

Original Paper

From Project-Embedded Practice to Ecosystem Co-construction: Construction and Practice of a Precision Talent Cultivation System for Industry-University Collaborative Education in Design-Related Majors

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Abstract

To address the disconnection between industry and academia in design-major education, this study analyzes the limitations of the “project-embedded” model and proposes a framework for its systematic upgrading toward an “ecosystem co-construction” model. By establishing a “precision talent cultivation” system covering dynamic demand mapping, personalized training, interdisciplinary integration and comprehensive evaluation, this paper conducts empirical analysis based on multi-university case studies. The results verify that the proposed model can effectively integrate the education chain with the industrial chain, providing theoretical models and practical guidelines for cultivating high-quality innovative design talents in the new era.

Keywords

industry-university collaboration, ecosystem co-construction, precision talent cultivation, design-related majors, project-embedded practice

1. Introduction

1.1 Research Background and Significance

Driven by the digital economy and the development of new-quality productive forces, the global industrial landscape is undergoing profound transformation, which imposes unprecedented new requirements on the cultivation of design talents. Industrial upgrading no longer merely demands specialists with narrow technical skills; instead, it urgently calls for compound-talented individuals capable of tackling complex problems, integrating technology with humanities, and driving innovative

practice. Nevertheless, China's current talent cultivation system for design-related majors still suffers from phenomena of "industry-academia separation", such as disjunction between theory and practice and misalignment between training modes and industrial demands. This has become a critical bottleneck restricting the innovative development of China's design industry.

Traditional university-enterprise cooperation mostly stays at the superficial "project-embedded" stage, in which enterprises introduce real-world projects into classroom teaching. Although this model improves students' practical competence to a certain extent, its inherent limitations have become increasingly prominent, making it difficult to satisfy the demands for in-depth integration and collaborative development in the contemporary context.

The state attaches great importance to this issue. Several Opinions on Deepening the Integration of Industry and Education, issued by the General Office of the State Council, explicitly states that efforts should be made to promote the organic linkage of the education chain, talent chain, industrial chain and innovation chain, give full play to the principal role of enterprises, and comprehensively improve the quality of independent talent cultivation (General Office of the State Council, 2017). Accordingly, the innovation of this research lies in systematically proposing a paradigm transformation from linear cooperation under "project-embedded practice" to network-based collaborative talent cultivation via "ecosystem co-construction". This study not only deepens and transcends existing industry-university collaboration models but also actively explores pathways for future design education reform.

Theoretically, this paper constructs a theoretical framework for industry-university collaborative talent cultivation featuring multi-agent symbiosis, resource sharing and value co-creation, offering a new theoretical perspective to resolve the "industry-academia separation" dilemma. Practically, it builds an operable and replicable implementation scheme and practical reference for higher-education institutions offering design-related majors to deepen industry-education integration and enhance the match between talent cultivation quality and industrial demands through the "precision talent cultivation" pathway centered on dynamic demand mapping, personalized training pathways, interdisciplinary integrated curricula and a comprehensive evaluation system. It thereby fuels sustained innovation in China's design industry.

1.2 Review of Domestic and International Research

Scholars worldwide have carried out extensive and in-depth research on industry-university collaborative talent cultivation. International research started relatively early. Germany's Duales Ausbildungssystem stands as a paradigm for industry-education integration. Applied universities in the United States widely adopt Project-Based Learning (PBL) and cooperative education models. In recent years, with the rise of the innovation ecosystem theory, international academia has begun to focus on complex interactions among universities, industries, governments and other stakeholders in collaborative innovation and talent cultivation. In particular, the Triple Helix theory holds that building an open, dynamic and symbiotic educational environment is pivotal for improving talent cultivation quality (Ha & Lin, 2023).

