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# Digital-intelligence convergence and a three-pronged approach: innovation and practice in the big data talent development system

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**Abstract:** Facing challenges in big data talent development—including the separation of theory and practice, superficial industry-academia collaboration, and fragmented innovation training—this study proposes principles of "industry demand orientation, integrated practical competency cultivation, and the reconstruction of the innovation ecosystem". It establishes a three-pronged training system encompassing "curriculum resources, talent development pathways, and quality assurance mechanisms". Through university-industry collaboration, this study adopts a "classroom-competition-innovation-industry" chain-based pathway, and an "AI-enabled, data-driven" quality assurance system, aligning talent development with industry needs. Over three years, it served 244 students, achieving an 87%+ employment rate, 17 national competition awards, 60% industry case studies, and a 15% retake rate reduction, providing a replicable model for application-oriented undergraduate big data programs.

**Keywords:** big data talent development; industry-education integration; curriculum-competition-innovation-production

## 1 Introduction

1.1 Dual drivers of national strategy and industry demand

Digital transformation is a national strategic priority, with the 14th Five-Year Plan emphasizing its role in production, lifestyle, and governance changes [1-3]. The big data industry is booming, yet it is projected to face a talent shortage of over 2.3 million by 2025, spanning positions in data development, analysis, and algorithm research [4][5]. However, a mismatch exists between higher education and industry needs, manifesting in three key disconnects:

(1) Curriculum-Practice Gap: Graduates lack practical experience, requiring extensive on-the-job retraining [6]. Traditional curricula lag behind technological advancements, with content becoming obsolete within 5–8 years [7]. For instance, new energy vehicle courses still focus on internal combustion engines, rendering 70% of the content irrelevant [8].

(2) Superficial Industry-Academia Collaboration: Only 35% of collaborations convert corporate resources into teaching materials, often limited to joint labs or company visits without deep integration [9].

(3) Fragmented Innovation Cultivation: Despite over 60% of students participating in competitions, only 12% of outcomes are integrated into teaching, leading to a mentality of "competition for competition's sake" [10].

1.2 Foundations and practical basis for reform

This study builds on the Data Science and Big Data Technology program at Ordos University of Applied Technology, focusing on "deep industry-education integration". It leverages the research achievements from Ministry of Education projects and adopts "Digital-Intelligence Integration, Three-in-One" talent cultivation system (Figure 1).

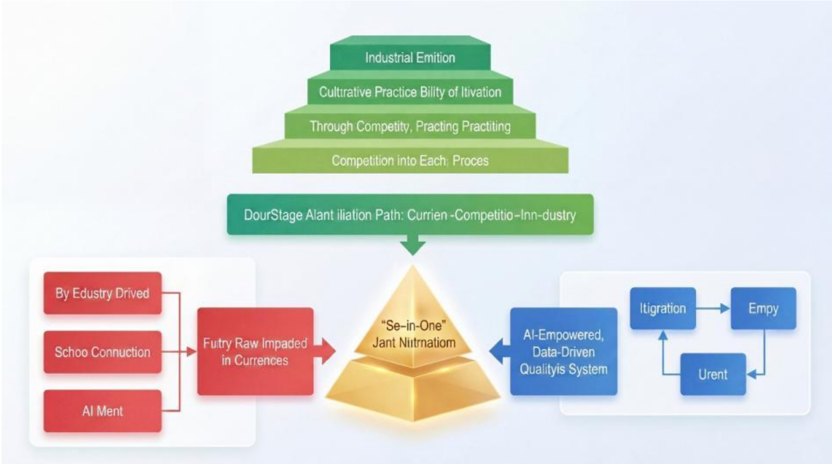


Figure 1. The "three-in-one" education mechanism: course resources, educational pathways, and quality assurance

## 2 System construction and innovation pathways

2.1 Three-tiered permeative curriculum development

2.1.1 Technology integration

To bridge the curriculum-practice gap, industrial-grade toolchains like PyTorch, Spark, and TensorFlow are integrated into the AI training platform, covering data collection to deployment. A virtualized GPU resource pool supports high-performance tasks, addressing computing power bottlenecks. Online lab modules for nine core courses combine "Tool Usage Guides", "Enterprise-Level Case Studies", and "Independent Task Design" to align tool instruction with course content.

