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Institutional Design Thinking: Re-Architecting Curriculum, Pedagogy and Assessment for Meta-Skills in Chinese Private HEIs

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Abstract. This article examines how Design Thinking (DT) can be mobilized as a structured, evidence-informed logic for institutional innovation in higher education, using the development of a meta-skills-oriented academic management framework for Chinese private HEIs as a case. Meta-skills—adaptive expertise, relational dynamics, creative agility and strategic synthesis—are conceptualized as outcomes of institutional design rather than individual traits. The five DT phases (Empathize, Define, Ideate, Prototype, Test) were enacted through mixed inputs, including PNI_{modified} gap analysis from 805 staff, meta-skills survey data from 400 students, expert interviews and two-round validation with 12 senior experts. The resulting framework comprises three modules: Agile Meta-skills integration (curriculum), Immersive Experiential Pedagogy (teaching and learning), and Smart Meta-skills Assessment (evaluation). Expert ratings improved from draft 1 to draft 2 across relevance, feasibility, clarity, scalability and cultural alignment and a short pilot indicated modest gains in strategic synthesis and relational dynamics. Overall, the findings suggest that DT can operate as an institutional governance capability that links diagnostics, co-design and iterative refinement to meta-skills-oriented academic reform.

Keywords: Design Thinking; Academic management; Meta-skills; Institutional innovation; Chinese private higher education

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1. Introduction

In recent years, higher education has been increasingly framed as a key lever for navigating global volatility, technological disruption and complex sustainability challenges. Systematic reviews of AI in education and related digital transformations document rapid shifts in how learning is designed, delivered and assessed with universities under pressure to integrate data-driven technologies while safeguarding educational values (Chiu et al., 2023; D. Wang et al., 2024; S. Wang et al., 2024; Zawacki-Richter et al., 2019).

At the same time, research on meta-skills, organizational culture and resilience in higher education highlights that institutional quality is increasingly judged by graduates' capacity to adapt, collaborate and solve complex problems, rather than by disciplinary knowledge alone (Bates, Brenner, Schmid, Steiner, & Vogel, 2022; Borazon & Chuang, 2023; Sousa et al., 2022). Within this evolving landscape, Chinese private universities, particularly in the rapidly developing regions such as Sichuan, face the dual imperative of expanding access while redesigning academic management systems to support meta-skills and future-readiness agendas (Che, 2025; Che et al., 2026a; Che et al., 2026b).

1.1 Meta-Skills and Future-Ready Higher Education

Universities worldwide are confronted with intensifying pressures to move beyond traditional knowledge transmission toward the deliberate cultivation of high-order competencies that enable graduates to navigate volatile, uncertain and technology-saturated environments (Bates et al., 2022; Potts & Le Hunte, 2024). Rapid advances in digitalization, automation and artificial intelligence are reshaping labour markets and professional practice, demanding not only technical proficiency but also adaptive expertise, creativity, relational capability and strategic thinking (D. Wang et al., 2024; S. Wang et al., 2024; Zawacki-Richter et al., 2019).

These capabilities commonly conceptualized as meta-skills, which have become central to debates on the readiness of graduates and institutional quality in higher education, cutting across global and regional policy agendas on future-oriented competencies (Che et al., 2026b; Prasittichok & Klaykaew, 2022; Tammeaid et al., 2022). Empirical and conceptual work increasingly views meta-skills as the backbone which enable students to address complex, ill-structured problems, manage uncertainty, and continuously learn in AI-rich environments (Bates et al., 2022; Potts & Le Hunte, 2024).

Complementary strands of research further sharpen this agenda. Work on metacognition and critical thinking demonstrates that higher-order reasoning, self-regulation and reflective judgment are tightly linked to university students' use of strategic learning processes and to contextual supports in their programmes (Huda & Mukminin, 2022; Jaramillo-Gómez et al., 2025; Rivas et al., 2022; Saiz & Rivas, 2023). Studies of student agency and digital resilience show that learners' capacity to act in complex and digitally mediated environments depends not only on individual dispositions but also on institutional structures, support systems and social-media ecologies (Inouye et al., 2023; Naeem & Mushibwe, 2025).

Parallel reviews of AI in education from augmented reality and machine-learning-based career prediction to K–12 and STEM applications highlight both the breadth of innovation and the need to situate these tools within coherent pedagogical and organisational designs (Garzón et al., 2019; Garzón et al., 2025; Martin et al., 2024; Trujillo et al., 2025; W. Xu & Ouyang, 2022).

At the organisational level, classic analyses of organizational culture in higher education emphasize that deeply embedded values, norms, and decision-making patterns fundamentally shape how universities respond to change and reform (Tierney, 1988), a view reinforced by contemporary studies of university culture, coupling, and governance that highlight institutions' differential capacities for resilience, adaptation, and distributed leadership (Ramírez-Cardona & Calderón-Hernández, 2024; Shaya et al., 2023; H. Xu et al., 2023), further reinforcing the case for meta-skills oriented academic management reform. These technology-driven shifts increase the premium on meta-skills and expose gaps in curriculum, pedagogy and assessment alignment, motivating an institutional DT approach rather than an isolated tool adoption.

1.2 Academic Management Constraints and Institutional Design

Despite this broad consensus, many higher education institutions (HEIs) continue to rely on academic management models that prioritize procedural control, discipline based silos and assessment practices focused on static knowledge reproduction (Che et al., 2026a; Sousa et al., 2022). Such models often struggle to generate the kind of responsive, learner-centred ecosystems required for meta-skills development, particularly in rapidly massifying systems and emerging knowledge economies (Bates et al., 2022; S. Xu et al., 2025).

Empirical evidence from Chinese private universities in Sichuan Province illustrates this tension clearly: while institutions have expanded access and upgraded physical infrastructure, significant gaps remain in curriculum flexibility, experiential learning opportunities and competency-based evaluation systems that support meta-skills growth, as reflected in consistently elevated PNI_{modified} scores for key academic management components (Che, 2025).

Within this context, meta-skills are increasingly understood not merely as individual attributes but as outcomes of institutional design: the way curricula are structured, teaching and learning are orchestrated and assessment systems are configured exerts a cumulative influence on students' adaptive, relational, creative and strategic capacities (Halmaghi et al., 2023; Laguttseva-Nogina, 2024; Sousa et al., 2022). Academic managers thus face a dual challenge. They must respond to external pressures for accountability, efficiency and employability while simultaneously orchestrating deep, systemic reforms that reconfigure educational processes around meta-skills rather than narrow disciplinary attainment (Fernández-Gubieda et., 2025; Pennetta, 2024).