Domestic research has yielded fruitful outcomes in fields such as industry-education integration and collaborative talent cultivation. Numerous scholars have explored practical modes including the dual-tutor system, industrial colleges and internship base construction. However, gaps persist in current domestic research and practice. First, most studies focus on optimizing the linear “project-embedded” cooperation model without thorough reflection on its intrinsic limitations. Second, clear theoretical frameworks and evolutionary pathways for systematic upgrading from point-based “project-embedded” cooperation to network-oriented “ecosystem co-construction” remain insufficient. Third, empirical studies are mostly limited to experience summaries, lacking in-depth analysis and comparative research on cases grounded in systematic theoretical frameworks.

Drawing on existing domestic and international findings, this study focuses on the paradigm shift from “project-embedded practice” to “ecosystem co-construction”, establishes a systematic theoretical framework, and validates its effectiveness via in-depth case analysis.

1.3 Definition of Core Concepts

Industry-university collaboration: Systematic institutional arrangements and practical activities in which multiple stakeholders including universities, enterprises, governments and industry associations establish long-term, stable and institutionalized cooperative relations under shared talent-cultivation goals. It realizes resource sharing, information exchange, cultural integration and value co-creation, with all participants engaging in the full process of talent cultivation.

Project-embedded practice: A primary industry-university cooperation mode where real-world corporate projects are incorporated as teaching modules into one or more courses to enhance teaching practicality.

Ecosystem co-construction: An advanced and sophisticated paradigm for industry-university collaborative talent cultivation. It conceptualizes the talent cultivation system as a complex, dynamic and open system analogous to natural ecosystems. Multiple stakeholders including universities, enterprises, governments and industry associations are interdependent and interact with one another to jointly build a dynamically balanced and co-evolving educational environment.

Precision talent cultivation: An educational philosophy and practical pathway within the “ecosystem co-construction” framework that pursues precise matching among the supply side of talent cultivation, industrial demand and students’ personalized developmental needs. Guided by Outcomes-Based Education (OBE), it leverages big data, artificial intelligence and other technologies to construct dynamic industrial demand maps, formulate personalized training schemes and curricula, and adopt comprehensive evaluation approaches to precisely supervise and iteratively optimize the whole talent-cultivation process.

1.4 Research Ideas and Framework

This research follows the logical thread: analyze current-day problems → construct a theoretical framework → explore practical pathways → verify case effectiveness. First, it dissects inherent limitations of the “project-embedded” model. Second, informed by theories such as the Triple Helix

theory, it develops a systematic theoretical framework for the transition from “project-embedded practice” to “ecosystem co-construction”. Third, under the “ecosystem co-construction” framework, it explores a four-in-one practical system oriented toward “precision talent cultivation”. Finally, multiple university cases are analyzed and compared to summarize successful experience.

The thesis consists of six chapters. Chapter One serves as the introduction. Chapter Two dissects practical dilemmas of the “project-embedded” model and pathways for transcendence. Chapter Three systematically constructs the theoretical framework for “ecosystem-based” industry-university collaborative talent cultivation. Chapter Four establishes the system and implementation pathways for “precision talent cultivation” within the ecosystem-co-construction framework. Chapter Five presents case analyses. Chapter Six draws conclusions and offers prospects. This study adopts literature review, case study and comparative research methods.

2. Practical Dilemmas of the Project-Embedded Model and Pathways for Its Transcendence

2.1 Achievements and Prevailing Practice of the Project-Embedded Model

As a primary form of industry-university cooperation, the “project-embedded” model has achieved remarkable results in breaking the closure of traditional classrooms and bridging theory and practice. For students, it enhances problem-solving abilities and employability. For universities, it facilitates curriculum renewal and the development of dual-competency teaching staff. Its common manifestations include project-based course transformation, joint graduation design, short-term workshops or internship programs, and discipline-competition-driven projects. These practices narrow the gap between industry and academia to varying degrees and represent a vital step for design education toward industry-education integration.

