of enterprises report that graduates from universities require more than six months of adaptation to be competent for data engineering positions, with a conversion rate of industry-academia collaboration of less than 20% [4]. Additionally, unclear intellectual property ownership (e.g., lack of data desensitization rules) and ambiguous benefit distribution mechanisms (e.g., unclear proportions of research achievement conversion benefits) exacerbate the difficulties in university-enterprise collaboration.

2.3 Lagging Innovation in Teaching Methods

Traditional classrooms still primarily rely on one-way knowledge transfer, lacking project-based and scenario-based teaching. Research shows that only 45% of universities introduce real enterprise data cases into teaching, making it difficult for students to develop full-process innovation capabilities from data mining to commercial application [4]. Courses related to big data in universities have a low introduction rate of real enterprise cases, with slow updates to case libraries (e.g., still using 2018 shared bike datasets) and insufficient coverage of new scenarios (e.g., AIoT, blockchain) [5].

2.4 Insufficient Practical Capabilities among Faculty

Faculty generally lack practical enterprise experience, with teaching content overly focused on theoretical derivation and insufficient analysis of real industry cases [6]. Data shows that only 30% of faculty in applied universities have experience in big data enterprise project development, and the two-way flow mechanism between universities and enterprises is imperfect [7]. For example, some university teachers may master Python programming theory but have not participated in enterprise-level data platform construction, making it difficult to guide students in solving practical problems such as concurrent data processing [8].

3. Countermeasures and Model Innovation for Cultivating Innovative and Entrepreneurial Talents in Big Data: A "Four-Chain Integration" Collaborative Education Ecosystem

To address the core issues in big data talent cultivation, it is necessary to break through traditional educational boundaries and construct a collaborative education ecosystem of "industry chain alignment, innovation chain empowerment, education chain optimization,

and talent chain closure" (see Figure 1). This model, driven by industry needs, achieves deep coupling between talent cultivation and industrial development through curriculum reconstruction, resource integration, and mechanism innovation.

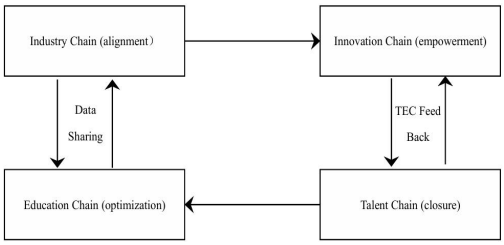

Figure 1. A "Four-Chain Integration" Collaborative Education Ecosystem

3.1 Industry Chain Alignment: Reconstructing a Demand-Oriented Curriculum System

Focusing on the full process of data collection, cleaning, modeling, and visualization, a three-level curriculum system of "basic theory + toolchain practice + industry application" is constructed, and enterprise business data is transformed into teaching cases. Specifically, in data processing and analysis courses, enterprise data computing platforms are introduced to cover Spark real-time computing scenarios; real projects are embedded into teaching practice through university-enterprise cooperation. Simultaneously, course content is updated every six months in collaboration with industry associations to ensure synchronization with technological iterations such as Hadoop and Flink.

3.2 Innovation Chain Empowerment: University-Enterprise Collaborative Research Achievements Feeding Back into Teaching

Horizontal research projects drive teaching by transforming enterprise technical needs into graduation projects or course projects, promoting the technical conversion of research results. Joint laboratories are established, with universities and enterprises co-building big data innovation centers to promote the integration of "faculty research - student training - enterprise application."

3.3 Education Chain Optimization: Innovating Digital Hybrid Teaching Models

Exploring a three-stage teaching model of "MOOC + SPOC + Virtual Laboratory." Specifically, at the theoretical level, foundational courses in data analysis solidify the basics; at the practical level, on-campus virtual simulation platforms (e.g., Spark cluster simulation environments) are used for transaction system design training; at the application level, real enterprise data (e.g., e-commerce user behavior logs) are used to complete commercial analysis projects. Additionally, based on students' varying abilities, AI tools (e.g., AWS Educate intelligent teaching systems) can be used to push learning paths, assisting personalized learning.

3.4 Talent Chain Closure: Establishing an Industry-Education Evaluation-Driven Employment Connection System

Specifically, a "1 + X + ∞" certificate and credit mutual recognition mechanism is established. "1" represents the university as the certification body, adhering to the academic education standards of the Ministry of Education; "X" represents the enterprise as the certification body, meeting industry technical certification standards; "∞" represents platforms like Coursera/Udacity as certification bodies, meeting micro-training skill point certifications. In this mechanism, universities can cooperate with relevant enterprises to encourage students to obtain professional technical certifications, with enterprise-recognized certificates convertible into corresponding credits, thereby promoting students' active exploration of the integration of theoretical learning and industrial practice. Simultaneously, a four-dimensional linkage employment platform is established in collaboration with enterprises, industry associations, and the government to track talent needs in real-time and update, iterate, and improve students' related skill education and training based on market recruitment demands.