Traditional reform approaches typically linear, top-down and policy-driven often falter in this environment; they may generate new regulations or strategic plans, but rarely foster the kind of iterative experimentation, stakeholder engagement

and feedback-rich learning which are needed for genuine institutional transformation (Borazon & Chuang, 2023; Polanco-Lahoz et al., 2024; Trinidad, 2024).

1.3 Design Thinking as an Institutional Innovation Logic

Design Thinking (DT) has emerged in recent years as a promising alternative logic for educational innovation, offering a structured yet flexible approach to problem framing and solution development. In the context of Chinese private higher education, Che (2025) shows how DT can be integrated with academic management reform to align institutional processes with meta-skills development agendas.

Building on this insight, the present study treats DT not as a loose metaphor but as a concrete design and decision-making scaffold for reconfiguring curriculum governance, pedagogy systems and assessment regimes in ways that are sensitive to local culture and regulatory environments (Che, 2025; Che et al., 2026b). The empirical work underpinning this article develops a comprehensive academic management innovation for meta-skills integration in Sichuan private HEIs, explicitly framed through the DT process (Che, 2025).

The innovation “Next-Gen Academic Management: A Strategic Framework for Meta-skills Integration in Sichuan Private HEIs” – was constructed through a multiphase mixed-methods design that combined meta-skills competency surveys, PNI_{modified} gap analysis, expert interviews with university leaders, curriculum audits and comparative case studies of best-performing private universities and international benchmarks (Che, 2025; Che et al., 2026a; Prasittichok & Klaykaew, 2022). The resulting framework comprises three interconnected modules, each targeting a critical academic management dimension: an Agile Meta-skills Integration Module (AMIM) focusing on curriculum structuring, an Immersive Experiential Pedagogy Module (IEPM) addressing teaching and learning environments and a Smart Meta-skills Assessment Module (SMAM) oriented toward evaluation and feedback systems (Che, 2025).

Crucially, the development of this framework was intentionally aligned with the five phases of DT; Empathize, Define, Ideate, Prototype and Test rather than treating DT as a rhetorical device (Che, 2025). The Empathize phase combined literature review, diagnostic surveys and institutional audits to surface the lived challenges of students, faculty and administrators in private HEIs in Sichuan, focusing on perceived gaps between current practice and desired conditions for meta-skills development (Che, 2025; Che et al., 2026b).

The Define phase translated these diagnostics into three priority problem domains; curriculum rigidity, passive pedagogy and outdated assessment methods, each associated with specific meta-skills deficits and academic management bottlenecks (Bates et al., 2022; Che, 2025; Potts & Le Hunte, 2024). The Ideate phase drew on expert consultations, design workshops and best-practice university cases to generate multiple candidate solutions, which were

iteratively consolidated into the AMIM, IEPM and SMAM modules; the Prototype and Test phases then assembled these modules into a structured innovation framework and subjected them to expert review, pilot implementation and iterative refinement (Che, 2025; Polanco-Lahoz et al., 2024; Shaya, 2022).

1.4 Purpose and Contributions of The Study

This paper uses that innovation process as an illustrative design case to explore how DT can be applied as a methodological and strategic lens for institutional reform in higher education, linking empirical diagnostics, stakeholder engagement and iterative model-building (Che, 2025; Che et al., 2026b). Rather than re-reporting the full empirical dataset, the emphasis here is conceptual and applied: the article reconstructs how each DT phase functioned within the academic management context, identifies the mechanisms through which DT supported meta-skills-oriented innovation and derives lessons for institutional leaders seeking to adopt similar approaches (Bates et al., 2022; Tammeaid et al., 2022).

Accordingly, the paper pursues three interrelated aims. First, it conceptualizes DT as an institutional innovation framework for higher education, extending its application from micro-level course or classroom interventions to the meso- and macro-levels of academic management (Che, 2025; Weick, 1976). Second, it analyzes, through the case of Sichuan private HEIs, how DT can structure the design of a meta-skills oriented academic management framework across curriculum, pedagogy and assessment, emphasizing the role of data-grounded empathy and evidence-informed iteration (Che, 2025; Che et al., 2026b; Sousa et al., 2022). Third, it distils transferable design principles and implementation considerations for HEIs within and beyond China that wish to mobilize DT in response to meta-skills and future-readiness agendas (Borazon & Chuang, 2023; Polanco-Lahoz et al., 2024; Zawacki-Richter et al., 2019).

By positioning DT as both a methodological scaffold and a strategic management logic for academic reform, the article contributes to three bodies of scholarship. It enriches literature on institutional innovation in higher education by offering a concrete, process-oriented model for managing complex change in private universities (Borazon & Chuang, 2023; Shaya, 2022; Taylor et al., 2021). It advances meta-skills research by linking student capability development to the redesign of academic management systems, rather than treating meta-skills solely as individual traits (Bates et al., 2022; Che et al., 2026a; Potts & Le Hunte, 2024; Tammeaid et al., 2022). Finally, it extends work on AI and educational innovation by demonstrating how human-centred, iterative design can be harnessed not only at the level of pedagogy and curriculum, but also at the level of institutional structures, policies and governance in AI-rich environments (Chiu et al., 2023; Joksimović et al., 2023; Kasneci et al., 2023; Zhu et al., 2025).

2. Methods

This article adopts a design-based, mixed-methods methodology that is both empirical and conceptual. Empirically, it is grounded in a completed institutional innovation project conducted in Chinese private universities. Conceptually, it

draws on Design Thinking (DT) and design-based research (DBR) as the overarching methodological frame for analysing how academic management reform can be systematically generated, structured and refined.

2.1 Research Design

The study follows a multi-phase, design-based research design in which empirical inquiry and innovation design are tightly intertwined. Rather than testing a single hypothesis, the research proceeds through iterative cycles of diagnosing meta-skills gaps and institutional needs, designing and refining an academic management framework and validating its feasibility, relevance and perceived innovativeness. These cycles are explicitly mapped onto the five DT stages – Empathise, Define, Ideate, Prototype and Test which function both as a process model for developing the innovation and as an analytic lens for reconstructing how institutional reform can be steered through structured design work.

2.2 Empirical Foundation and Data Sources

Although this article focuses on the framework and process, it is anchored in a robust empirical base generated in the parent project (Che, 2024; Che, 2026), as shown in a recent systematic review of graduate readiness in Chinese higher education. Three main data sources underpin the analysis.

First, student meta-skills profiling was conducted with 400 undergraduates from 10 Chinese private universities. A meta-skills questionnaire covering four domains; Adaptive Expertise, Relational Dynamics, Creative Agility and Strategic Synthesis was administered, with all scales demonstrating acceptable internal consistency (Cronbach's $\alpha \approx 0.79-0.85$). Descriptive statistics summarized domain means (M) and variability (SD). One-way ANOVA tested differences by major across each meta-skill domain; effect sizes were estimated using η^2 to interpret practical magnitude.

