

Research Article

EMPATHY-TO-EXECUTION (E2E): AN EXECUTION-ORIENTED DESIGN THINKING MODEL FOR META-SKILLS-BASED ACADEMIC SYSTEM TRANSFORMATION

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Abstract

Academic systems often generate reform ideas but struggle to sustain execution at scale. This brief synthesis draws on multiphase-mixed-methods-research in private higher education institutions in Sichuan Province, China, combining a student meta-skills survey ($n = 400$) and an institutional stakeholder needs assessment ($n = 805$) with PNI_{modified} to rank gaps, alongside design-thinking-guided development and expert validation of an innovation framework. Student meta-skills were moderate-to-high overall, yet item-level patterns revealed weaker performance in uncertainty handling and continuous strategic recalibration; institutional diagnostics identified curriculum structuring and learning engagement as the highest priority needs (followed by instructional design), indicating that structural and experiential learning conditions are key constraints on meta-skills development. Building on these findings, this study proposes an Empathy-to-Execution (E2E) model that preserves design thinking while adding execution requirements—decision-grade prioritization, implementation artifacts, and scaling governance—implemented through three validated modules (Agile Meta-skills Integration, Immersive Experiential Pedagogy, Smart Meta-skills Assessment) to align curriculum, pedagogy, and evaluation for sustainable institutional transformation. Theoretically, E2E extends Design Thinking by specifying an institutional execution layer—decision-grade prioritization, artifact-based implementation, and governance-for-scaling—that translates prototypes into durable academic routines.

Keywords: Design Thinking, Empathy-to-Execution, Meta-Skills, Curriculum Structuring, Learning Engagement, Experiential Pedagogy, Competency-Based Assessment

Introduction

1. 21st-Century pressure on academic systems

Higher education must sustain disciplinary credibility. It must also operate as a fast-learning system that continually redesigns curriculum, pedagogy, and assessment under persistent social, technological, and labor-market disruption (Alvarado, 2025; Baker, 2021; Lake et al., 2024; Yu et al., 2024). Expectations are shifting toward producing adaptable, innovative, and collaborative graduates. As a result, institutions face rising pressure to modernize how learning is designed and governed (Fitriyah et al., 2025; Rogers-Draycott et al., 2024). Yet reforms often stall because they are treated as isolated projects. They are not managed as operating-system redesigns with routines for diagnosis, prioritization, resourcing, implementation, evaluation, and iterative improvement (Baker, 2021; Griffith & Lechuga-Jiménez, 2024). Consequently, innovation remains localized and fades when resources, champions, or policy attention declines (Baltador et al., 2024; Brandão et al., 2024; Rogers-Draycott et al., 2024). This execution fragility is amplified in competitive settings, including private and rapidly expanding systems with high employability pressure and stakeholder diversity (Che, 2024; Che et al., 2026). It reinforces the need for coherent academic management that coordinates curriculum, teaching, and evaluation as integrated levers (Griffith & Lechuga-Jiménez, 2024; Lake et al., 2024).

2. Meta-skills as the core outcome and the reform gap

The study argues that contemporary transformation should prioritize meta-skills—transferable capabilities for adaptation, collaboration, innovation, and synthesis—rather than content coverage alone (Spencer & Lucas, 2021; Guerra-Macías & Tobón, 2024; Prasittichok & Klaykaew, 2022). Reviews similarly frame transversal/future skills and graduate attributes as key indicators of readiness across systems (Che et al., 2026; Fitriyah et al., 2025; Guerra-Macías & Tobón, 2024). Accordingly, the study specifies four outcome domains—Adaptive Expertise, Relational Dynamics, Creative Agility, and Strategic Synthesis—aligned with validated constructs in design thinking and design-thinking mindset research and broader work on creativity and higher-order outcomes (Muneer et al., 2025; Vignoli et al., 2023; Che, 2026a). Because these are institution-level outcomes, they require alignment across program structures, teaching practices, and assessment systems rather than stand-alone initiatives (Auernhammer & Roth, 2021; Baker, 2021; Che, 2024, Che, 2026b). However, evidence shows persistent misalignment: curriculum sequencing, engagement design, and assessment practices often lag behind stated outcome aspirations (Guerra-Macías & Tobón, 2024; Muangkaew et al., 2025; Prasittichok & Klaykaew, 2022). Consistent with this, the study identifies curriculum structuring and learning engagement as top reform priorities, while assessment remains insufficiently sensitive to higher-order outcomes central to a meta-skills agenda (Che, 2024; Che et al., 2026). This reflects the broader dilemma that institutions can articulate desired graduate attributes but struggle to redesign academic systems so routine teaching, learning, and evaluation reliably produce them (Baker, 2021; Yu et al., 2024, Che, 2026c).