2.2 Core Limitations of the Project-Embedded Model

Despite its merits, the “project-embedded” model essentially constitutes linear and superficial cooperation. Its intrinsic limitations hinder its capacity to satisfy demands for high-quality innovative talent cultivation in the new era. Its core drawbacks are manifested as follows:

Shallow collaboration: Cooperation is mostly confined to project-level activities. Corporate tutors participate in a fragmented and limited manner, preventing the formation of deep educational partnerships.

Disjunction between projects and curricula, fragmented knowledge construction: Corporate projects feature high randomness and can hardly cover requirements specified in teaching syllabi. In addition, commercial project cycles often conflict with university administrative systems, resulting in decoupling between practical project work and theoretical learning.

Distorted educational objectives: Driven by commercial logic, students may be assigned repetitive, low-skill execution-oriented tasks, while the cultivation of innovative thinking is neglected.

Lack of long-term mechanisms for cooperation, unsustainable synergistic effects: Cooperation often relies on personal connections rather than institutional guarantees. Collaborative activities are prone to interruption caused by external factors and fail to accumulate sustainable collaborative assets.

2.3 Evolution Logic from Project-Embedded Practice to Ecosystem Co-construction

The transition from “project-embedded practice” to “ecosystem co-construction” represents a fundamental paradigm shift. Its internal logic is reflected in the following dimensions:

Objective impetus from national innovation strategies: National policies emphasize deepening industry-education integration and promoting in-depth convergence of the education, talent, industrial and innovation chains. Industry-university collaboration must therefore be elevated to the level of building regional or sector-specific innovation and talent-cultivation ecosystems.

Theoretical impetus from evolving innovation theories: Innovation ecosystem theory posits that innovation arises from open, interactive and value-co-creating activities among universities, enterprises, governments, end-users and other stakeholders. When applied to talent cultivation, this theory implies that educational processes themselves should be open and collaborative.

Systematic transcendence over limitations of project-embedded practice: “Ecosystem co-construction” directly addresses and systematically overcomes the four major limitations of the “project-embedded” model. It deepens collaborative engagement via stable multi-agent collaborative platforms; guarantees holistic knowledge construction through jointly formulated training schemes; prioritizes the cultivation of students’ core competencies under shared educational values; and renders cooperation institutionalized and sustainable via long-term mechanisms.

To sum up, the evolution from “project-embedded practice” to “ecosystem co-construction” marks a shift from tactical modification to strategic upgrading, symbolizing the maturity of industry-university collaborative talent-cultivation thinking.

3. Ecosystem Co-construction: Establishing a Theoretical Framework for Industry-University Collaborative Talent Cultivation

3.1 Connotation of the Industry-University Collaborative Talent-Cultivation Ecosystem

The industry-university collaborative talent-cultivation ecosystem is defined as a complex adaptive system within a given region or industrial sector. Stakeholders including universities, enterprises, governments and industry associations converge around the training and development of design talents. Through efficient resource flow, full information sharing and in-depth cultural integration, they form an interdependent, dynamically balanced, value-co-creating and continuously evolving community. It exhibits prominent features: openness, dynamism and evolvability, symbiosis, and value co-creation. This theoretical framework re-positions industry-university collaboration from an operational “project-management” issue to a strategic “ecosystem-building” endeavor.

3.2 Key Components and Interaction Mechanisms of the Industry-University Collaborative Talent-Cultivation Ecosystem

A well-functioning industry-university collaborative talent-cultivation ecosystem depends on its internal key components and sophisticated interaction mechanisms.

Multi-agent roles and network-based interaction mechanisms: Distinct from the binary university-enterprise structure under “project-embedded” practice, “ecosystem co-construction” emphasizes network-style collaboration among universities, enterprises, governments and industry associations. Drawing on the Triple Helix theory, each stakeholder assumes differentiated roles:

University: Intellectual core and principal site for talent cultivation.

Enterprise: Carrier of industrial demands and main venue for practical teaching.

Government: Macro-level guide and provider of institutional safeguards.

Industry association: Mediator and coordinator.