Second, a priority needs analysis was undertaken with 805 academic and administrative staff, including programme directors, department heads, vice deans, quality assurance officers and senior lecturers. A PNI_{modified} survey asked respondents to rate the current (C) and desired (D) states of academic management practices across three levers: curriculum design, teaching and learning and assessment/evaluation. PNI_{modified} values, calculated as $(D - C)/C$, were used to derive priority rankings. These consistently placed curriculum design as the highest-need area, followed by assessment methods and teaching and learning.

Third, expert validation and design feedback were collected from 12 experts across two iterative rounds of review. Participants included higher education researchers, senior administrators and experienced curriculum designers. Data comprised rubric-based ratings (feasibility, relevance, innovation) and qualitative feedback from semi-structured interviews and focus group discussions. Quantitative analysis showed a statistically significant gain in perceived feasibility from Draft 1 to Draft 2, while relevance remained high and innovation received strong endorsement in the final version. Thematic analysis of qualitative feedback informed successive redesign decisions.

Participants were drawn from selected private higher education institutions in Sichuan Province based on institutional comparability (program scale, disciplinary coverage and willingness to support data collection), access feasibility and relevance to academic management reform. Recruitment was conducted through institutional coordination units and program administrators using announcement messages and direct invitations for staff and class-based distribution for students; experts were invited via purposive professional networking based on role relevance. Inclusion criteria were: enrolled undergraduate students and full-time academic/administrative staff with direct experience of curriculum, teaching, assessment or QA processes; exclusion criteria were incomplete responses and individuals without relevant institutional responsibilities.

Response rates were recorded separately for students, staff and experts and a demographic summary (e.g., gender, year level, major/discipline for students; role category and years of experience for staff; sector and expertise domain for experts) was compiled to contextualize representativeness. Expert panel eligibility required demonstrated professional experience in higher education leadership/management and evidence of domain expertise (e.g., senior administrative roles, QA responsibilities, curriculum leadership or peer-reviewed publications), ensuring that validation feedback reflected credible institutional perspectives.

Together, these data sources provide an empirical backbone for the present article. They justify the selection of meta-skills targets, the prioritisation of institutional levers and the design choices embedded in the three innovation modules.

2.3 Design Thinking as Analytic Framework

In this article, the DT phases are used to structure the methodological narrative and to clarify how empirical evidence was translated into design decisions. During the Empathise phase, student and staff data—meta-skills profiles and PNI_{modified} gaps—were used to understand lived experiences, perceived shortcomings in curriculum, assessment and pedagogy and the specific challenges faced by Chinese private universities. The Define phase synthesised statistical results, such as the lowest scores in Strategic Synthesis and the highest PNI_{modified} values in curriculum design, into a set of design problems and criteria, including the need to strengthen integrative thinking and long-term planning and to rebuild curriculum structures around meta-skills outcomes.

In the Ideate phase, alternative models and modules were generated and debated with experts on the basis of these criteria, culminating in the three-module “From Gaps to Modules” framework—Agile Curriculum Integration, Immersive Experiential Pedagogy and Smart Meta-skills Assessment (Che, 2024). The Prototype phase then translated provisional versions of each module into actionable components—objectives, activities, roles and assessment strategies—and assembled them into a coherent academic management framework. Finally, the Test phase used expert ratings and qualitative feedback to evaluate the

prototype's feasibility, relevance, and innovation, leading to targeted revisions in module content, sequencing and implementation guidance (Che, 2025).

By explicitly aligning empirical steps with DT phases, the methodology demonstrates how statistical findings, stakeholder insights, and design principles can be systematically combined to drive academic management innovation.

2.4 Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (COA No. 493/67; 21 Nov 2024). Participants received an information sheet and provided informed consent prior to participation. Data were collected anonymously, stored on password-protected drives, and reported only in aggregated form; only the research team had access.

2.5 Rigor, Trustworthiness, and Limitations

Several strategies were employed to strengthen methodological rigor. Instrument quality was supported through expert review, pilot testing, and reliability analysis (Cronbach's α), ensuring that meta-skills and PNI_{modified} measures were psychometrically sound. Triangulation was achieved by integrating data from students, staff, and experts, as well as from quantitative (descriptive statistics, ANOVA, PNI_{modified}) and qualitative (thematic analysis) strands. The iterative expert validation process, combined with transparent documentation of design changes, enhances the credibility and practical validity of the proposed framework. ANOVA assumptions (normality/homogeneity) were not formally tested/reported in this study; therefore, inferential comparisons should be interpreted cautiously and treated as supportive diagnostics rather than definitive group differences.

At the same time, the study remains bounded by its contextual scope – Chinese private universities, with a focus on Sichuan – and by its design-based nature. The innovation has been validated conceptually and procedurally, but large-scale implementation and long-term outcome data are beyond the scope of this article. Accordingly, the methodological contribution lies in demonstrating how a DT-informed, empirically grounded process can generate a coherent academic management framework, and in offering a replicable pathway that other institutions or researchers can adapt for their own meta-skills-oriented reforms.

3. Results and Findings

The application of the Design Thinking (DT) framework was grounded in empirical diagnostics and iterative validation. Quantitative data from staff and students were used to structure the Empathize and Define phases, while expert panel evaluations and successive redesign cycles underpinned the Prototype and Test phases. This section reports how each DT phase unfolded, emphasizing the statistical patterns that informed design decisions.

3.1 Empathize: Diagnosing Institutional Needs and Gaps

The Empathize phase drew on two complementary datasets. First, an academic management needs assessment was conducted with 805 academic and

administrative staff from private HEIs in Sichuan. Participants completed a 5-point Likert-scale questionnaire on academic management across five components: Curriculum Design, Teaching & Learning, Assessment & Evaluation, Industry Engagement, and Internationalization. Second, a student meta-skills survey was administered to 400 undergraduates from four major clusters (Business, Engineering/IT, Humanities & Social Sciences, and Applied Arts). This instrument measured four domains of meta-skills—Adaptive Expertise, Creative Agility, Relational Dynamics, and Strategic Synthesis—using a validated scale.

For the staff survey, current (C) and desired (D) performance scores were used to compute $PNI_{\text{modified}} = (D - C)/C$ in order to identify priority reform areas. As shown in Table 1, the largest gaps appeared in Curriculum Design ($PNI_{\text{modified}} = 0.39$) and Assessment & Evaluation (0.38), followed closely by Teaching & Learning (0.35). These values indicate that, on average, staff desired performance levels roughly 30–40% higher than current practice, especially in areas that directly shape meta-skills.