3. Design Thinking and Empathy-to-Execution as an execution-oriented extension

The study uses Design Thinking as a human-centered, iterative method linking empathy-based diagnosis to problem definition, ideation, prototyping, and testing (Alvarado, 2025; Auernhammer & Roth, 2021;

Sandars & Goh, 2020), with established value for curriculum innovation, experiential learning, and engagement in higher education (Crites & Rye, 2020; Doğantan, 2023; Liu & Li, 2023). Implemented as Empathize–Define–Ideate–Prototype–Test, the approach connects stakeholder insights to prioritized needs and institutional interventions (Che, 2024; Sinfield et al., 2023), while PNI_{modified} strengthens Define by ranking current–desired gaps to support decision-grade prioritization rather than reform fashion (Che et al., 2026; Prasittichok & Klaykaew, 2022), consistent with calls for disciplined, operational applications of design thinking in educational systems (Baker, 2021; Yu et al., 2024). However, prototypes often fail to institutionalize when testing is not translated into routines—decision rights, ownership, indicators, and feedback loops for scaling—making execution capacity a key determinant of sustainability (Baker, 2021; Griffith & Lechuga-Jiménez, 2024; Roth et al., 2020; Baltador et al., 2024; Brandão et al., 2024; Rogers-Draycott et al., 2024). This study addresses that gap by synthesizing the study into Empathy-to-Execution (E2E), which preserves the Design Thinking backbone while making execution explicit through artifacts, decision gates, and feedback loops for adoption and scale (Auernhammer & Roth, 2021; Baker, 2021; Che, 2024; Che et al., 2026). E2E is operationalized via three modules—AMIM, IEPM, and SMAM—aligned with practice-oriented guidance and empirical work on design thinking implementation and experiential learning in higher education (Brandão et al., 2024; Doğantan, 2023; Guaman-Quintanilla et al., 2025). Accordingly, this study distills the study’s priority gaps and presents E2E as an execution-oriented extension of Design Thinking for academic system transformation (Che, 2024; Che et al., 2026; Yu et al., 2024); Figure 1 summarizes the added institutional execution layer.

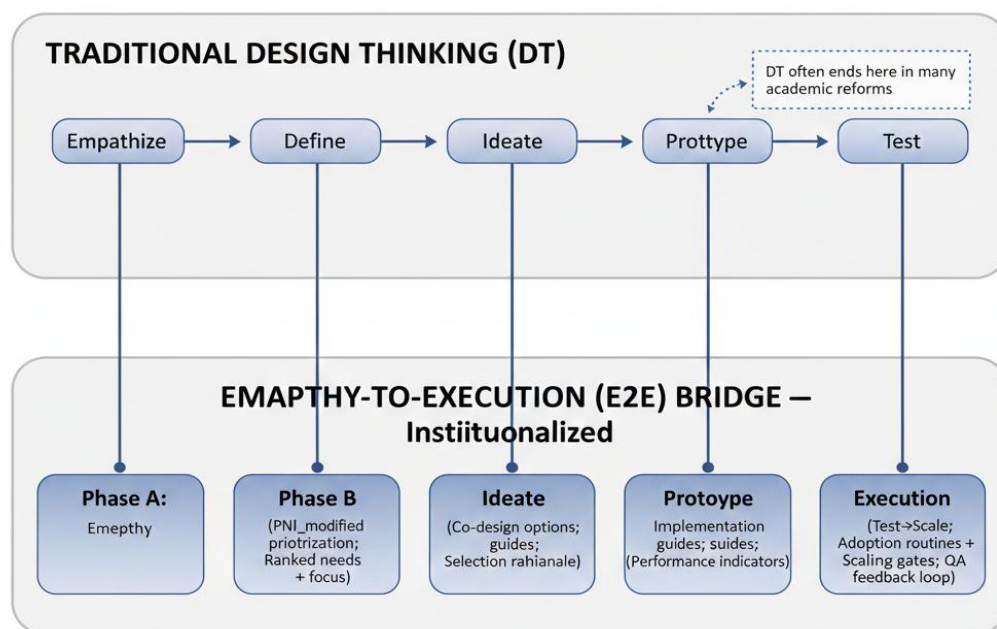


Figure 1 Bridging Traditional Design Thinking into the Empathy-to-Execution (E2E) Model