Platform-based pathways for resource flow and sharing: Platform-oriented approaches facilitate circular flow of resources, including co-building physical entities, advancing bidirectional mobility of personnel and knowledge, and constructing shared information platforms.

Cultural integration and joint creation of an innovation-oriented atmosphere: Shared educational values should be established. Corporate culture and craftsmanship ought to be embedded throughout teaching procedures to foster a collaborative innovation culture of “co-construction, sharing and symbiosis”.

3.3 Operational Mechanisms of Ecosystem Co-construction

Efficient operation of the “ecosystem-co-construction” industry-university collaborative talent-cultivation system hinges on interrelated core mechanisms that enable self-regulation, self-optimization and continuous evolution.

Demand discovery and dynamic adjustment mechanism (demand-driven): Regular industrial-demand investigation is implemented to capture emerging industrial requirements dynamically and precisely. This motivates universities and enterprises to iteratively and agilely revise talent-training schemes and curricula.

Collaborative education and whole-process co-management mechanism (process-oriented collaboration): Multiple stakeholders participate in the full talent-cultivation workflow, including joint formulation of training schemes, co-development of courses and teaching materials, co-implementation of teaching activities, and joint evaluation of educational outcomes.

Value co-creation and benefit-sharing mechanism (win-win outcomes): Institutional design maximizes value realization and ensures benefit sharing for all participating parties, forming a community of shared interests with interlinked prosperity.

Feedback assessment and continuous optimization mechanism (closed-loop improvement): Regular consultation meetings, graduate follow-up surveys and employer-satisfaction feedback channels are deployed to systematically evaluate the whole collaborative education process and final outcomes. A

complete closed loop is formed: demand discovery → collaborative talent cultivation → value co-creation → feedback-driven optimization.

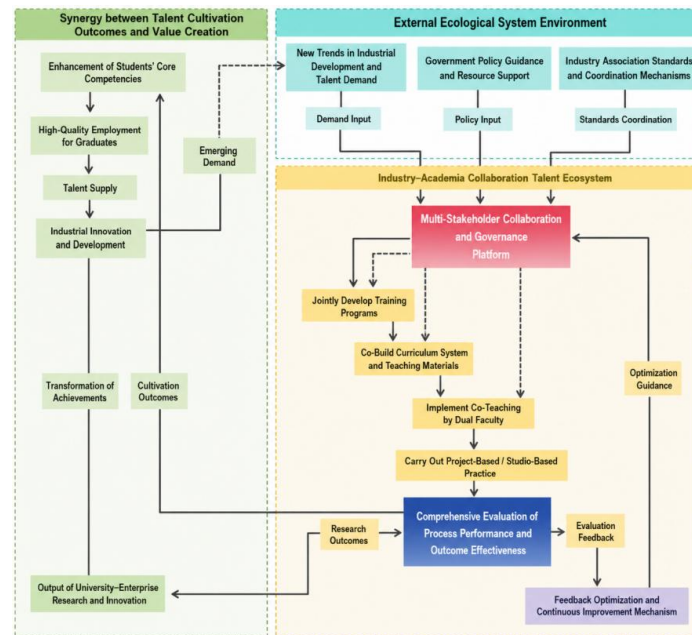


Figure 1. Flowchart Illustrating Operational Mechanisms of Ecosystem Co-construction

4. Precision Talent Cultivation: System Construction and Practical Pathways under the Ecosystem-Co-construction Framework

Within the theoretical framework of “ecosystem co-construction”, a talent-cultivation system centered on “precision” must be built. Countering the drawbacks of traditional “blanket-style” education, precision talent cultivation adopts refined procedural design to realize high-level alignment among educational supply, industrial requirements and students’ individual developmental aspirations.