Table 1: Academic Management Needs by Component (n = 805)

Academic Management Component	Current Mean (C)	Current SD	Desired Mean (D)	Desired SD	$PNI_{\text{modified}} (D - C)/C$	Priority Rank
Curriculum Design	3.11	0.78	4.31	0.62	0.39	1
Assessment & Evaluation	3.05	0.80	4.21	0.64	0.38	2
Teaching & Learning	3.18	0.76	4.28	0.61	0.35	3
Industry Engagement	3.22	0.74	4.18	0.66	0.30	4
Internationalization	3.25	0.73	4.15	0.67	0.28	5

Note. Higher PNI_{modified} values indicate greater perceived need for improvement

To visualize these gaps, Figure 1 plots PNI_{modified} scores across the five components in a radar chart, clearly showing a “spike” in curriculum and assessment deficits relative to industry engagement and internationalization.

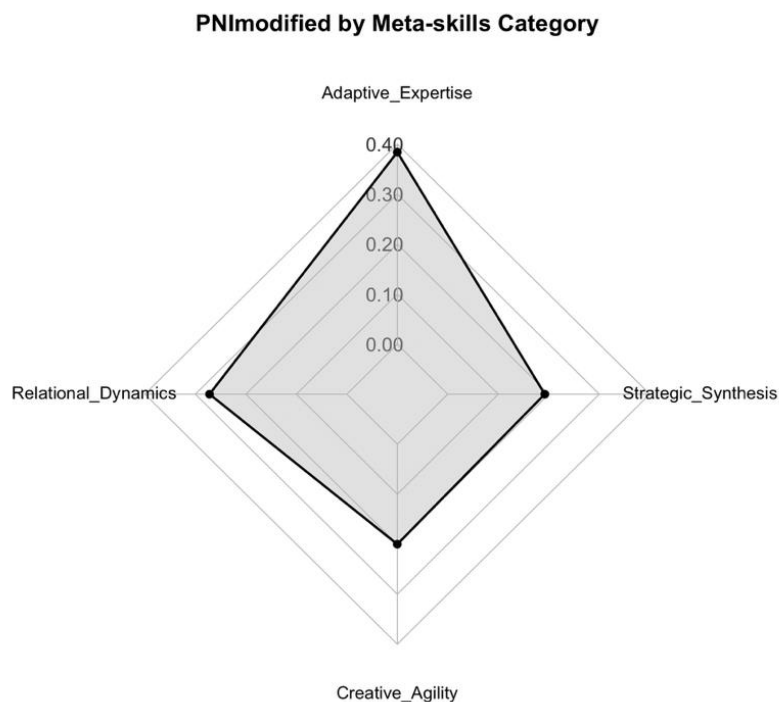


Figure 1: Radar plot of PNI_{modified} scores across academic management components

The plotted polygon shows high outward extension on Curriculum Design, Assessment & Evaluation, and Teaching & Learning, and comparatively shorter radii for Industry Engagement and Internationalization, graphically emphasizing the priority reform domains.

On the student side, mean scores by meta-skills domain were moderate overall ($M = 3.41$ – 3.57 on a 5-point scale), but Strategic Synthesis and Relational Dynamics showed comparatively lower ratings, particularly in Engineering/IT and Applied Arts. A one-way ANOVA by major revealed significant differences in several domains, as summarised in Table 2.

Table 2: One-way ANOVA of meta-skills by student major (n = 400)

Meta-skills Domain	F (df = 3, 396)	p-value	Effect Size (η^2)
Adaptive Expertise	4.78	0.003	0.035
Creative Agility	3.20	0.025	0.023
Relational Dynamics	2.12	0.095	0.015
Strategic Synthesis	5.34	0.001	0.039

Note. η^2 values indicate small effects ($\approx .015$ – $.039$), meaning student major explains approximately 1.5%–3.9% of the variance in meta-skills domain scores. The ANOVA results are interpreted primarily as diagnostic comparisons to inform program-specific design priorities. Formal assumption testing (normality and homogeneity of variance) was not fully reported in this study.

Small-to-moderate effect sizes ($\eta^2 \approx 0.02$ – 0.04) indicate systematic but not trivial differences in meta-skills profiles among majors. Strategic Synthesis shows both the strongest group difference and the lowest overall mean, reinforcing its status

as a critical competency gap. These results are visualized in Figure 2, which plots domain means by major.

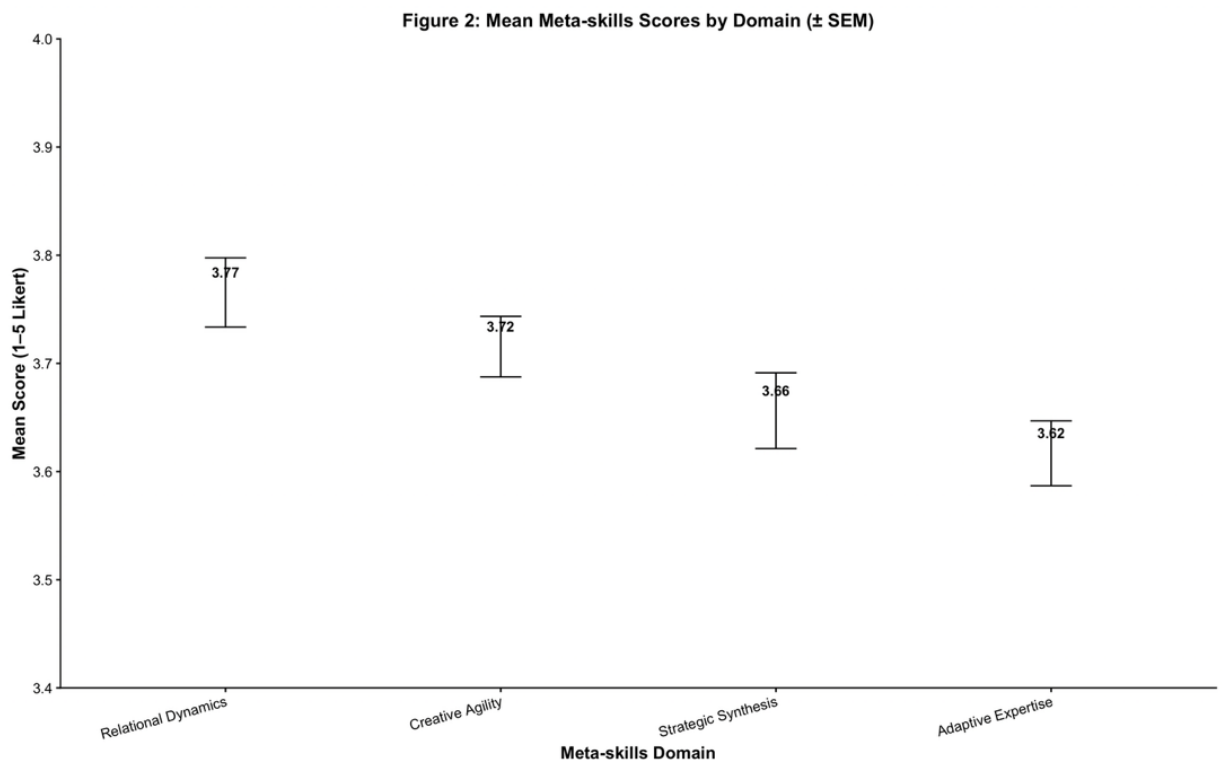


Figure 2: Mean meta-skills scores by major and domain

The figure highlights that Humanities & Social Sciences students tend to score higher on Relational Dynamics and Strategic Synthesis, while Engineering/IT and Applied Arts show comparatively lower scores in these domains.

