

From gaps to modules: design thinking for meta-skills in Chinese private universities

Chi Che¹, Sukanya Chaemchoy², Pruet Siribanpitak²

¹Department of Educational Leadership, International College, Payap University, Chiang Mai, Thailand

²Department of Educational Policy, Management and Leadership, Faculty of Education, Chulalongkorn University, Bangkok, Thailand

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ABSTRACT

This study addresses persistent misalignment between academic management and meta-skills development in Chinese private higher education institutions (HEIs). It aimed to design, validate, and disseminate an academic management innovation that embeds four meta-skills domains: adaptive expertise, relational dynamics, creative agility, and strategic synthesis into curriculum, teaching, and assessment in Sichuan private HEIs. A multi-phase mixed-methods design aligned with design thinking (empathize, define, ideate, prototype, test) was employed. Data were collected from 400 undergraduates (meta-skills questionnaire), 805 academic and administrative staff (*PNI_{modified}* needs survey), and 20 experts (interviews, focus groups, and rubric-based evaluations). Quantitative analyses used descriptive statistics, analysis of variance (ANOVA), reliability indices, and *PNI_{modified}* prioritization, while qualitative data underwent thematic content analysis and integrative synthesis. Results indicated moderate overall meta-skills, with strategic synthesis and relational dynamics weakest, and significant disciplinary variation for strategic synthesis. The highest reform priority was curriculum design, followed by assessment and teaching-learning practices. Across two validation rounds, experts reported improved feasibility and consistently high relevance and innovation. The resulting next-gen academic management framework offers an empirically grounded, adoption-ready pathway for modular academic management innovation.

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Corresponding Author:

Chi Che

Department of Educational Leadership, International College, Payap University

Super-highway Chiang Mai-Lumpang Road Amphur, Mueang Chiang Mai District, 50000, Thailand

Email: chi_c@payap.ac.th

1. INTRODUCTION

Meta-skills such as adaptability, creativity, strategic thinking, and relational intelligence are increasingly recognized as core capabilities for thriving in volatile, uncertain, complex, and ambiguous (VUCA) environments [1]–[3]. Rather than functioning as task-bound competences, they operate as higher-order “enablers” that allow learners to transfer knowledge across contexts and respond to emerging challenges with flexibility and judgment [4], [5].

Empirical and conceptual work in higher education shows that meta-skills underpin employability, professional identity formation, and readiness for complex work, particularly when linked to authentic and project-based learning designs in marketing and related fields [2], [4], [6]. Studies in language and disciplinary education further demonstrate how meta-skills can be cultivated through targeted pedagogical

designs, such as English for international relations and outcome-based curricula that explicitly integrate meta-skills into level learning outcomes [7], [8].

At the same time, meta-skills research increasingly converges with the creativity and innovation literature, where design-oriented and problem-solving capacities are treated as essential for future-ready graduates [9], [10]. Together, these strands position meta-skills not merely as “soft skills”, but as cross-cutting capabilities that mediate how students learn, collaborate, and innovate across diverse educational and professional ecosystems.

In the Chinese higher education context, national reform agendas emphasizing innovation-driven development and graduate employability have heightened the urgency to embed meta-skills into institutional practices. Yet, as discussed below, operationalizing these aspirations through academic management systems remains uneven, with many institutions still constrained by exam-centered and content-heavy traditions [1], [3], [7].

However, an implementation gap persists: meta-skills are widely endorsed as graduate outcomes, but they are inconsistently translated into the academic-management routines that shape curriculum design, teaching-learning enhancement, and assessment especially in Chinese private higher education institutions (HEIs). As a result, innovation often appears as isolated teaching initiatives rather than a coherent operating system for diagnosing needs, prioritizing reforms, and scaling practices across programs. This study addresses the gap by integrating student meta-skills profiling with institutional priority diagnosis (*PNI_{modified}*) and a design thinking-aligned development pathway to produce and validate a modular “next-gen academic management” framework that is documented for adoption and adaptation.

Debates on academic management increasingly intersect with research on instructional innovation and design-based pedagogy. Systematic and scoping reviews demonstrate that design thinking can function as an active teaching methodology in higher education [11], as a broader pedagogical approach aligned with institutional quality enhancement [12], and as an institutional strategy for linking experiential learning, innovation, and academic performance through challenge-based learning [13].

Within Chinese universities, academic management environments have been shown to shape not only organizational processes but also the psychological well-being and adjustment of international academics, underscoring how governance structures and management cultures condition the lived experience of academic work [14]. Design-thinking oriented teaching and learning initiatives implemented across multiple universities further illustrate that academic innovation is inherently multi-actor, involving staff, students, and external partners in co-creation processes [15].

Against this backdrop, Che [16] conducted a systematic review of academic management and meta-skills in Chinese higher education, documenting the extent to which graduate readiness discourses have been translated into concrete academic management reforms. Their synthesis concluded that meta-skills are frequently invoked in policy and strategic rhetoric but only weakly embedded in curriculum governance, pedagogical enhancement, and assessment regimes in many institutions.

Complementary work on future orientation and perceived employability among Chinese undergraduates demonstrates that students’ temporal perspectives and self-beliefs are tightly linked to their readiness for transition into the labor market [17]. Studies on metacognitive abilities and meta-skills in problem solving further show how higher-order thinking, monitoring, and regulation support complex learning tasks, particularly in mathematically demanding contexts [18]. Under distance and hybrid learning conditions, research on soft and meta-skills formation in foreign language education highlights both opportunities and challenges for maintaining high-quality interaction and support [19].