2.1.2 Scenario integration: knowledge reconstruction driven by real-world projects

Real-world projects are decomposed into modular teaching cases through a three-step process: project decomposition, course alignment, and full-process coverage. For example, the project entitled "Coal Mine Safety Early Warning Model" was broken down into four modules mapped to "Machine Learning" course chapters. Currently, 60% of teaching materials in nine core courses are derived from real-world cases, progressing from foundational to specialized courses.

Table 1. Correspondence table for corporate projects, course modules, and learning objectives

| Industry Sectors | Notable Corporate Projects | Related Courses | Core Teaching Modules |
|---|---|---|---|
| Healthcare | CT Image Pulmonary Artery Segmentation | Image Data Mining | Medical Image Preprocessing and Segmentation Algorithm Implementation |
| Energy Security | Coal Mine Safety Early Warning Model | Machine Learning | Time-Series Data Feature Engineering and Early Warning Model Development |
| Smart Policing | Kangcheng Micro-Policing Facial Recognition System | Deep Learning | Facial Feature Extraction and CNN Model Optimization |
| Cultural Heritage | Development of a Digital Database for Intangible Cultural Heritage | Data Visualization | Intangible Cultural Heritage Data Cleaning and Interactive Visualization Design |

2.2 Course-competition-innovation-industry chain-based education

2.2.1 Implementation Pathway for the Dual-Mentor System

A dual-mentor system involving "campus mentors and industry mentors" guides students from campus competitions to national events. Currently, 50% of graduation projects are jointly supervised by universities and industry partners, such as the "YOLO-Based Algorithm for Hepatobiliary Ultrasound Monitoring" project, which is aligned with hospital needs.

2.2.2 Mechanism for commercializing studio outcomes

The advanced innovation and entrepreneurship studios implement a three-stage incubation mechanism: Enterprise Proposal – Team Challenge Acceptance – Market-Oriented Acceptance to commercialize student innovations.

2.3 AI-empowered quality assurance: from experience-driven to data-driven

An "AI-empowered, data-driven" quality assurance system adopts end-to-end data collection, intelligent analysis, and dynamic intervention to precisely control talent cultivation quality, overcoming the experience dependence and time lag inherent in traditional approaches.

2.4 Closed-loop feedback system

A closed-loop feedback mechanism links "industry needs—training process—graduate quality" via a "Graduate Competency Database" updated quarterly with employer evaluations. For instance, after the identification of "feature engineering capabilities" as a weakness, lab training projects were adjusted, increasing excellent grades from 35% to 62% and competency standards compliance to 85%.

## 3 Implementation outcomes

3.1 Significant improvement in the quality of talent development

Since 2021, the system has covered 244 students, with key indicators effectively improved (Table 2). The Class of 2024 excelled in competitions, winning national awards and achieving 82% proportion of practical graduation projects, such as "Detection and Identification of Mold and Pests in Museum Collections".

Table 2. Results of the implementation of digital-intelligence integration and the three-in-one approach

| Indicator | 2023 | 2024 | Percentage Increase |
|---|---|---|---|
| Average Employment Rate | 85% | 90% | +5% |
| Job-Major Alignment | 65% | 85% | +20% |
| Number of National Competition Awards | 3 | 9 | +200% |
| Percentage of Practical Graduation Projects | 60% | 82% | +22% |
| Average Grade in Core Courses | 71 | 78 | +9.86% |
| Percentage of Students Receiving High Marks in Corporate Internships | 52% | 79% | +27% |

3.2 Achievements in teaching resource development

High-quality resources have been developed including textbooks (*Machine Learning Applications* and *Practical Training, Python Programming*), an AI training platform (1,024 class hours), 17 industry datasets (500 GB), and a "Course-Competition-Innovation-Industry" resource repository with 40 competition cases and 17 enterprise project analyses.

3.3 Social services and contributions to industry

Reforms extend beyond campus, generating social value. The "Kangcheng Micro-Policing System" boosted policing efficiency, the "Liver and Gallbladder Ultrasound Monitoring Algorithm" improved disease identification accuracy, and the "Ordos Intangible Cultural Heritage Management Platform" supported cultural preservation. The university obtained 2 invention patents and 8 software copyrights.

## 4 Conclusions and reflections

The logic of the system extends to AI, data science, and software engineering, providing a reference model for applied undergraduate institutions. Future plans include introducing a Meta-Learning assessment model to quantify innovation transfer capabilities, enhancing evaluation rigor.

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## Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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