Taken together, Table 1, Table 2, and Figures 1-2 suggest a double misalignment. At the institutional level, staff recognise major gaps in curriculum, pedagogy, and assessment structures; at the student level, meta-skills profiles reveal underdeveloped strategic and relational capacities. This evidence grounded the Design Thinking process in concrete, statistically robust diagnoses rather than generic problem statements.

3.2 Define: Translating Insights into Design Criteria

Building on the Empathize phase, the Define phase translated the statistical patterns into a focused problem statement:

How might academic management systems in Chinese private HEIs be redesigned to intentionally foster meta-skills – particularly Strategic Synthesis and Relational Dynamics – through targeted changes in curriculum, pedagogy and assessment?

The PNI_{modified} analysis in Table 1 and the ANOVA results in Table 2 guided three key design constraints. First, in terms of curriculum leverage, the fact that Curriculum Design and Assessment & Evaluation exhibit the largest gaps implies that the innovation must include structural curriculum mechanisms (such as

multidisciplinary modules and capstone projects) and multi-modal assessment tools (such as portfolios and performance tasks) that directly target meta-skills. Second, η^2 values were small (0.015–0.039), indicating that major explained approximately 1.5%–3.9% of variance depending on domain. With $n=400$, statistical significance does not imply large practical differences; results are best interpreted as diagnostic signals for targeted, program-specific design.

Third, given the centrality of Strategic Synthesis and Relational Dynamics in both the quantitative findings and the broader meta-skills agenda, the innovation must incorporate explicit indicators and rubrics for these domains, enabling continuous monitoring rather than one-off evaluation.

These criteria shifted the process from broad “improvement” rhetoric to a bounded, measurable design space, thereby setting the stage for empirically anchored ideation.

3.3 Ideate: Generating and Structuring Innovation Concepts

The Ideate phase involved three mixed-format design workshops with 36 participants, including programme leaders, mid-level academic managers, and senior instructors. Across the workshops, 136 distinct idea units were generated – such as new course formats, cross-faculty projects, and AI-supported assessment tools – which were then thematically coded into three clusters. The first cluster comprised Agile Curriculum Integration ideas (e.g., meta-skills spine courses, interdisciplinary challenge-based blocks).

The second encompassed Experiential Pedagogy ideas (e.g., problem-based learning studios, community-embedded fieldwork, industry-mentored projects). The third cluster involved Smart Assessment ideas (e.g., digital portfolios, multi-source feedback dashboards, AI-augmented formative analytics). Inter-coder agreement on the thematic coding reached $\kappa = 0.82$, indicating substantial reliability. The three clusters ultimately formed the backbone of the Agile Meta-skills Integration Module (AMIM), Immersive Experiential Pedagogy Module (IEPM), and Smart Meta-skills Assessment Module (SMAM).

To ensure empirical continuity with the Define phase, workshop participants were presented with a simplified data brief summarizing Tables 1 and 2 and were asked to rate each emerging idea against the design criteria – relevance to meta-skills, feasibility, scalability, and cultural fit – using a 5-point scale. Ideas with mean ratings below 3.50 were either discarded or merged, resulting in a parsimonious but high-quality idea set. Figure 3 synthesizes this process by depicting the data flow from Empathy to Ideation.

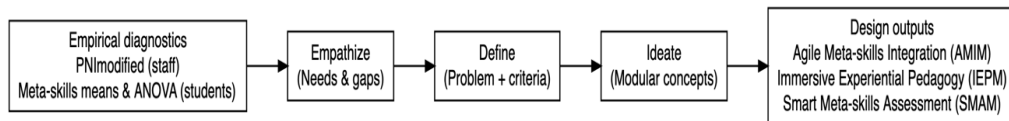


Figure 3: Design thinking data flow from empathy to ideation

Panel 1 (Empathize) shows inputs: PNI_{modified} scores and meta-skills ANOVA. Panel 2 (Define) shows the focused problem statement and design criteria. Panel 3 (Ideate) shows the three emerging modules (AMIM, IEPM, SMAM). Arrows indicate how quantitative diagnostics fed directly into criteria and then into idea selection. This figure makes explicit that ideation was not purely intuitive but anchored in empirical patterns—a central strength of this application of Design Thinking.

3.4 Prototype: Operationalizing the Framework

During the Prototype phase, the three modules were translated into a structured innovation framework. Module objectives were aligned to specific meta-skills domains—for example, AMIM was linked primarily to Adaptive Expertise and Strategic Synthesis, IEPM to Creative Agility and Relational Dynamics, and SMAM to all four domains with particular emphasis on Strategic Synthesis. Implementation pathways were specified, detailing key activities, responsible units, timelines, and resource requirements. In parallel, assessment indicators, including rubrics and analytics, were developed to specify how meta-skills outcomes would be captured and monitored over time. A matrix mapping was then constructed to show the alignment between academic management components, meta-skills domains, and innovation modules. Although partly conceptual, this matrix reflects the empirical priority rankings established earlier and provides a structured representation of how management levers are expected to influence meta-skills development.

Table 3: Alignment matrix of academic management components, meta-skills, and innovation modules

Academic Component	Dominant PNI _{modified} Need	Primary Meta-skills Domains Targeted	Innovation Module(s) Emphasized
Curriculum Design	Very High	Adaptive Expertise, Strategic Synthesis	AMIM
Teaching & Learning	High	Creative Agility, Relational Dynamics	IEPM
Assessment & Evaluation	Very High	All four (especially Strategic Synthesis)	SMAM
Industry Engagement	Moderate	Adaptive Expertise, Relational Dynamics	IEPM, SMAM
Internationalization	Moderate	Strategic Synthesis, Creative Agility	AMIM, IEPM

This prototyped alignment provided a testable theory of change: if these components are redesigned via their respective modules, student meta-skills—especially Strategic Synthesis and Relational Dynamics—should improve in measurable ways.