Broader analyses of soft, hard, and meta-skills in foreign language learning position meta-skills development as a motivational engine for effective professional growth, stressing the need for deliberate institutional strategies [20]. From a management perspective, work on Kairos-management, marketing, social intelligence, and meta-skills in higher education frames meta-skills as strategic resources for navigating rapidly changing academic and market conditions [21].

Taken together, these studies suggest that academic management must be reconceptualized as a system that deliberately organizes curriculum, pedagogy, and assessment around meta-skills outcomes, rather than treating them as incidental by-products of traditional programs [14]–[16], [20], [21].

Design thinking has gained prominence as a methodology for driving educational innovation at both course and institutional levels. Research on digital innovation capabilities among Chinese college students shows that design-thinking oriented activities can foster creativity, problem solving, and innovation skills when embedded in project-based learning environments [22]. Training strategies based on multimodal large models demonstrate how design thinking and innovation ability can be scaffolded through AI-supported, data-rich learning tasks [23].

In parallel, design-thinking driven models for cultivating innovative talents within innovation education explicitly link empathetic problem framing, ideation, and prototyping to the development of

students' innovation capacity and entrepreneurial mindset [24]. Within design education, studies emphasize the cultivation of innovative thinking and its connection to career development, arguing that structured design projects and reflective practice enhance students' long-term adaptability in creative industries [25]. Integrative approaches that combine critical thinking and design thinking in design innovation education indicate that mindset shifts, rather than technical skills alone, are central to shaping future-ready graduates [26].

At the organizational level, empirical work on Chinese private higher education institutions reveals how job satisfaction and turnover intentions among academics signal deeper structural challenges in academic management, including workload allocation, governance, and support for innovation [27]. Research on organizational factors influencing university teachers' acceptance of online teaching during the COVID-19 pandemic highlights the role of institutional culture, infrastructure, and support mechanisms in enabling or constraining digital transformation [28].

Studies of artificial intelligence in Chinese universities further show that AI tools can both enhance and disrupt academic work: teachers' work engagement is mediated by job crafting and career calling, suggesting that academic management must address not only technological integration but also professional identity and agency [29]. Analyses of institutional governance in the development of private universities illustrate how legal frameworks, funding models, and governance arrangements shape the strategic options available to academic leaders [30]. Student perspectives on blended learning adoption reveal expectations for flexibility, interaction, and support that must be considered in program and course design [31]. Finally, systematic reviews of educational leadership and management research in China point to persistent gaps in evidence-based frameworks that integrate leadership, governance, and pedagogical innovation [32].

Overall, this literature suggests that design thinking and related innovation approaches are promising but still underutilized for reconfiguring academic management and aligning institutional practices with meta-skills-oriented outcomes, particularly in Chinese private higher education.

Synthesizing these strands, this study frames meta-skills development as an institutional design problem that must be addressed through: i) clearly specified meta-skills outcome domains, ii) academic-management levers (curriculum design, teaching-learning enhancement, and evaluation), and iii) an iterative design thinking logic for moving from diagnosis to implementable modules. Figure 1 summarizes this integration by positioning three coordinated modules agile curriculum integration, immersive experiential pedagogy, and smart meta-skills assessment as the primary institutional mechanisms for strengthening student meta-skills in Chinese private HEIs.

The three modules agile curriculum integration, immersive experiential pedagogy, and smart meta-skills assessment contributes in complementary ways to the overarching goal of meta-skills development. First, meta-skills are treated as structured outcome domains that span cognitive, interpersonal, and strategic capabilities, including adaptive expertise, relational dynamics, creative agility, and strategic synthesis. Evidence from hospitality education shows that design-thinking infused curricula can enhance students' problem solving, collaboration, and innovation dispositions, illustrating how sector-specific programs operationalize meta-skills in practice [33]. Research on art and design teachers' personal "rules of thumb" when designing studio instruction further underscores that meta-skills are also required at the level of academic staff, who must orchestrate complex learning environments that foster experimentation and reflection [34].

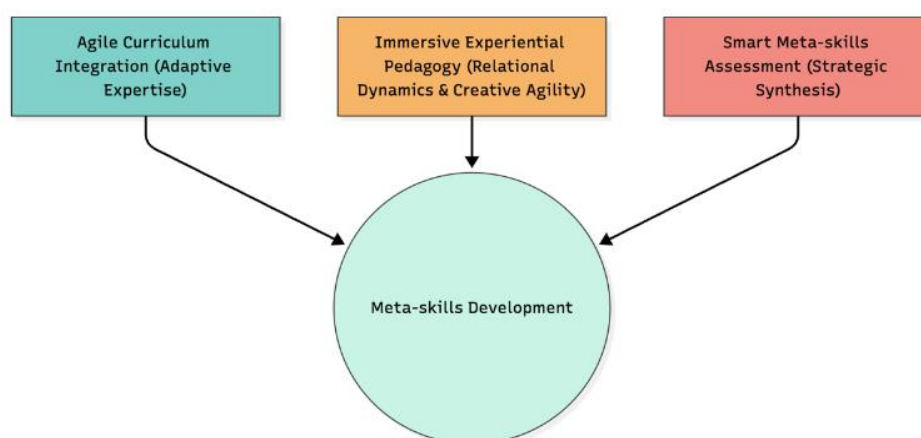


Figure 1. Conceptual framework of the next-gen academic management innovation for meta-skills development in Chinese private HEIs

Second, academic management is conceptualized as a set of institutional levers curriculum design, teaching and learning enhancement, and evaluation that mediate the relationship between meta-skills goals and lived student experiences. Studies on Chinese academic management environments and international academics' psychological well-being illustrate how governance arrangements, decision-making processes, and organizational climates shape the feasibility and sustainability of innovation [35]. Curriculum designs that explicitly seek to promote design thinking among art and design students in vocational colleges demonstrate how meta-skills targets can be embedded into course structures and learning tasks [36]. Work on problem-based learning in HyFlex environments shows that carefully designed tasks and modalities can strengthen critical thinking, a core meta-skill, when supported by appropriate scaffolding and assessment [37].