4.1 Construction of Dynamic Demand Mapping: Precisely Answering “What Talents Should Be Cultivated?”

Constructing dynamic, quantifiable and visualized industrial demand maps constitutes the critical first step for precision talent cultivation. A big-data cloud platform for industry-education integration should be established to aggregate recruitment data, industry reports, corporate requirements and educational process data. Knowledge-graph and artificial-intelligence technologies are deployed for demand forecasting and visualization. Acting as a “decision-making dashboard”, the dynamic demand map delivers sustained optimization references for universities, ensuring that cultivated talents consistently satisfy real-world industrial needs.

4.2 Design of Personalized Training Pathways: Precisely Answering “How to Cultivate Talents?” (Process Dimension)

Rejecting one-size-fits-all training models, precision talent cultivation advocates diversified and optional growth pathways for individual students. Core modes include:

In-depth integration of the dual-tutor system and modern apprenticeship system: Each student or study group is assigned an on-campus academic tutor and an enterprise-based practical tutor, who collaboratively formulate personalized mentoring plans.

Systematic implementation of the studio-based and project-based models: Learning and creative communities spanning multiple grades and majors are organized around specific design directions or industrial sectors. Driven by a series of authentic projects, students receive long-term and systematic practical training.

4.3 Interdisciplinary Integration: Precisely Answering “How to Cultivate Talents?” (Content Dimension)

Boundaries of design disciplines are rapidly dissolving. Integration with technology, business, humanities and other fields has become essential for nurturing top-tier innovative talents. The precision talent-cultivation system must break disciplinary barriers at the curriculum level. Core implementation approaches are listed below:

Offering cutting-edge interdisciplinary courses: Following trends in technology and industrial development, universities cooperate with schools of computer science, business and other disciplines to deliver interdisciplinary courses.

Design × Artificial Intelligence: AIGC Design Application and Model Training, Computational Art and Generative Design, etc., equipping design students with tools and methodologies for AI-empowered innovative design. As scholar Xue Jie notes, while AIGC empowers education, it simultaneously brings ethical challenges, necessitating a full-chain ethical guarantee system covering “education-regulation-certification” (Xue, 2025).

Design × Business: Design Strategy and Management, Service Design and Business-Model Innovation, etc.

Design × Humanities and Social Sciences: Design Ethics, Sustainable Design and Social Innovation, etc.

Developing micro-majors or minor programs: Interdisciplinary learning contents are packaged as micro-majors or minor programs to grant students formal certification of interdisciplinary competencies.

Organizing interdisciplinary workshops and competitions: University-wide interdisciplinary innovation-design workshops or hackathons are held regularly to facilitate collisions of thinking across disciplines.

4.4 Comprehensive Evaluation System Combining Process-Oriented and Outcome-Oriented Assessment: Precisely Answering “How to Evaluate Talents?”

Precision talent cultivation requires a multi-dimensional, whole-process and stereoscopic comprehensive evaluation system. Its core framework and modes are described below:

Constructing the evaluation framework based on Outcomes-Based Education (OBE): Universities and enterprises jointly define core competency dimensions expected of design-major graduates and formulate corresponding evaluation rubrics.

Adopting the multi-faceted evaluation mode: process observation + outcome assessment + development tracking: Multi-stakeholder evaluation is introduced throughout project workflows. Joint university-enterprise review panels conduct comprehensive scoring for final deliverables. A follow-up survey system tracking graduates' career development is built to form a closed loop for quality assurance and continuous improvement.

5. Practical Exploration and Case Analysis

This chapter conducts in-depth analysis of multiple innovative and representative cases of industry-university collaborative talent cultivation for design-related majors across domestic universities. It verifies the feasibility and effectiveness of the “ecosystem co-construction” theoretical framework and “precision talent cultivation” practical pathways proposed above.

5.1 Case 1: The “Three-Chain Integration” Industry-University Collaborative Educational Ecosystem at Hunan Women's University

Analysis of the ecosystem model: Its innovation lies in systematically building a “three-chain integration” ecosystem: the industrial chain drives the education chain; the education chain supports the innovation chain; the innovation chain feeds back into the industrial chain. An industry-education integration expert committee consisting of industry specialists and entrepreneurs participates deeply in revising talent-training schemes and configuring curricula. For instance, responding to urgent industrial demands for AIGC-proficient talents in the video cultural-creation sector, industrial-chain requirements directly propelled the launch of the micro-major AI-Generated Art and Dynamic Imaging within the education chain.