This figure shows that E2E preserves the study’s Design Thinking backbone (Empathize–Define–Ideate–Prototype–Test) while adding an explicit institutional execution layer. E2E strengthens two common failure

points in higher education reform: Define becomes decision-grade through needs prioritization (e.g., PNI_{modified}), and Prototype/Test becomes execution-capable by linking prototyping to implementation guides and performance indicators and testing to feasibility and suitability judgments. E2E then extends Test into Test→Scale, designing institutionalization through governance routines, adoption criteria, scaling triggers, and a quality-assurance feedback loop. The bridge is made visible through one-to-one DT-to-E2E mappings and their deliverables, clarifying how E2E prevents pilot decay and supports durable scaling.

Research Objectives (ROs). This study has four objectives:

RO1: To examine student meta-skills profiles across four domains—Adaptive Expertise, Relational Dynamics, Creative Agility, and Strategic Synthesis.

RO2: To diagnose and rank institutional academic-management priority needs using PNI_{modified} across curriculum development, teaching and learning, and evaluation.

RO3: To develop an execution-oriented extension of Design Thinking—Empathy-to-Execution (E2E), and translate it into three implementable intervention modules (AMIM, IEPM, SMAM).

RO4: To validate execution readiness through expert suitability–feasibility evaluation and supporting measurement-coherence reporting (see Appendix A for CFA model-fit indices).

To clarify the study logic and variable relationships, Figure 2 presents the conceptual framework of the study (E2E logic). In this framework, academic management components (curriculum development, teaching & learning, evaluation) constitute the institutional levers, while student meta-skills outcomes represent the intended learning results across four domains (Adaptive Expertise, Relational Dynamics, Creative Agility, Strategic Synthesis). The E2E logic is informed by Design Thinking principles, but the figure is intentionally presented as a research framework—showing how needs are diagnosed and prioritized, how interventions are selected, and how execution readiness conditions whether improvements can be institutionalized and sustained.

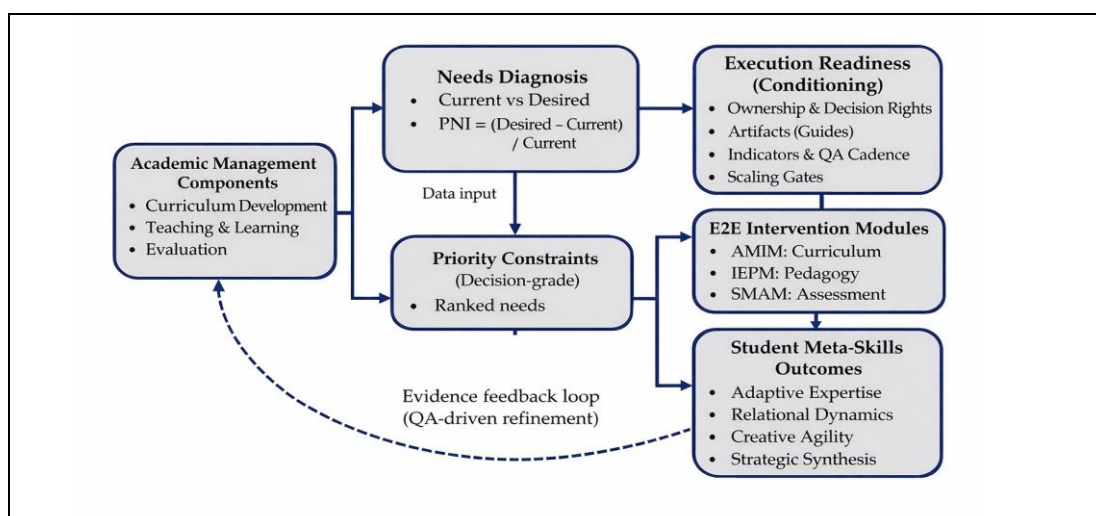


Figure 2 Conceptual framework of the study (E2E logic)