Third, design thinking is positioned as the methodological “engine” that links meta-skills outcomes with academic management levers. By iteratively cycling through empathize-define-ideate-prototype-test, institutions can adapt curricula, pedagogy, and assessment in response to student feedback, labor-market demands, and emerging technological trends. Studies on innovation capability, social adaptability, and employability among undergraduates suggest that when programs deliberately cultivate these capabilities through authentic, iterative learning experiences, graduates display stronger readiness for dynamic work environments [38].

Within this framework, meta-skills function as the target outcomes, academic management provides the structural and procedural mechanisms, and design thinking offers the innovation logic that orchestrates continuous adaptation. The proposed academic management innovation for Sichuan private HEIs is therefore conceived as a modular system that aligns these three dimensions in a context-sensitive way.

To make the logic of Figure 1 explicit and reader-friendly, Table 1 maps the student meta-skills need profile to the primary academic management levers, the design thinking focus used in this study, and the specific mechanisms embedded in the three-module next-gen academic management innovation.

Table 1. Meta-skills to academic management mapping

Meta-skills priority (student profile)		Primary academic management lever(s)	Design thinking focus	Module mechanism (next-gen academic management)
Strategic (lowest)	synthesis	Curriculum design; assessment (visibility of synthesis)	Define (diagnose gaps) → ideate (prioritize) → prototype/test (refine tools)	Agile curriculum integration embeds synthesis outcomes and integrative tasks; smart meta-skills assessment operationalizes synthesis via authentic tasks, rubrics, and feedback.
Relational (low)	dynamics	Teaching-learning enhancement; assessment (team processes)	Empathize/define (learning experience constraints) → prototype/test (feasibility)	Immersive experiential pedagogy scales collaborative, challenge-driven learning; smart meta-skills assessment assesses teamwork/leadership behaviors with criteria and feedback cycles.
Adaptive (stronger)	expertise	Curriculum sequencing; pedagogy (transfer and adaptation)	Ideate (learning sequence) → prototype (implementation design)	Agile curriculum integration strengthens transfer-oriented outcomes and progression; immersive experiential pedagogy provides repeated adaptive practice in authentic contexts.
Creative (stronger)	agility	Pedagogy; assessment (innovation processes)	Ideate/prototype (activity+assessment design)	Immersive experiential pedagogy structures experimentation and iteration; smart meta-skills assessment captures creative processes through portfolios, criteria, and formative feedback.

Overall, the Table 1 clarifies how the quantified needs profile (especially the weaker strategic synthesis and relational dynamics domains) directly informs both the sequencing of academic management reform levers and the design choices within each module, operationalized through a design thinking pathway from diagnosis to feasible, testable implementation mechanisms.

Despite the growing body of work on meta-skills, design thinking, and academic management, several critical gaps remain. First, much of the existing innovation literature in Chinese higher education focuses on specific technologies or pedagogical tools rather than on system-level academic management frameworks. For example, studies on immersive virtual reality in higher art education emphasize opportunities and challenges for studio-based disciplines but rarely address how institutional governance and program management must evolve to support sustainable adoption [39]. Goal-oriented analyses of stakeholders' data literacy show how learning analytics and data-informed decision-making can contribute to student success, yet they seldom link these capabilities to meta-skills frameworks or academic management structures [40]. Research on animation teaching that integrates design thinking and creative methods provides valuable insights into course-level innovation without fully theorizing how such approaches scale institutionally [41].

Second, while there is increasing recognition of the need for meta-skills development among both students and education personnel including secondary education staff and school-level actors [42] few studies conceptualize meta-skills as institutional capacities embedded in culture, governance, and management routines. Emerging work on Meta AI literacy among university students extends this conversation into the AI era, highlighting new forms of literacy that intersect with ethical judgment, critical thinking, and systems awareness [43]. However, these literacies are rarely integrated into academic management frameworks that coordinate curriculum, pedagogy, assessment, and staff development.

Third, macro-level analyses of open and distance education in China, as well as commentaries on AI-driven transformations such as those triggered by tools like DeepSeek, underline the scale and speed of change confronting higher education systems [44], [45]. These developments amplify the need for academic management models that can strategically harness digital, AI, and open-learning innovations while simultaneously cultivating meta-skills as core graduate outcomes. Yet, current practices in many private HEIs remain fragmented, with pockets of innovation that lack an overarching design logic or evidence-based framework.

This study responds to these gaps by framing meta-skills as system-level capabilities embedded in academic management, using design thinking to structure the development of a modular innovation framework, and grounding the proposed next-gen academic management model, documented in an open-access Zenodo booklet (<https://doi.org/10.5281/zenodo.17827034>), in the specific realities of Sichuan private HEIs, thereby offering a context-sensitive yet transferable approach to future-ready institutional transformation [16], [46].