Precision talent-cultivation practices: Studio-based and project-oriented teaching are fully implemented. Guided by dual tutors consisting of on-campus core teachers and senior corporate directors, students conduct systematic learning around real-world projects. Curricula are precisely aligned with industrial demands. For example, the course Commercial Photography fully incorporates authentic corporate e-commerce product-shooting projects. The university cooperates with enterprises to construct high-level practical teaching platforms such as the AI Design Training Center and the AR/XR Virtual-Shooting Teaching and Training Platform.

Achievements and implications: The “three-chain integration” ecosystem has yielded prominent educational outcomes. Students have won numerous awards in top-tier domestic and international competitions, while graduates' counterpart employment rate and employment quality keep rising. This case demonstrates that by identifying appropriate positioning and proactively engaging regional

industries, local application-oriented universities can achieve breakthroughs in talent cultivation through building tight industry-university collaborative educational ecosystems.

5.2 Case 2: The “Whole-Chain” Industry-University Collaborative Educational Ecosystem at Shenzhen Technology University

Analysis of the ecosystem model: Its innovation resides in constructing a whole-chain ecosystem connecting “education-talent-industry-innovation”. It systematically integrates educational philosophies including Outcomes-Based Education (OBE), Project-Based Learning (PBL) and the Conceive-Design-Implement-Operate (CDIO) engineering-education concept. Faculty teams regularly carry out a full-industrial-chain research program for the design sector to acquire holistic and forward-looking insights into industrial demands.

Precision talent-cultivation practices: On the basis of full-industrial-chain investigations, the university collaborates with enterprises including BYD and Tencent to build multiple industrial colleges and customized elite classes, realizing precise training characterized by “enrollment equivalent to recruitment and graduation equivalent to employment”. Cutting-edge curricula are developed with high agility; examples include AIGC Design Application and Model Training. A cross-disciplinary curriculum system of “Design + Technology + Business” is developed, promoting cross-course selection and project-based cooperation between design majors and schools of artificial intelligence, Internet of Things and other engineering disciplines.

Achievements and implications: Graduates are highly sought-after by leading industrial enterprises. Faculty-student teams have repeatedly received awards in world-class design competitions, and multiple design outputs have undergone industrial transformation. This case represents an advanced form of industry-university collaborative talent cultivation. It situates talent cultivation within the broader context of serving regional industrial innovation and achieves symbiotic prosperity among universities, cities and industries.

5.3 Case 3: The “Smart Education” Precision Talent-Cultivation Paradigm at Beijing Institute of Technology

Precision talent-cultivation practices: Beijing Institute of Technology has developed its indigenous paradigm for independent talent cultivation. It pioneers the “Three-Color, Four-Spectrum, Five-Dimensional” smart-education concept. Digital-intelligence technologies are adopted to generate student “individual portraits”, and bidirectional mapping enables precise training (News Center of Beijing Institute of Technology, 2025). Its AI assistant “Aibit” delivers personalized learning support for students. The self-developed smart supervision platform leverages multimodal large-scale models to interpret classroom videos in real time and dynamically generate teaching-quality reports, enabling precise classroom diagnosis shifted from experience-driven to intelligence-driven modes.

Achievements and implications: This case illustrates the powerful enabling role of digital technologies in precision talent cultivation. By constructing a pentagonal educational cultivation model of “teachers-students-AI-environment-culture” for the intelligent era, the university realizes non-linear

exponential improvement in talent-cultivation efficiency. It offers valuable experience for other universities seeking to enhance educational precision via technological tools.

