

Exploring the “Four Collaborations and Four Integrations” Collaborative Cultivation Model for the Design Majors Driven by the Demands of the Digital Design Industry

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Abstract: With the development of China’s digital economy and the accelerating intelligent transformation of the design sector, design education faces great pressure to restructure its talent development systems. Local universities, in particular, struggle with curricula that lag industry practice, shallow university–enterprise partnerships, and assessment methods that bear little relation to professional standards. Drawing on theories of industry — education integration, constructivism, and design thinking, this study proposes a “Four Collaborations and Four Integrations” model. The collaborative dimensions (co-construction, co-management, co-creation, and co-evaluation) establish a governance framework, while the integrative dimension merges curricula with industry capabilities, faculty expertise with professional practice, teaching spaces with production platforms, and academic evaluation with industry benchmarks. The model starts from a dynamic mapping of regional digital design competency needs. It introduces agile pedagogies such as project-based flipped classrooms (PBL 2.0) with live industry briefs and design sprints and builds a hybrid practice environment combining on-campus digital workshops with enterprise project sites. A multi-component value-added assessment system (drawing on portfolios, process logs, employer feedback, and competition results) completes the loop. A two-year action research cycle in the institution indicates that the model has improved students’ integrated professional readiness, strengthened faculty members’ dual-qualified profiles, and deepened the discipline’s regional embeddedness. The findings offer a workable, adaptable blueprint for reform in applied design education, with both theoretical relevance and practical transferability.

Keywords: Digital design; Industry-education integration; Four Collaborations and Four Integrations; Collaborative education; Design education; Teaching model reform

Online publication: August 13, 2026

1. Introduction

Digital technologies such as artificial intelligence and extended reality are fundamentally reshaping the definition, production mode, and value of designs ^[1-5]. Digital design competence has become a cornerstone of national cultural competitiveness and a driver of the so-called “new quality productive forces.” China’s “Digital China” initiative and the cultural development goals of the 15th Five-Year Plan both emphasize deeper convergence between digital tools and creative industries. This context places new demands on higher education: educators must produce graduates who combine aesthetic sensibility and design thinking with digital fluency, technical understanding, collaborative skills, and project management ability.

However, a number of local universities find it difficult to keep pace. The curricula often remain wedded to older tools and methods, while the digital design industry has moved on to BIM, AIGC, real-time rendering, and interactive prototyping ^[2]. University–industry cooperation, where it exists, tends to be superficial (occasional guest lectures, internships, or sponsorship of final-year projects) without touching core aspects like curriculum design, pedagogical delivery, or quality assurance. Assessment still relies heavily on static skill tests and final portfolio presentations, whereas employers value problem-solving under constraints, team communication, and delivery discipline. These mismatches are intertwined and self-reinforcing between what is taught and what is needed, between partnership rhetoric and reality, and between academic grading and professional judgment.

Breaking this impasse calls for a new collaborative education model that is deeply engaged with the industry, spans the entire student journey, and can renew itself over time ^[4-5]. This paper draws on the reform experience at Tangshan Normal University to present the “Four Collaborations and Four Integrations” model as a systematic, evidence-based response to these challenges.

2. Core challenges and theoretical grounding: the rationale behind the “Four Collaborations and Four Integrations” model

The difficulties that design education in local applied universities faces can be understood as a failure of coupling between a relatively closed academic system and an open, fast-moving industrial system. Industry–education integration is not simply resource exchange; it involves different actors (universities, firms, professional bodies) with different logics (educational vs. commercial) and different values (cultivation of persons vs. market returns). A sustainable integration requires a stable governance structure and clear interaction pathways.

The “Four Collaborations” refer to the co-construction, co-management, co-creation and co-evaluation, which address the partnership’s governance and sustainability. Specifically, co-construction means that curricula and development plans are jointly designed, based on a shared understanding of skill needs. Co-management brings industry experts into routine teaching oversight and milestone reviews, establishing a recurring “dual-mentor” pattern. Co-creation involves shared investment in and operation of realistic practice platforms, aligning interests and resources. Co-valuation integrates industry standards and market feedback into the final judgment of student outcomes, closing the quality loop. Together, these four mechanisms create a stable foundation for collaboration—one that moves beyond the typical asymmetry of university-led or enterprise-passive cooperation, towards a genuine community of shared responsibility and benefit.