As shown in Figure 2, the study proceeds from needs diagnosis (current vs. desired states quantified through PNI_{modified}) to priority constraints that become decision-grade targets for reform. These prioritized constraints then inform the design of three E2E intervention modules—AMIM (curriculum), IEPM (pedagogy), and SMAM (assessment), which are expected to strengthen student meta-skills outcomes. Importantly, the framework highlights execution readiness (ownership/decision rights, artifacts, indicators, QA cadence, and scaling gates) as the conditioning mechanism that determines whether interventions move beyond pilot activity to durable institutional routines. The evidence feedback loop indicates that implementation is refined through QA-driven monitoring, which also provides the logic for the subsequent methodology and analysis reported in this study.

Research Methodology

1. Design and Setting

Drawing on the previous fundamental research, the study employed a multiphase mixed-methods design to develop and validate an academic management innovation for strengthening student meta-skills in private HEIs in Sichuan Province, China (with ten private HEIs referenced as the population frame for needs analysis). The inquiry progressed through four linked phases—framework development, student meta-skills profiling, PNI_{modified} -based institutional needs prioritization, and innovation development with validation—so that diagnostic evidence directly informed design decisions. Across phases, a five-stage Design Thinking backbone (Empathize–Define–Ideate–Prototype–Test) organized stakeholder understanding, priority setting, solution generation, prototype construction, and evidence-based refinement toward implementation readiness.

2. Research Procedure (Step-by-step)

Step 1 (Empathize): Semi-structured engagement with best-practice private HEIs and expert consultation generated implementable design propositions and execution constraints.

Step 2 (Define): (i) Student meta-skills survey ($n = 400$) produced the domain profile and item-level signals reported in Table 1; (ii) institutional current–desired needs assessment ($n = 805$) produced PNI_{modified} rankings reported in Table 2.

Step 3 (Ideate/Prototype): Priority constraints (Table 2) were translated into the E2E design logic and three-module architecture (AMIM–IEPM–SMAM), reported in Figures 3–4.

Step 4 (Test→Scale readiness): Expert suitability–feasibility evaluation generated module-level readiness evidence reported in Tables 4–5, supported by reliability and CFA reporting (Appendix A). This step also guided refinement for adoption-facing clarity (e.g., naming/positioning).

3. Participants and Data Sources

Two primary stakeholder groups provided quantitative evidence. Undergraduate students ($n = 400$) were recruited through stratified cluster sampling across disciplines to support representativeness and completed the meta-skills survey. Institutional stakeholders ($n = 805$) were recruited via purposive sampling to

capture system-level perspectives from academic and administrative roles (e.g., program directors, department heads, vice deans, and QA staff), comprising 375 academic staff and 430 administrative staff. In addition, qualitative inputs supporting innovation ideation and refinement were gathered through semi-structured engagement with best-practice private HEIs and expert consultations during the Design Thinking Ideate/Test stages to generate implementation-relevant guidance.

4. Instruments, Procedures, and Analysis

Four instruments linked learner outcomes, institutional constraints, and execution readiness:

(1) a Likert-type meta-skills questionnaire (Adaptive Expertise, Relational Dynamics, Creative Agility, Strategic Synthesis), quality-assured via IOC, Cronbach's α , and CFA (LISREL; RMSEA/CFI/GFI).

(2) a current–desired academic management needs instrument across Curriculum Development, Teaching & Learning, and Evaluation, prioritized using $PNI_{\text{modified}} = (\text{Desired} - \text{Current}) / \text{Current}$. PNI_{modified} was selected because it standardizes improvement gaps relative to baseline levels, enabling cross-subcomponent prioritization and execution sequencing rather than selecting reforms by preference or trend. PNI_{modified} was computed as $(\text{Desired} - \text{Current}) / \text{Current}$, where Current is the baseline mean rating and Desired is the target mean rating for each subcomponent.

(3) an expert suitability–feasibility rubric to evaluate the overall innovation and modules for iterative refinement.

(4) semi-structured interview/consultation guides with best-practice HEIs and experts, analyzed via content analysis to generate design propositions and implementation guidance. Data were collected via postal and Wenjuanxing modes under voluntary, confidential participation; analysis used descriptive statistics and proficiency-band interpretation for survey profiles, PNI_{modified} for ranked needs, and qualitative content synthesis to inform design and refinement.