2. METHOD

2.1. Research design

This study adopted a multi-phase mixed-methods design to develop, refine, and validate an academic management innovation framework aimed at enhancing meta-skills in Chinese private HEIs. Quantitative and qualitative strands were integrated sequentially and iteratively, following a four-phase structure mapped onto the five stages of design thinking (empathize, define, ideate, prototype, and test). Literature synthesis and needs analysis were used to empathize with stakeholders and define core problems; survey and *PNI_{modified}* results informed the ideation of framework components; and expert review, interviews, and focus groups supported the prototyping and testing of successive draft versions. This design ensured that the final framework was both empirically grounded and context-sensitive.

2.2. Participants and sampling

Three participant groups were involved. First, 400 undergraduate students from ten private HEIs were selected via stratified cluster sampling, with strata defined by discipline and region. Eligible participants were full-time undergraduates who had completed at least one year of study and consented to complete a meta-skills diagnostic questionnaire. Second, 805 academic and administrative staff program directors, department heads, vice deans, quality assurance officers, and senior lecturers involved in curriculum governance were recruited through purposive sampling coordinated by institutional academic affairs offices. They responded to a *PNI_{modified}* survey assessing current and desired levels of academic management practices. Third, 20 expert panelists and key stakeholders, including educational researchers, senior HEI administrators, and curriculum designers with at least five years of relevant experience, were engaged through semi-structured interviews and focus group discussions to critique and refine the innovation framework. All participation was voluntary and data were anonymized.

2.3. Instruments

Four principal instruments were employed. The student meta-skills questionnaire measured four domains adaptive expertise, relational dynamics, creative agility, and strategic synthesis using Likert-type items adapted from international frameworks and calibrated to the Chinese HE context; content validity was established through expert review and piloting. The *PNI_{modified}* survey for staff captured perceived gaps between current (C) and desired (D) states of curriculum, teaching and learning, and assessment practices, with *PNI_{modified}* values $(D-C)/C$ calculated to identify and rank priority needs. Semi-structured interview and focus group protocols were designed to elicit views on existing academic management, meta-skills development, institutional best practices, and the feasibility of proposed modules; these guides were peer-reviewed and pilot-tested for clarity. Finally, analytic validation rubrics were developed to rate the innovation framework on suitability, feasibility, clarity, and innovation using Likert scales and open comments, and were applied in two rounds to evaluate the first and second drafts.

2.4. Research phases

Across Phase 1, an extensive literature review was combined with preliminary expert input to delineate the meta-skills domains and academic management components relevant to private HEIs in China, resulting in an initial conceptual framework and operational definitions. In Phase 2, the meta-skills questionnaire was administered to 400 undergraduates across ten institutions, and the resulting data were screened and analyzed descriptively to produce baseline profiles and identify comparatively weak meta-skills domains as priority development areas. Phase 3 focused on diagnosing institutional needs: 805 staff completed the *PNI_{modified}* survey, *PNI_{modified}* values were computed for each item, and academic management needs were ranked, with cross-tabulations by role and institutional characteristics informing the design emphasis of the innovation. In Phase 4, findings from Phases 2 and 3 were integrated with expert interviews and focus groups to co-design the innovation framework; the first draft was evaluated using validation rubrics and qualitative feedback, revised into a second draft, and then subjected to a second round of expert review and scoring, culminating in a finalized “Next-gen academic management” framework tailored to Sichuan private HEIs.

2.5. Data analysis

Quantitative data from the student and staff surveys were analyzed using statistical software. Descriptive statistics (means, standard deviations, frequency distributions) summarized meta-skills levels and perceptions of academic management, while reliability analyses (Cronbach’s α and item-total correlations) assessed internal consistency. *PNI_{modified}* values were calculated for each item and dimension to generate priority rankings, and comparative analyses, where sample sizes permitted, explored variations by role, discipline, or institution. Qualitative data from interviews and focus groups were transcribed and analyzed using thematic content analysis, starting from open coding and progressing to higher-order categories that captured barriers, enablers, design principles, and implementation risks; code-recode checks and memoing were used to enhance rigor. Integration occurred at the interpretation stage, where quantitative priority maps were juxtaposed with qualitative themes, and expert rubric scores were interpreted alongside narrative comments to guide successive refinements. This integrated analytic strategy ensured that the final innovation framework was both methodologically robust and practically grounded in stakeholder realities.

3. RESULTS

3.1. Student meta-skills profiles

Data from 400 students across 10 private HEIs indicate moderately developed meta-skills, with clear differentiation across domains as shown in Table 2. On a five-point scale, adaptive expertise ($M=3.62$, $SD=0.54$, $\alpha=0.85$) and creative agility ($M=3.58$, $SD=0.58$, $\alpha=0.83$) are relatively stronger, while relational dynamics ($M=3.42$, $SD=0.60$, $\alpha=0.80$) and especially strategic synthesis ($M=3.27$, $SD=0.62$, $\alpha=0.79$) lag behind. Skewness and kurtosis values remain close to zero, suggesting approximately normal distributions suitable for subsequent parametric analyses.

To complement the descriptive statistics in Table 2, Figure 2 presents a radar chart comparing students’ average scores in the four meta-skills domains with the institutional ideal level. This visual profile highlights relative strengths and weaknesses across adaptive expertise, creative agility, relational dynamics, and strategic synthesis. Figure 2 shows the radar chart contrasts observed mean scores with institutional ideals. The largest gaps appear in strategic synthesis and relational dynamics, highlighting systemic weaknesses in foresight, systems thinking, collaboration, and leadership—core targets for the proposed academic management innovation.