5.4 Case 4: Integration-Oriented Innovation of “Emerging Engineering + Emerging Liberal Arts” at Huazhong University of Science and Technology

Analysis of the ecosystem model: Founded in 2025, the School of Design at Huazhong University of Science and Technology features interdisciplinary integration. It endeavors to develop the new paradigm of “AI + Cultural Innovation” and prioritizes the integrated-development strategy of “Emerging Engineering + Emerging Liberal Arts” (The Beijing News, 2025).

Precision talent-cultivation practices: The school establishes an integrated undergraduate-master-PhD training structure. It advances the “Design + X” compound-talent training initiative and builds an “H-shaped” talent framework that facilitates deep integration of design with artificial intelligence, architecture, medicine, engineering, humanities and other disciplines. “Design + X” interdisciplinary teaching and research activities are implemented. Within curricular systems, core courses such as generative design and intelligent-experience design are emphasized.

Achievements and implications: This case represents cutting-edge explorations in design-education reform undertaken by top comprehensive universities. Through top-level strategic planning and resource integration, it aims to cultivate compound leading-edge talents capable of spearheading industrial transformation, offering a new template for “Design + X” interdisciplinary talent cultivation.

Table 1. In-Depth Analysis of Domestic Representative University Cases of Industry-University Collaborative Talent Cultivation for Design-Related Majors

Univ ersit y	Ecosystem Model	Core Philosophy	Driving Force	Educational Features	Primary Achievemen ts
Huna n Wom en’s Univ ersit y	“Three-Chain Integration” (Industrial-Chain – Educat ion-Chain – Innovation-Ch ain)	OBE + PBL	Demand traction from regional characteristic industrial chains	Emphasis on application of emerging technologies such as AIGC; focus on digital cultural creation, fashion consumption and other targeted	Improved students’ innovation-e ntrepreneurs hip capacity and competition performance ; enhanced counterpart employment rate and

				industrial sectors	practical capabilities
Shen zhen Tech nolo gy Univ ersit y	“Whole-Chain” Ecosystem (Education – Talent – Indu stry – Innovation)	OBE + PBL + CDIO Engineering Education	Forward-look ing and holistic demand driven by full-industrial -chain in-depth investigations	“Design × Tech nology × Busine ss” compound interdisciplinary system; cultivation of innovative talents with outstanding engineering competence	Superior graduate employment quality (many recruited by leading enterprises); prominent socioeconom ic benefits from patent transformati on and industrial services
Beiji ng Instit ute of Tech nolo gy	Smart-Education Ecosystem	Data-driven + Personaliz ed Cultivation	Core impetus from artificial-intel ligence and big-data technologies	Technological tools including AI assistants and smart supervision platforms enable precise diagnosis and support for student development and teaching processes	Exponentiall y improved talent-cultiva tion efficiency; selected for multiple national-leve l educational-r eform pilot projects; continuously improved student admission quality

Huazhong Univ ersity of Science and Technology	New Paradigm of “AI + Cultural Innovation”	of Emerging Engineering + Emerging Liberal Arts	Top-level design and interdisciplin ary-developm ent strategy	“Design + X” “H-shaped” talent structure; deep integration of design with artificial intelligence, medicine, engineering and other fields	Cultivation of compound leading-edge talents driving industrial transformati on; construction of a new highland for interdisciplin ary talent cultivation
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5.5 Comparison and Implications of Cases

Comparative analysis extracts the following universal core implications from these successful practical initiatives:

Demand-driven development serves as the fundamental prerequisite: Whether local application-oriented universities or top research-oriented institutions, success originates from precise perception of industrial demands. Reforms for industry-university collaborative talent cultivation must shift from the supply-side logic (“teach what the university possesses”) to the demand-side logic (“cultivate talents the industry needs”).

Joint platform construction constitutes key support: Successful cases attach high importance to co-built and shared platforms, including physical industrial colleges and laboratories as well as information-oriented big-data platforms. Such platforms break barriers between industry and academia and enable sustained and efficient flows of resources, information and personnel.