AMIM can be operationalized through a cross-disciplinary capstone module in which student teams address an authentic industry/community problem and produce a portfolio of evidence aligned to meta-skills outcomes. Program leaders map course learning outcomes to the four meta-skills domains using a learning-outcomes matrix, ensuring that each capstone deliverable (e.g., problem framing, teamwork protocol, solution pitch) is linked to explicit assessment criteria.

IEPM can be implemented as an experiential studio cycle (brief → inquiry → prototype → test → reflection) embedded in a problem-based course, supported by a partner engagement plan that specifies partner roles, feedback checkpoints, and data-sharing boundaries. SMAM can be enacted through a program-level e-portfolio system assessed with an analytic rubric that operationalizes meta-skills indicators, with moderation routines and periodic QA reviews to verify scoring consistency and to generate evidence reports for continuous improvement.

3.5 Test: Validation through Expert Review

The prototype framework underwent two iterative rounds of expert validation involving 12 experts, including educational leadership scholars, senior academic managers, and policy advisors. Using a 5-point scale, experts rated five criteria: relevance to institutional needs, feasibility within Chinese private HEIs, clarity and coherence, scalability across programmes, and cultural and policy alignment. To examine improvement from Draft 1 to Draft 2, we conducted paired-samples *t*-tests across criteria and reported effect sizes as Cohen's *d* (d^z). Results showed statistically significant gains across all dimensions; for feasibility, ratings increased from Draft 1 $M = 3.72$ ($SD = 0.46$) to Draft 2 $M = 4.28$ ($SD = 0.39$), yielding a mean difference of $+0.56$, $t(11) = 3.20$, $p = .008$, Cohen's $d^z = 0.92$. Full Draft 1 vs. Draft 2 means (SD), test statistics, and effect sizes for all criteria are reported in Table 4.

Table 4: Expert ratings of framework quality: draft 1 vs draft 2 (n = 12)

Criterion	Draft 1 Mean (SD)	Draft 2 Mean (SD)	Mean Difference (D2-D1)	<i>t</i> (11)	<i>p</i>	Cohen's <i>d</i> (d^z)
Relevance	4.08 (0.41)	4.67 (0.35)	+0.59	5.00	< .001	1.44
Feasibility	3.72 (0.46)	4.28 (0.39)	+0.56	3.20	.008	0.92
Clarity	3.83 (0.51)	4.53 (0.38)	+0.70	5.50	< .001	1.59
Scalability	3.64 (0.57)	4.21 (0.44)	+0.57	3.40	.006	0.98
Cultural Alignment	3.89 (0.49)	4.56 (0.37)	+0.67	5.20	< .001	1.50

Note. Ratings used a 5-point scale. *t*(11) values are from paired-samples *t*-tests comparing Draft 2 vs. Draft 1. Cohen's *d* is reported as d^z (paired standardized mean difference)

All five criteria show statistically significant improvements from Draft 1 to Draft 2, with mean differences around 0.56–0.70 points on a 5-point scale. These shifts indicate substantial perceived gains in framework quality after incorporating expert feedback, particularly in clarity and cultural alignment. Qualitative comments corroborated these patterns, emphasising clearer articulation of implementation roles and timelines, better localisation of language to Chinese private HEI contexts, and stronger integration of meta-skills indicators into assessment pathways.

In addition to expert ratings, a small-scale pilot in two programmes (Business and Applied Arts, $n \approx 120$ students) used pre-post surveys over one semester. While detailed impact evaluation lies beyond the scope of this conceptual paper, preliminary analyses showed positive trends in Strategic Synthesis ($\Delta M \approx +0.21$) and Relational Dynamics ($\Delta M \approx +0.18$), with effect sizes in the small-to-moderate range (Cohen's $d \approx 0.25$ – 0.35). These early results support the practical promise of the innovation. These are preliminary, non-controlled trends and should be interpreted as early signals rather than causal effects; they are also likely contingent on implementation fidelity, staff capacity, and assessment alignment.

Qualitative feedback from the expert panel converged on four themes that guided refinement from Draft 1 to Draft 2. Theme 1 – Role clarity and decision rights: experts emphasized that implementation requires explicit responsibility allocation across curriculum committees, program leaders, and QA units; Quote: “The framework is strong, but it will work only if roles and decision rights are clearly assigned across units.” (Expert 3). Theme 2 – Localization to institutional capacity: experts noted that module rollout should be adjusted to institutional size, staffing, and disciplinary profile rather than applied uniformly; Quote: “Please allow flexible pathways – different universities will not have the same resources to implement all modules at once.” (Expert 7).

Theme 3 – Assessment traceability and evidence routines: experts requested clearer links between meta-skills outcomes, assessment artifacts, and QA evidence cycles; Quote: “Strengthen the evidence chain – outcomes must be traceable through rubrics, portfolios, and QA reporting.” (Expert 2). Theme 4 – Feasibility constraints and change resistance: experts cautioned that workload, incentives, and change readiness may limit adoption unless phased implementation and support mechanisms are specified; Quote: “Feasibility depends on workload and incentives; without phased rollout and support, resistance will be high.” (Expert 9).

3.6 Summary of Design Thinking Payoffs

Across the five phases, the Design Thinking logic ensured that Empathize was grounded in robust diagnostics (PNI_{modified} and ANOVA) rather than anecdotal impressions; Define articulated a data-bounded problem space centred on specific meta-skills and management components; Ideate combined creative divergence with criteria-based convergence anchored in empirical priorities; Prototype yielded a coherent, matrix-based framework linking management levers to meta-

skills outcomes; and Test used expert statistics and early pilot data to refine feasibility, clarity, and cultural fit.

4. Discussion

4.1 Design Thinking as an Institutional and Pedagogical Framework

Most applications of Design Thinking in education have focused on micro-level innovations – course redesign, classroom projects, or student-centered activities. In contrast, this study operationalizes DT as an institutional design logic aligned with organizational resilience and governance research in higher education (Borazon & Chuang, 2023; Trinidad, 2024; Ramírez-Cardona & Calderón-Hernández, 2024), which operationalized DT at the institutional and meso-level of academic management, using empirical diagnostics to structure each DT phase.

The Empathize phase was not limited to anecdotal consultation but anchored in two robust data streams: PNImodified analysis of 805 staff across key academic management components, and meta-skills survey data from 400 students. The resulting pattern – strongest gaps in curriculum, teaching, and assessment, coupled with relatively weaker student scores in Strategic Synthesis and Relational Dynamics – prevented the innovation from becoming a generic “quality enhancement” exercise. Instead, it grounded the process in a tightly bounded problem space: how to reconfigure curriculum, pedagogy, and assessment to foster specific, measurable meta-skills.