Table 2. Descriptive statistics and reliability of Meta-skills domains

Meta-skill domain	Mean	SD	Cronbach’s α	Skewness	Kurtosis
Adaptive expertise	3.62	0.54	0.85	-0.12	0.45
Creative agility	3.58	0.58	0.83	-0.10	0.40
Relational dynamics	3.42	0.60	0.80	-0.05	0.30
Strategic synthesis	3.27	0.62	0.79	+0.02	0.25

As shown in Figure 2, students are closest to the institutional ideal in adaptive expertise and creative agility, while the profile is most compressed in relational dynamics and especially strategic synthesis, indicating larger gaps in collaboration/leadership and in systems-level, future-oriented thinking. Although all four domains remain below the ideal boundary, the asymmetric shape clarifies that integrative and relational capabilities are the most fragile, and therefore the most strategically important targets for institutional

intervention. This pattern directly informed the framework logic: agile curriculum integration prioritizes program-level structures that require synthesis and integrative performance, while immersive experiential pedagogy and smart meta-skills assessment strengthen the learning and assessment conditions needed for relational practice and higher-order integration.

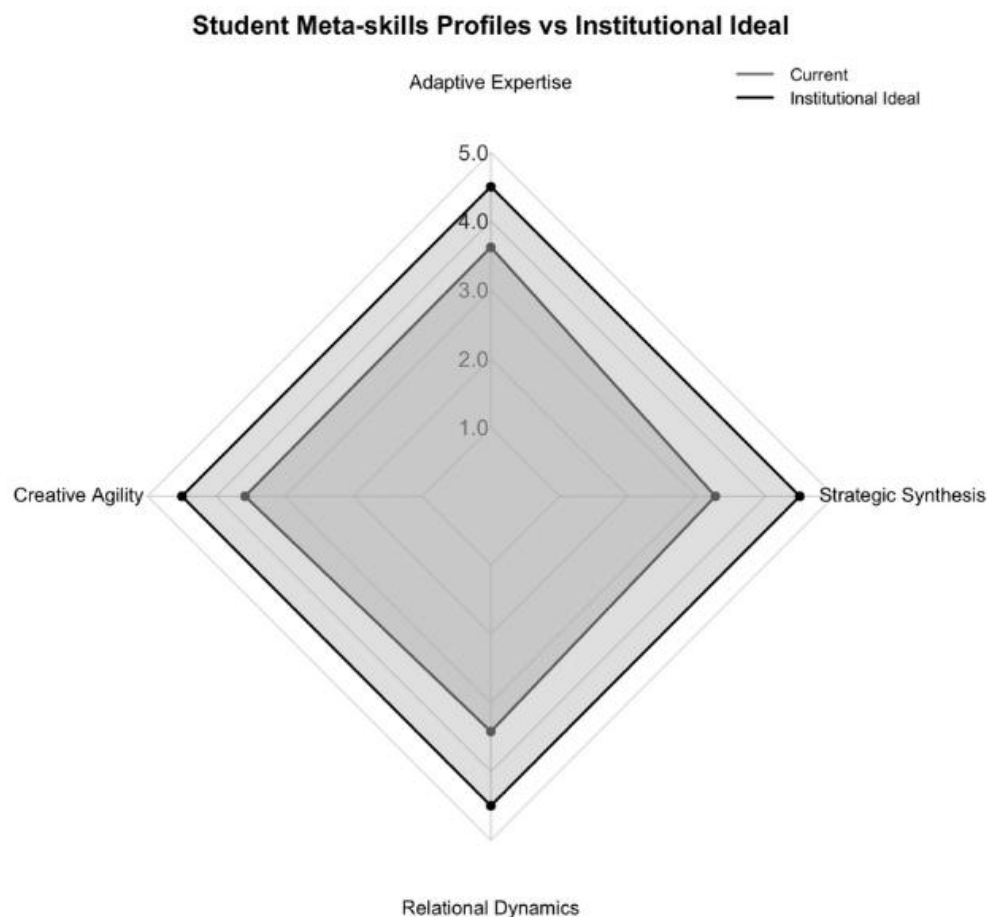


Figure 2. Radar chart of student meta-skills profiles versus institutional ideal

3.2. Meta-skills variation by major

Meta-skills were not uniform across majors, indicating that implementation should be discipline-sensitive as shown in Table 3. Differences were statistically significant for adaptive expertise, creative agility, and strategic synthesis, while relational dynamics did not differ significantly at the 0.05 level. Notably, strategic synthesis showed the strongest differentiation across majors, $F(3, 396)=5.65$, $p=0.001$, $\eta^2=0.041$, suggesting that some programs provide fewer structured opportunities for integrative thinking, systems reasoning, and longer-term planning. Although the effect size is small, the pattern is practically relevant for targeting module emphasis by discipline.

Table 3 indicates that meta-skills development is not uniform across majors. Differences are statistically significant for adaptive expertise, creative agility, and strategic synthesis, with strategic synthesis showing the largest (still small) effect ($\eta^2=0.041$). This pattern suggests that discipline-sensitive implementation is required, particularly for strengthening integrative and future-oriented thinking in programs where strategic synthesis is comparatively weaker.

Table 3. One-way analysis of variance (ANOVA) of meta-skills by student major

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	5.65	0.001	0.041

3.3. Institutional priority needs ($PNI_{modified}$ results)

Responses from 805 academic and administrative staff show substantial perceived gaps between current and desired academic management practices as shown in Table 4. Curriculum design has the highest priority (current $M=2.85$; ideal $M=4.23$; $PNI_{modified}=0.38$), followed by assessment methods ($PNI_{modified}=0.34$) and teaching and learning ($PNI_{modified}=0.29$). This prioritization directly informs the module sequence of the proposed framework.