The “Four Integrations” (curriculum with industry capabilities, faculty with professional practice, teaching spaces with production environments, and assessment with industry metrics) focus on the

operational layer. They specify how and where fusion should happen. For instance, educators embed toolchain workflows and digital project management into course modules; educators foster mutual learning between academic staff and industry practitioners; educators design physical and virtual learning spaces that resemble real design studios; and educators bring external validation (certifications, project sign-offs, client satisfaction) into the grading system. These four threads carry the logic of integration into every corner of the educational process, moving from ceremonial partnership to substantive educational reform.

Conceptually, the model is not a checklist of measures but a closed-loop system in which governance mechanisms (the Four Collaborations) enable the integration pathways (the Four Integrations), and the pathways, in turn, reinforce the mechanisms. The “Regional Digital Design Industry Capability Spectrum” serves as the compass — a living document that keeps all initiatives aligned with actual, emerging industry demands, rather than with abstract trends or technological fads. This framework offers both a theoretical map and a practical guide for deep, enduring industry-education synergy.

3. Implementation pathways and key actions: From capability mapping to diversified assessment

Translating the framework into classroom practice requires a sequence of linked steps. Over two years, educators piloted the model in the courses Environmental Design and Visual Communication Design, which follows four phases: precise-needs diagnosis, project-based curriculum redesign, ecosystem-based platform development, and comprehensive-assessment reform.

First, educators mapped the regional industry’s capability needs. Working with a dozen firms and industry bodies in the Beijing-Tianjin-Hebei region specializing in digital culture, smart cities, and virtual exhibitions, educators used job analysis, interviews, and graduate tracking to produce a competency framework. The framework distinguishes foundational skills, core technical skills, and higher-order competencies. The findings confirmed that local employers had moved decisively away from traditional rendering and layout work towards AIGC-assisted concept generation, BIM-based collaborative data management, interactive prototyping, and cross-functional coordination. This map not only exposed gaps in the existing curriculum but also gave the educators precise targets for new module design, ensuring that their efforts would be focused and efficient.

Second, educators restructured selected core courses (Architectural Design Methods and Exhibition Design) around real-industry projects. Educators abandoned the conventional tool-by-tool or knowledge-category sequence. Instead, educators adopted a flipped, project-based model (PBL 2.0). For example, students worked on a live brief: a digital immersive guide for the Tangshan Industrial Heritage Museum. Before class, they studied micro-modules (GIS basics, Unity interface, prompt engineering) through online resources. In class, interdisciplinary teams worked under dual mentors through a full iteration cycle, intensively applying and combining multiple digital skills, which included brief interpretation, concept generation, rapid prototyping, and user testing. After class, they refined and documented their solutions. Educators also introduced the “Design Sprint” method, condensing a typical multi-week design process into five intense workshop days. This sharpened students’ abilities to learn quickly, make decisions under time pressure, and innovate collaboratively. Course content thus became a series of project modules, each anchored in a real problem and mapped to the competency framework, with knowledge acquisition occurring organically through problem-solving.

Third, educators built a hybrid practice ecosystem including an on-campus “digital workshop” and an off-campus “enterprise enclave.” The on-campus workshop was fitted with industry-grade workstations, VR/AR equipment, 3D scanners, and licensed software. The layout and workflow mimicked a professional design firm. It serves as both a teaching space and a “pre-incubator” for small enterprise projects and competition briefs. The enterprise enclave, based at partner firms, hosts selected student teams for 4- to 8-week residencies, where they are fully embedded in commercial project teams. A shared information system connects the two sites, synchronizing project workflows, personnel schedules, and data. This arrangement creates a virtuous cycle: students train in a simulated environment and then test their skills in the real world, breaking down the physical and psychological barriers between campus and industry.

Finally, educators introduced a diversified, process-oriented assessment system. Educators also designed a four-pillar model with portfolio, process data, employer evaluation, and competition/certification outcomes to move beyond final-product grading. A dedicated learning management platform automatically captures iteration logs, team communication records, and reference search trails. Industry mentors review milestone deliverables online, and their scores and comments count toward the final grade. Students earn bonus credits for professional certifications (e.g., Autodesk Revit) or awards in recognized competitions. For graduation projects, a joint university-industry panel conducts the defense, with enterprise experts holding substantial voting weight, and commercial viability or innovation becoming key criteria. This system redirects assessment towards capability development and value creation, rather than mere knowledge recall.