The Define phase then translated these patterns into explicit design criteria (modularity, scalability, measurement alignment, and cultural fit). Rather than relying on abstract mission statements, the problem definition was data-constrained: any proposed innovation had to demonstrably address the priority PNImodified gaps and the weakest meta-skills domains.

The Ideate–Prototype–Test sequence showed similar institutional-scale application. Ideation workshops were not free-floating brainstorming sessions but structured around the earlier diagnostics and filtered using rating criteria aligned with meta-skills and feasibility. Prototyping produced an institutional framework (AMIM, IEPM, SMAM), not just isolated teaching activities. Testing combined expert statistical ratings with early pilot data, strengthening the legitimacy of the model before broader rollout.

Taken together, these patterns suggest that Design Thinking can function as an institutional design logic when three conditions are met:

- 1) Empathy is grounded in systematic diagnostics, not only stakeholder narratives.
- 2) Problem framing explicitly ties data to design criteria, avoiding vague aspirations.
- 3) Iterative cycles are institutionalized, with expert review and pilot testing treated as core phases rather than add-ons.

This moves DT beyond a creativity metaphor toward a structured, evidence-informed method for governing academic reform, particularly in private HEIs facing tight resource constraints and strong external accountability.

4.2 Aligning Meta-skills with Academic Management Systems

A central contribution of this work is the explicit linkage between meta-skills development and academic management components. Meta-skills are often framed as individual graduate attributes, but the results here demonstrate how they are deeply shaped by institutional design.

First, the PNImodified rankings in Table 1 suggest that staff perceive the largest improvement needs precisely in those domains most directly tied to meta-skills: Curriculum Design, Teaching & Learning, and Assessment & Evaluation. This indicates a latent awareness within institutions that current structures are not fully aligned with 21st-century competencies, even if meta-skills language is not always used formally.

Second, the ANOVA results in Table 2 show systematic differences in meta-skills by major, with Strategic Synthesis and Relational Dynamics particularly underdeveloped in certain fields (e.g., Engineering/IT, Applied Arts). This reinforces the idea that meta-skills are not evenly distributed by default; they depend on the learning architectures and cultures of specific programs.

By translating these findings into the three innovation modules—AMIM for curriculum, IEPM for pedagogy, SMAM for assessment—the framework makes the alignment explicit and operational:

- 1) AMIM addresses the need for integrative, interdisciplinary, and challenge-based curricular structures that naturally cultivate Adaptive Expertise and Strategic Synthesis.
- 2) IEPM responds to the call for more immersive, collaborative, and community-embedded learning environments, which are crucial for Creative Agility and Relational Dynamics.
- 3) SMAM tackles the chronic underdevelopment of assessment systems capable of capturing meta-skills growth, using portfolios, multi-source feedback, and analytics to align evaluation with the four domains.

The alignment matrix in Table 3 is therefore more than a descriptive tool—it functions as a theory of change linking specific management levers to targeted meta-skills outcomes. In doing so, the study contributes to meta-skills scholarship by shifting the focus from students’ “personal qualities” to institutional design capabilities. This aligns with evidence that institutional culture and coupling patterns shape reform uptake and data use in universities (Shaya et al., 2023; Trinidad, 2024), but extends prior work by specifying module-level design levers tied to meta-skills outcomes.

4.3 Iteration, Validity, and Cultural Fit in Chinese Private HEIs

The expert validation results (Table 4) provide empirical evidence that an iterative DT process can substantially enhance the perceived quality and feasibility of an institutional innovation framework. The statistically significant improvements

from Draft 1 to Draft 2 across all five criteria—especially clarity, cultural alignment, and relevance—highlight three important points.

First, they underscore the importance of localized language and framing in Chinese private HEIs. Initial drafts often borrow vocabulary from international literature (e.g., “design thinking,” “meta-skills,” “agile curriculum”), which may not immediately resonate with institutional stakeholders. Expert feedback prompted the adaptation of terminology into policy-compatible and culturally familiar formulations, without diluting the underlying concepts.

Second, the ratings reflect the value of explicit implementation guidance. Expert comments indicated that the first draft was conceptually strong but lacked sufficient detail on responsibilities, timelines, and resource implications. The revised framework incorporated clearer implementation pathways and role definitions, which significantly increased perceived feasibility and scalability. This suggests that, in contexts where academic staff already face heavy workloads and tight regulation, clarity about “who does what, when, and with what support” is a precondition for innovation acceptance.

Third, early pilot results—though modest in effect size—point to the practical viability of the framework. Increases in Strategic Synthesis and Relational Dynamics scores over one semester, with small-to-moderate effect sizes, are noteworthy given the limited duration of exposure and the fact that most structural changes were still in early stages. They indicate that meta-skills can be nudged in positive directions when academic management is explicitly designed around them, even without sweeping systemic reforms.

However, the findings also reveal important constraints. Implementation in private HEIs occurs under:

- 1) Intense market and enrollment pressures, which can prioritize short-term recruitment targets over long-term capability building.
- 2) Hierarchical governance structures, where decision-making remains centralized and risk aversion is common.
- 3) Resource limitations, especially in smaller institutions lacking extensive instructional design or educational technology support.

In such environments, Design Thinking is not a neutral technique; it is a change in organizational mindset, requiring leaders to tolerate uncertainty, support iterative experimentation, and integrate stakeholder feedback—even when this challenges existing routines. The improved expert ratings between drafts suggest that such a shift is possible but must be carefully choreographed.

4.4 Theoretical Implications

The study generates several theoretical insights at the intersection of institutional innovation, meta-skills, and Design Thinking. First, it positions Design Thinking as a bridge between measurement and design. By embedding PNI-modified analysis and ANOVA results directly into the DT process, the study demonstrates that quantitative diagnostics can serve not only evaluative functions but also generative roles in innovation design. This challenges the common separation

between “assessment” and “design,” suggesting that data can and should be mobilized at the front end of reform, not only at the back end as a post-hoc check. Second, the work reconceptualizes meta-skills as institutional, not only individual, constructs. Meta-skills are framed as outcomes of academic management systems – operationalized through the AMIM-IEPM-SMAM framework – rather than as purely personal traits. This adds a meso-level layer to meta-skills theory and implies that meta-skills frameworks must be read not only as student competency models but also as organizational design specifications that guide how curriculum, pedagogy, and assessment are structured.

Third, the case suggests that institutional Design Thinking can be understood as a governance capability. When structured around empirical needs and iterative validation, DT becomes the capacity of an institution to sense, frame, co-create, prototype, and refine responses to complex challenges. This view aligns DT with theories of organizational learning and dynamic capabilities, positioning it as an engine of continuous academic renewal rather than a one-off innovation method.