4. Guarantee Mechanisms for Cultivating Innovative and Entrepreneurial Talents in Big Data

4.1 Organizational Coordination Guarantee: Quadruple Governance Ecosystem

Construct a collaborative governance

framework of "government guidance - university leadership - enterprise participation - industry evaluation" (as shown in Figure 2), clarifying the boundaries of rights and responsibilities for each party. On the government side, introduce relevant policies to provide institutional guarantees, such as the "Regulations on Promoting Industry-Education Integration," which encourage deep cooperation between universities and enterprises, establish provincial-level special funds for big data talent cultivation, and implement tax reduction policies for enterprises participating in education (up to 30% of taxable income). On the university side, establish a "Big Data Innovation and Entrepreneurship College" as a physical entity to coordinate university-enterprise cooperation, curriculum development, and faculty management. On the enterprise side, create a "Talent Co-Cultivation Responsibility List," specifying obligations such as providing technical resources (e.g., open desensitized data) and equipment donations (e.g., Alibaba Cloud providing 1000 computing nodes for free). On the industry side, the Big Data Industry Alliance should formulate talent competency standards and talent cultivation quality standards, incorporating "technological innovation contribution" and "enterprise project delivery rate" into assessment indicators, and conduct third-party quality certifications (e.g., Huawei HCIE certification).

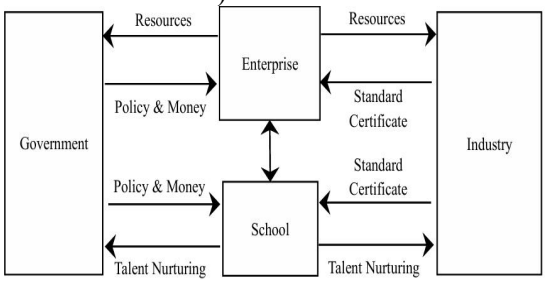

Figure 2. Mechanism of Quadruple Governance Ecosystem

4.2 Resource Integration Guarantee: Dual-Cycle Resource Pool Construction

For the internal resource pool, build a virtual simulation experimental teaching center integrating facilities such as Hadoop clusters and GPU computing nodes; develop "modular teaching resource packages" containing massive real enterprise cases and industry datasets. For the external resource pool, draw on the "Campus Cloud Warehouse" training base model of JD Logistics, and collaborate with universities and enterprises to construct a multi-level platform of "industry colleges + training bases + innovation centers," providing students with real practice environments; build an industry-education integration cloud platform, integrating desensitized datasets (e.g., UnionPay consumption data), enterprise case libraries (1000+), and open-source toolchains (e.g., Apache ecosystem), enabling cross-regional sharing of course resources and training resources.

4.3 Institutional Innovation Guarantee: Three Core Mechanisms

First, establish a dynamic adjustment mechanism. For example, hold industry-education dialogue meetings every six months to adjust course content based on the Gartner Technology Readiness Level curve. Second, create a benefit-sharing mechanism. Develop a comprehensive university-enterprise cooperation management system, clarifying the rights and responsibilities of each party and reducing cooperation costs [9]. For instance, formulate detailed rules for benefit distribution in university-enterprise cooperation ("60% university - 30% enterprise - 10% team"), ensuring the smooth conversion of research achievements and university-enterprise cooperation. Third, establish a risk prevention and control mechanism. Set up a data security committee, using blockchain technology to achieve full traceability of training data (e.g., Chongqing University using AntChain for data certification).

5. Conclusion

Industry-education integration and university-enterprise collaboration are crucial pathways for cultivating innovative and entrepreneurial talents in big data. By constructing a scientific and reasonable curriculum system, faculty, and teaching models, and improving support guarantee systems, the quality of university innovation and entrepreneurship education can be effectively enhanced, cultivating more high-quality innovative talents for economic and social development. This study, through the analysis of current problems, the construction of innovative models, and the

support guarantee system, provides certain references and insights for universities in the practice of big data innovation and entrepreneurship talent education.

In the future, the cultivation model for innovative and entrepreneurial talents in big data needs to be further expanded in the following aspects. In terms of international expansion, align with the "Digital Silk Road" construction, co-build cross-border training bases with overseas enterprises, and promote "Belt and Road" industry-education integration projects, such as co-building cross-border e-commerce big data laboratories with Southeast Asian countries [10]. In terms of technological integration, incorporate generative AI and metaverse technologies into virtual training, developing immersive teaching scenarios (e.g., VR-based industrial data analysis simulation systems) [11]. In terms of interdisciplinary integration, explore compound talent cultivation paths such as "big data + finance" and "big data + healthcare." In terms of ecological development, use city-level industry-education consortiums as carriers to form a "government-university-enterprise-industry" collaborative network, achieving a closed-loop regional talent supply.

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