4. Results, reflections, and future directions

After two complete action-research cycles (plan-act-observe-reflect), the model has produced tangible, multi-faceted improvements in the pilot programs. Both quantitative and qualitative evidence show positive impacts on students, faculty, the discipline, and the wider regional ecosystem.

Student outcomes: Proficiency in key digital skills such as BIM, interaction tools, and AIGC rose from below 30% to over 75% among pilot cohorts. The share of project submissions rated by industry partners as “highly promising and worth further development” increased from 5% to nearly 30%. More importantly, the 2026 pilot graduates enjoyed starting salaries 25% higher than their non-pilot peers within the same university. Employers consistently noted that these graduates were technically competent, quickly productive, collaborative, and displayed a nascent project-management mindset.

Faculty and curriculum development: The five participating faculty members renewed their knowledge and enriched their teaching cases through their stints in enterprise workstations and ongoing co-teaching with industry mentors. They have evolved into “dual-qualified” instructors. Four modularized courses (Architectural Design Methods, Exhibition Design, and two others) have been standardized, and educators have built a repository of 12 complete real-project cases, plus an open digital-tools resource platform—all now used across all year levels. The discipline’s ties with local industry have grown substantially; educators have jointly submitted multiple municipal research proposals and delivered feasible plans for urban renewal and industrial-heritage digitization. This has enhanced the regional service profile, creating a positive feedback loop: contribution begets support, and support enables further contribution.

Discipline-ecosystem synergy: The relationship has shifted from a one-way resource flow in which enterprises provide inputs, to a co-creative partnership. Through the physical hubs (workshop and enclave), the design department has become a local node for incubation of small-scale digital culture and

urban-regeneration projects. Over two years, faculty-student teams produced more than 20 solutions—two of which were adopted by municipal authorities. This has raised the visibility and regional relevance, initiating a virtuous cycle of talent cultivation, applied R&D, and community service.

Challenges and caveats: The stability of the Four Collaborations depends on the strategic trust and long-term benefit-sharing between universities and firms. Therefore, it requires institutional flexibility in areas like faculty workload recognition and intellectual-property arrangements. The Four Integrations also strain traditional academic scheduling; aligning the fixed semester calendar with fluid project timelines is an ongoing management issue. Moreover, the success of this pilot owes much to the project team’s pre-existing relationships and resourcefulness; transferring the model to other institutions or disciplines will demand local adaptation rather than rote replication.

Looking ahead: As generative AI continues to evolve, design education will inevitably shift its focus from tool proficiency to higher capabilities like critical judgment, aesthetic discernment, ethical reasoning, and human-AI collaboration. The next steps include weaving modules on AI ethics, sustainable design, and systems thinking into the existing integrative framework. Educators also plan to use learning analytics to track student growth trajectories more precisely and to enable more personalized interventions, pushing the model towards greater intelligence and customization. Ultimately, educators believe this approach (industry-driven, collaboration-centered, and systemically implemented) offers valuable lessons not only for design education but also for broader applied disciplines in engineering and the humanities, as higher education actively responds to and helps shape socio-economic transformation.

5. Conclusion

The “Four Collaborations and Four Integrations” model addresses the three core dilemmas of digital-design education, referring to the curriculum–industry gaps, shallow partnerships, and misaligned assessment. Such a model owns a dual strategy of governance innovation (co-construction, co-management, co-creation, co-evaluation) and operational integration (curriculum, faculty, platform, evaluation). The experience shows that the model has successfully shifted students from passive recipients to active project-based learners and co-creators, repositioned faculty as learning-ecosystem designers and industry connectors, and redefined the discipline’s relationship with the regional economy as mutually constitutive and symbiotic.

As a dynamic and open system, the model’s real strength lies in its built-in capacity for iteration and adaptation. The Four Integrations provide natural entry points for emerging topics like AI ethics and human-machine co-creation, while the Four Collaborations offer a sturdy governance foundation for expanding the industry-education community. The underlying principle through which deep collaboration can align the educational and industrial systems around shared value carries lasting practical wisdom, not only for design but for applied education more broadly.

Funding

This research is funded by the Teaching Reform Research and Practice Project of Tangshan Normal University, titled “Construction and Practical Research on the ‘Four Collaborations and Four Integrations’ Collaborative Cultivation Model for Design Majors Driven by the Demands of the Digital Design Industry” (Project No. 2026JGZD036).

Disclosure statement

The authors declare no conflict of interest.

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