These findings underscore that curriculum reform is not only desirable but foundational. Without redesigning curricula to embed meta-skills outcomes and integrative performance tasks, improvements in teaching and assessment are likely to remain fragmented. The $PNI_{modified}$ results therefore justify sequencing curriculum design as the primary reform lever (current $M=2.85$; ideal $M=4.23$; $PNI_{modified}=0.38$), followed by assessment methods (0.34) and teaching and learning (0.29). This priority structure directly shaped the framework architecture: agile curriculum integration addresses the largest system-level gap, while immersive experiential pedagogy and smart meta-skills assessment operationalize the corresponding teaching and evaluation mechanisms needed to sustain meta-skills development at scale.

Table 4. Academic management reform priorities

Area	Current mean	Ideal mean	Gap	$PNI_{modified}$	95% CI	Rank
Curriculum design	2.85	4.23	1.38	0.38	[1.25-1.51]	1
Assessment methods	2.95	4.20	1.25	0.34	[1.12-1.38]	2
Teaching and learning	3.05	4.10	1.05	0.29	[0.92-1.18]	3

3.4. Expert validation of the innovation framework

Twenty experts evaluated the innovation framework across two iterative drafts. As shown in Table 5, perceived feasibility improved significantly from draft 1 ($M=4.11$, $SD=0.45$) to draft 2 ($M=4.28$, $SD=0.38$), $t=2.34$, $p=0.03$, indicating that revisions enhanced implement ability in private HEI contexts. Relevance ratings also increased (from $M=4.24$ to 4.35), although this change did not reach conventional significance levels ($p=0.09$), suggesting that the framework was already perceived as substantively aligned with institutional needs in its initial form. The dimension of Innovation was introduced in the second round only and received a high mean rating ($M=4.45$, $SD=0.36$), reinforcing the view that the framework offers added value beyond existing practices. These validation results support the design thinking-based iterative refinement process and provide empirical evidence of expert consensus on the suitability and feasibility of the final framework.

Table 5. Expert ratings: first vs. second draft

Dimension	Draft 1 mean (SD)	Draft 2 mean (SD)	Δ mean	t-value	p-value
Feasibility	4.11 (0.45)	4.28 (0.38)	+0.17	2.34	0.03
Relevance	4.24 (0.48)	4.35 (0.40)	+0.11	1.78	0.09
Innovation	-	4.45 (0.36)	-	-	-

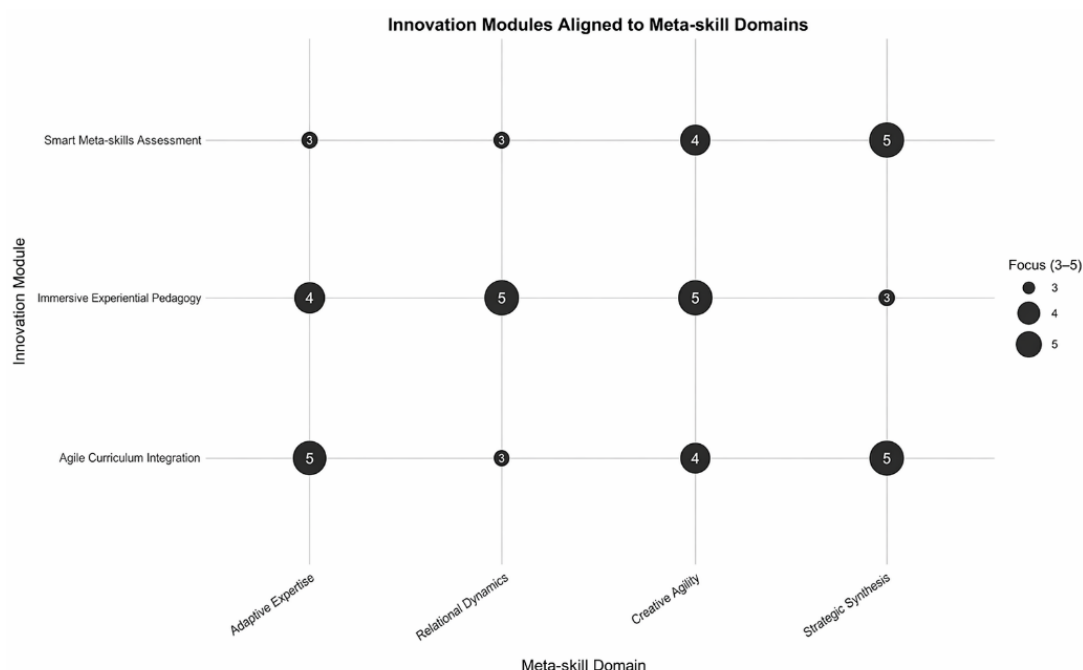
Note: innovation was evaluated only in draft 2.

3.5. Final framework output

The final innovation framework, summarized in Figure 3, consists of three interrelated modules that collectively address curriculum design, teaching-learning processes, and assessment for meta-skills integration: agile curriculum integration, immersive experiential pedagogy, and smart meta-skills assessment. Each module is mapped to the four meta-skills domains (adaptive expertise, relational dynamics, creative agility, and strategic synthesis) and to the priority needs identified by the $PNI_{modified}$ analysis. To clarify how the three modules operationalize the four meta-skills domains, Figure 3 presents a module meta-skills alignment matrix; bubble size indicates relative emphasis (3-5) based on design intent and expert validation.