4.5 Practical and Policy Implications

For institutional leaders and policy actors, several practical implications follow from these findings. A first implication is the need to start with evidence-based empathy. Large-scale staff and student diagnostics, including techniques such as PNImodified and meta-skills profiling, should be treated as the beginning of design, not the end of evaluation. National and regional policy bodies can strengthen this orientation by funding diagnostic studies that feed directly into institutional design labs or innovation studios rather than remaining as isolated reports.

A second implication concerns modularity and adaptability. The observed heterogeneity across majors indicates that reforms should be designed as modular architectures, allowing faculties to adapt core principles – embodied in AMIM, IEPM, and SMAM – to their specific disciplinary cultures. Policy frameworks that mandate uniform templates risk suppressing the local adaptability that meta-skills development requires.

Third, the results highlight the importance of institutionalising iterative review. The marked improvements in expert ratings between framework drafts demonstrate the value of formalised iteration. Universities might establish recurring “innovation sprints” or structured design cycles, each culminating in expert review, pilot testing, and recalibration, rather than treating reform as a one-shot initiative.

A fourth implication is the need to align incentives with meta-skills outcomes. For Design Thinking-based innovations to move beyond pilot status, governance systems – including promotion criteria, internal funding schemes, and quality assurance indicators – must recognise and reward efforts that enhance meta-skills outcomes, not solely traditional metrics such as exam scores or publication counts. At the policy level, ministries and accrediting bodies could explicitly incorporate meta-skills and design-based innovation into quality assurance frameworks,

encouraging HEIs to experiment with DT-based institutional reforms while maintaining accountability through transparent, data-driven processes.

Transferability of the proposed Design Thinking-informed academic management framework depends on several boundary conditions that vary across higher education systems. First, governance autonomy determines whether institutions can redesign curriculum structures, reallocate decision rights, and adjust assessment policies without lengthy external approvals. Second, quality assurance (QA) capacity shapes implementation fidelity: institutions require a functioning QA routine (e.g., program-level evidence cycles, rubric governance, and periodic review mechanisms) to ensure that meta-skills outcomes are not treated as symbolic add-ons but as auditable learning outcomes.

Third, faculty workload and incentive structures influence uptake; where teaching loads are high and promotion criteria privilege publication over teaching innovation, institutions may need staged rollouts, workload relief, and incentive alignment to sustain participation. Fourth, assessment infrastructure (e.g., portfolio systems, learning analytics, moderation processes, and examiner training) is critical for producing credible evidence of meta-skills growth. Accordingly, outside China, adoption is likely to require adaptation to local QA regimes, decision-right structures, and resource baselines; the framework should therefore be implemented as a modular, context-sensitive design rather than a uniform template.

4.6 Limitations and Directions for Future Research

Several limitations should be acknowledged. The study is situated in private universities within a single Chinese province, which constrains generalisability to public institutions and to other systems with different governance and QA regimes. The main surveys are cross-sectional and the pilot was short-term and non-controlled; accordingly, the results support institutional diagnosis and design refinement but do not warrant causal claims about sustained meta-skills growth. In addition, reliance on self-reported measures may introduce social desirability and common-method bias, ANOVA assumptions were not fully tested/reported, and expert validation involved a small panel ($n = 12$).

Transferability is therefore conditional on contextual factors (e.g., governance autonomy, QA capacity, faculty workload, and assessment infrastructure) and may require language and cultural adaptation to ensure measurement equivalence and local relevance. Future research should prioritize longitudinal and comparative designs (private vs. public HEIs; cross-province/cross-national settings), incorporate stronger counterfactuals where feasible, and use mixed-method case studies to examine how leadership, organizational culture, and governance structures shape implementation fidelity and long-term impact.

From an application standpoint, administrators should adopt the framework as a staged operating model, embed explicit decision rights and workload supports for implementation, and monitor progress using program-level meta-skills indicators. In parallel, QA policy routines should embed meta-skills outcomes

into standard evidence cycles (rubrics, portfolios, moderation, and periodic review reports), adopt traceability templates for consistent documentation, and monitor alignment and impact through scheduled audits and KPI-linked dashboards.

5. Conclusion

This study shows how Design Thinking (DT) can be used as a structured, evidence-informed approach to drive institutional innovation in higher education, using the case of meta-skills integration in Chinese private universities. Instead of limiting DT to creative classroom activities, the approach was applied to academic management systems as a whole. Each DT phase—Empathize, Define, Ideate, Prototype, and Test—was grounded in data and iterative feedback. The initial phases used a modified gap analysis and student meta-skills profiling to identify mismatches in curriculum design, teaching practices, and assessment methods.

These diagnostics also revealed weaknesses in strategic thinking and relational dynamics, helping define the problem more precisely and set criteria like modularity, measurability, and contextual fit. From there, the Ideate and Prototype phases produced a three-part framework—Agile Meta-skills Integration (AMIM), Immersive Experiential Pedagogy (IEPM), and Smart Meta-skills Assessment (SMAM)—with a clear theory of change linking institutional practices to student outcomes. The Test phase involved expert review and pilot testing, which showed improved ratings in clarity, scalability, and cultural fit, along with early gains in student strategic and interpersonal capabilities.

More broadly, the case contributes to our understanding of how institutions can use DT as a governance tool to respond to complex challenges through data, stakeholder engagement, and structured experimentation. It also reframes meta-skills—not as individual traits developed in isolation, but as outcomes shaped by the way institutions design and align curriculum, pedagogy, and assessment. The key takeaway is that lasting meta-skills reform won't come from policy declarations or isolated teaching efforts alone. Instead, it requires redesigning academic systems in an integrated, evidence-based way, with modular solutions and quality assurance built in. While this case is grounded in one specific Chinese context, the overall approach is adaptable to other settings when tuned to local governance, resources, and QA structures. In this sense, institutional design itself emerges as a meta-skill—the organization's capacity to learn, adapt, and evolve in the face of uncertainty.

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Conflict of Interest Statement

Authors state no conflict of interest.

7. Ethical Approval

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (Research Ethics Review Committee for Research Involving Human Subjects: The Second Allied Academic Group in Social Sciences, Humanities and Fine and Applied Arts, Chulalongkorn University, Bangkok, Thailand; protocol code COA No. 493/67, approval date 21 November 2024). The data collection and all research procedures were completed within the approved IRB validity period (COA No. 493/67; valid from 21 November 2024 to 20 November 2025).

8. Data Availability

The data that support the findings of this study are available from the author upon reasonable request. The dataset contains information that could compromise participant privacy and institutional confidentiality; therefore, it is not publicly available.

9. Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During manuscript preparation, the authors used a generative AI tool solely for language editing and readability improvement. The authors reviewed and edited all text and take full responsibility for the final content.

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