Multi-agent collaboration represents an inevitable pathway: A functional ecosystem is open and multi-participant oriented. Beyond universities and enterprises, governmental policy support and coordinating services from industry associations play indispensable roles. “Ecosystem co-construction” requires universities to develop stronger social engagement capabilities.

Transition from “embedding” to “integration” acts as the core symbol: A prominent commonality of successful cases is that industrial resources are no longer simply embedded within individual courses or projects but fully integrated into all elements and the entire workflow of talent cultivation. This transformation from physical grafting to chemical interaction marks whether industry-university collaboration has advanced to the high-level stage of “ecosystem co-construction”.

Technology empowerment defines future trends: Cutting-edge technologies including AIGC and big data are reshaping educational ecosystems profoundly. Universities should proactively embrace technological transformation and treat it as an important instrument to realize precision talent cultivation and enhance teaching quality.

In summary, these cases provide solid empirical evidence demonstrating that the transition from “project-embedded practice” to “ecosystem co-construction” with “precision talent cultivation” as the objective constitutes an inevitable path for Chinese design-related majors to improve talent-cultivation quality and achieve high-quality development in the new era.

6. Conclusions and Prospects

6.1 Research Conclusions

Through systematic discussion on industry-university collaborative talent-cultivation modes for design-related majors, this study draws the following major conclusions:

As a primary industry-university collaboration mode, the “project-embedded” model exhibits increasingly prominent limitations, making paradigm transformation imperative. Its deficiencies including insufficient collaborative depth, disjunction with curricular frameworks, distorted educational objectives and lack of long-term mechanisms prevent it from satisfying urgent demands for high-quality compound innovative design talents brought by the development of new-quality productive forces.

“Ecosystem co-construction” represents the ideal direction and advanced paradigm for the evolution of industry-university collaborative talent cultivation. This study innovatively builds the theoretical framework for “ecosystem co-construction”, pointing out that industry-university collaborative talent cultivation should operate as a network-based collaborative ecosystem participated by universities, enterprises, governments, industry associations and other stakeholders.

The practical system centered on “precision talent cultivation” constitutes the critical pathway to implement the philosophy of “ecosystem co-construction”. This system includes four core links: construction of dynamic demand mapping, design of personalized training pathways, interdisciplinary integration, and establishment of comprehensive evaluation systems. Together they form a logically connected closed-loop practical roadmap.

Practices reflected in typical cases verify the feasibility and superiority of the “ecosystem co-construction” and “precision talent cultivation” model. Cases indicate that this mode yields prominent outcomes in improving students’ innovative capabilities, enhancing employment quality, advancing industry-university-research achievements transformation, and serving regional economic development.

6.2 Practical Implications

Findings of this research deliver practical insights for promoting industry-university collaborative talent-cultivation reforms in China’s design-related majors as well as broader applied disciplines.

Implications for universities: Shift mindsets from “solo performers” to “ecosystem organizers”; take proactive action from passive response to active linkage; deepen reforms from curriculum adjustment to systematic reconstruction.

Implications for enterprises: Elevate positioning from mere project providers to educational partners; participate in the whole educational workflow by extending engagement from talent recruitment to pre-employment talent cultivation; open resources to realize joint construction and sharing.

Implications for governments and industry associations: Strengthen guidance and improve policy and institutional safeguards; build platforms to perform bridging and supervisory functions.

6.3 Limitations and Future Research Prospects

Despite theoretical construction and practical explorations achieved in this study, certain deficiencies remain for further in-depth investigation.

Research limitations: Selected cases may suffer from survivorship bias; the universality of the theoretical framework requires further validation; this study mainly adopts qualitative methodologies lacking large-scale quantitative data support.

Prospects for future research: Follow-up studies can conduct comparative research on differentiated ecosystem modes, explore in-depth application of digital technologies, investigate transnational university-enterprise collaborative ecosystem-co-construction modes, and establish quantitative indicator systems for assessing collaborative-education effectiveness.

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