The pattern in Figure 3 shows that no single module is expected to develop all meta-skills equally; instead, each module has a distinct but complementary emphasis. Agile curriculum integration is positioned as the structural driver of adaptive expertise and strategic synthesis by embedding higher-order learning outcomes and integrative tasks into program design. Immersive experiential pedagogy provides the primary engine for strengthening relational dynamics and creative agility through collaborative, project-based, and challenge-driven learning experiences. Smart meta-skills assessment concentrates on making strategic synthesis and creative agility visible and actionable through authentic, feedback-rich assessment, while still contributing moderately to adaptive expertise and relational dynamics. Together, the bubble pattern confirms

that the framework addresses the empirically weakest domains—particularly strategic synthesis and, to a lesser extent, relational dynamics—not through a single intervention, but through a coordinated portfolio of modules.



Note: bubble size indicates the relative focus of each module (3=moderate, 4=strong, 5=very strong). Agile curriculum integration emphasizes adaptive expertise and strategic synthesis, immersive experiential pedagogy focuses on relational dynamics and creative agility, and smart meta-skills assessment targets strategic synthesis and creative agility while supporting the other domains at a moderate level.

Figure 3. Alignment of innovation modules with meta-skills domains

4. DISCUSSION

4.1. Bridging meta-skills gaps through strategic academic innovation

The quantitative results clearly delimit where current provision is weakest and therefore where academic management reform must focus. Descriptive statistics showed that, although students reported moderate levels of meta-skills overall, strategic synthesis ($M=3.27$, $SD=0.62$) and relational dynamics ($M=3.42$, $SD=0.60$) were consistently lower than adaptive expertise and creative agility. ANOVA results further indicated significant disciplinary variation, with strategic synthesis displaying the largest effect size ($\eta^2=0.041$), suggesting that some programs leave students particularly under-prepared for integrative, future-oriented thinking. In parallel, $PNI_{modified}$ analysis identified curriculum design as the highest priority need ($PNI_{modified}=0.38$), followed by assessment methods (0.34) and teaching and learning (0.29), signaling substantial perceived gaps between current and desired academic practices. Taken together, these findings point to structurally constrained opportunities for students to practice systems thinking, leadership, and collaborative problem solving. The “next-gen academic management” framework directly responds to this pattern: agile curriculum integration is designed to address the largest $PNI_{modified}$ gap by embedding meta-skills outcomes especially strategic synthesis into program structures and learning sequences, while immersive experiential pedagogy and smart meta-skills assessment tackle documented weaknesses in interactional learning and evaluative practices that support relational dynamics and higher-order synthesis.

A brief comparative reading further clarifies the contribution of this study. While public universities may have stronger resource bases and more stable governance structures, private HEIs often face tighter budget constraints, higher staff turnover risk, and faster market responsiveness conditions that can amplify fragmentation when reforms are implemented as isolated projects rather than as coordinated academic-management redesign. Internationally, meta-skills initiatives are frequently advanced through program-level learning outcomes, challenge-based learning, and authentic assessment; the present study contributes by translating these broad approaches into a context-sensitive academic-management operating model for Chinese private HEIs, anchored in quantified priorities ($PNI_{modified}$) and an explicit design thinking pathway from diagnosis to modules.

4.2. Iterative framework development and expert validation

The iterative refinement of the framework through design thinking and expert consultation further underscores the importance of participatory innovation in higher education management. Two cycles of expert review yielded measurable gains in perceived feasibility and sustained high ratings for relevance, indicating that the framework evolved toward greater implementability without losing its strategic focus. Qualitative feedback from interviews and focus groups highlighted the value of clear implementation guidance, modular structure, and alignment with existing quality assurance processes. Conceptually, this supports the view that academic transformation is most effective when treated as a co-created process that integrates empirical evidence, local constraints, and practitioner insight, rather than as a top-down, one-off reform. The framework's modular design allows institutions to phase in components, adapt them to disciplinary contexts, and pilot test innovations before scaling, thereby increasing both transferability and sustainability.

4.3. Dissemination, utility, and limitations

To maximize practical impact, the finalized innovation framework has been disseminated as a publicly accessible, infographic-based booklet hosted on Zenodo [46]. Presenting the framework in a visual, practitioner-oriented format lowers the barrier to adoption for academic leaders, curriculum committees, and quality assurance units, and supports adaptation and iterative refinement across institutional settings. As an openly available working report, it provides a citable, implementation-ready resource that connects the empirical work reported in this article with real-world change efforts.

By coupling rigorous mixed-methods development, expert validation, and open dissemination, this project aligns with global calls for evidence-based, scalable innovations in higher education management. It also extends the recent studies on AI literacy as a meta-skill and institutional design thinking for curriculum, pedagogy, and assessment redesign, thereby positioning the present framework within a broader research agenda on meta-skills-based academic management innovation [47], [48]. The framework offers a concrete starting point for institutions seeking to redesign their academic management systems around meta-skills, while also providing a platform for future comparative studies, longitudinal evaluations of implementation outcomes, and context-specific adaptations in other provinces or countries.

Several limitations should be noted. First, the empirical work is situated in Sichuan private HEIs, and institutional conditions (governance arrangements, resourcing, and quality assurance practices) may differ in public universities or in other provinces, which may affect transferability. Second, student meta-skills were measured through self-report, which may be influenced by social desirability or students' self-awareness of higher-order competencies. Third, while the framework was developed through iterative mixed-methods integration and expert validation, the present study does not yet report longitudinal implementation outcomes; future work should evaluate impact over time using multi-source evidence (e.g., performance tasks, portfolios, supervisor ratings, and graduate outcomes).

5. CONCLUSION

This study developed, empirically validated, and openly disseminated a strategic academic management innovation designed to embed meta-skills into the core structures of Chinese private higher education institutions. Using a multi-phase mixed-methods design aligned with design thinking, the research integrated student meta-skills profiling, institutional priority needs analysis, and iterative expert validation. The findings highlighted pronounced weaknesses in strategic synthesis and relational dynamics, alongside sizeable institutional gaps in curriculum design, assessment, and teaching-learning practices, particularly in private HEIs. In response, the proposed framework centred on agile curriculum integration, immersive experiential pedagogy, and smart meta-skills assessment strategies translates abstract policy commitments to "future-ready graduates" into concrete academic management mechanisms. Iterative expert review improved the perceived feasibility and clarity of the framework, while consistently high ratings for relevance and innovation confirmed its strategic fit with sector needs. The final version, disseminated as an open-access, infographic-based resource, offers both a validated model and a practical toolkit for institutional actors. Beyond the specific context of Sichuan private HEIs, the study contributes a replicable methodological pathway for higher education innovation that combines meta-skills theory, design-based academic development, and implementation-oriented evaluation. It demonstrates how system-level academic management can be re-engineered around meta-skills outcomes through participatory, data-informed design.

The results translate into several actionable steps for institutional stakeholders. For institutional leaders, begin with curriculum redesign as the foundational lever: revise program learning outcomes to explicitly specify the four meta-skills domains, with particular emphasis on strategic synthesis and relational dynamics; embed integrative tasks (e.g., interdisciplinary projects, capstones, and problem-based briefs) into

the curriculum sequence so synthesis is practiced repeatedly rather than episodically (agile curriculum integration); align program review and quality assurance routines to evidence meta-skills progression (rubrics, exemplars, and program-level performance indicators). For educators, scale learning designs that systematically produce relational and integrative practice: implement sustained team-based and challenge-driven learning cycles with structured roles, peer feedback, and reflection protocols (immersive experiential pedagogy). For assessment and QA units, make meta-skills visible and improvable: adopt authentic assessment packages (criteria-based rubrics, portfolios, and iterative feedback loops) that capture both the process and quality of synthesis and collaboration (smart meta-skills assessment). For policymakers and regulators, support adoption by enabling piloting and scaling through targeted incentives, evaluation flexibility, and recognition mechanisms that reward institutions for demonstrable meta-skills outcomes rather than procedural compliance alone.

Future research should first conduct longitudinal evaluations to examine the sustained impact of the innovation on student meta-skills, graduate outcomes, and institutional culture, including whether changes in academic management routines become embedded over time. Second, cross-institutional implementation studies spanning public universities, vocational colleges, and institutions in other provinces or countries are needed to test the transferability and adaptability of the framework under different governance and resource conditions. Third, further work on digital integration should explore how learning analytics, AI-enabled assessment, and digital portfolio platforms can support real-time monitoring, feedback, and visualization of meta-skills progression at both student and institutional levels. In sum, these directions position the present project as a foundation for a new paradigm in academic management, one that is competency-driven, design-informed, and openly shareable, and that invites ongoing refinement through collaborative practice and evidence-based research.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Chi Che	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Sukanya Chaemchoy	✓	✓				✓				✓				
Pruet Siribanpitak	✓	✓				✓				✓				

C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : Writing - **O**riginal Draft

E : Writing - Review & **E**ding

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

Informed consent was obtained from all participants included in this study prior to their participation. Participation was voluntary, and submission of the questionnaire indicated consent to participate.

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).

DATA AVAILABILITY

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

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BIOGRAPHIES OF AUTHORS



Chi Che    holds a Ph.D. in Educational System Management Leadership from Chulalongkorn University, Thailand. He is currently a lecturer and the Head of Educational Leadership Department at the International College, Payap University, Chiang Mai, Thailand. His research focuses on academic management innovation and the development of meta-skills in higher education, with a particular emphasis on leadership practices and institutional transformation in private universities. His scholarly work contributes to advancing global competence and educational innovation in the higher education sector. He can be contacted at email: chi.che@foxmail.com or chi_c@payap.ac.th.



Sukanya Chaemchoy    is an associate professor of Educational Management at the Faculty of Education, Chulalongkorn University. She holds a Ph.D. in Educational Management and has over two decades of experience in higher education. Her areas of expertise include educational leadership, academic management, and curriculum development. Her research focuses on educational policy reform, leadership in academic institutions, and the implementation of innovative teaching strategies. At Chulalongkorn University, she has mentored numerous graduate students and led international research collaborations aimed at improving education systems in Thailand and beyond. She is an active member of several educational management associations and has received recognition for her contributions to academic leadership and curriculum innovation. She can be contacted at email: sukanya.chae@chula.ac.th.



Pruet Siribanpitak    is a distinguished professor in the field of education at the Faculty of Education, Chulalongkorn University, Thailand. He formerly served as Dean of the Faculty, where he played a key role in advancing both academic and administrative excellence. He is widely recognized for his expertise in educational policy and sustainable development and has received numerous awards for his contributions to academia and university leadership. His teaching and research areas include education for sustainable development, critical analysis in education, educational policy and strategic planning, and research in educational management for national development. In addition to his academic roles, he has served as a consultant to government agencies and educational institutions, contributing significantly to the development of education policy and strategic planning across Thailand. He can be contacted at email: pruet.s@chula.ac.th.