5. Ethical Considerations

Ethical approval was obtained from a human research ethics review committee prior to data collection (COA No. 493/67). Participants provided informed consent, participation was voluntary, and responses were handled confidentially. Data were securely stored and analyzed in aggregate form only.

Results

To clarify alignment with the research objectives, this section reports findings in the current subsection order while mapping each result to a specific research objective and its corresponding evidence. RO1 (student meta-skills profile) is addressed through the descriptive domain and item-level results reported in Table 1. RO2 (priority needs in academic management) is addressed through the current–desired gap analysis using PNI_{modified} , reported in Table 2. RO3 (needs-to-meta-skills alignment and the E2E design response) is addressed through the mapping logic in Table 3 and the diagnosis-to-design translation visualized in Figures 3–4. RO4 (execution readiness and supporting measurement coherence) is addressed through expert suitability–feasibility evaluation

results in Tables 4–5 and CFA model-fit reporting in Appendix A. Together, these linked results connect learner outcomes, institutional constraints, and execution-capable intervention design.

1. Student Meta-Skills Profile

Table 1 summarizes students' self-reported meta-skills across four domains, showing mid-to-upper mean scores with Strategic Synthesis highest ($M = 3.76$, $SD = 0.72$), followed by Relational Dynamics ($M = 3.71$, $SD = 0.75$), Creative Agility ($M = 3.65$, $SD = 0.74$), and Adaptive Expertise ($M = 3.62$, $SD = 0.77$). Despite this broadly positive baseline, item-level results indicate uneven development: students scored strongly on concentration in complex tasks (focusing items > 4.0) but weaker on uncertainty management and anticipatory behaviors. The lowest signal within Strategic Synthesis—"regularly reassess strategies to stay ahead of potential trends" ($M = 2.92$, $SD = 1.041$)—suggests foresight is not yet a stabilized routine. These results indicate domain-level strength with item-level weaknesses in uncertainty handling and strategic recalibration.

Table 1 Student Meta-skills domain profile

Meta-skill domain	Mean (M)	SD	Interpreted pattern
Adaptive Expertise	3.62	0.77	Solid baseline; weakest signals around uncertainty/flexibility and proactive initiative
Relational Dynamics	3.71	0.75	Generally strong; variability suggests uneven leadership/integrity/emotional cue recognition
Creative Agility	3.65	0.74	Moderate-to-strong; requires strengthening of creativity-to-action pathways
Strategic Synthesis	3.76	0.72	Highest domain; trend/foresight behaviors remain weak (e.g., $M = 2.92$)

2. Priority Needs in Academic Management

Using PNI_{modified} to compare current versus desirable academic management practices, Table 2 identifies the largest institutional constraints on meta-skills development: Curriculum Structuring ($PNI_{\text{modified}} = 0.647$; Rank 1), Learning Engagement (0.590; Rank 2), and Instructional Design (0.532; Rank 3). These priorities indicate that the most urgent barriers are structural and systemic—how learning is sequenced, engineered, and sustained in practice—while evaluation gaps are smaller but still present (Outcome Analysis: 0.330; Rank 5; Comprehensive Assessment: 0.195; Rank 7). Overall, the results imply that reform should begin by strengthening curriculum and engagement “engines,” not isolated pedagogical initiatives.

Table 2 PNI_{modified} ranking of academic management components

Component area	Subcomponent	Current state M (SD)	Desirable state M (SD)	PNI _{modified}	Rank
Curriculum Development	Need Assessment	3.35 (0.88)	3.8075 (0.6825)	0.457	4
Curriculum Development	Curriculum Structuring	3.197 (0.85)	3.844 (0.665)	0.647	1
Curriculum Development	Instructional Design	3.367 (0.82)	3.90 (0.582)	0.532	3
Teaching & Learning	Pedagogical Strategies	3.775 (0.535)	4.092 (0.492)	0.317	6
Teaching & Learning	Learning Engagement	2.835 (0.945)	3.425 (0.8475)	0.590	2
Evaluation	Comprehensive Assessment	3.895 (0.475)	4.09 (0.442)	0.195	7
Evaluation	Outcome Analysis	3.8125 (0.5025)	4.142 (0.442)	0.330	5

3. Needs-to-Meta-Skills Alignment and the Resulting E2E Design Response

To operationalize Table 3, the dominant meta-skill alignment was derived using a transparent three-step rule. First, a theory-driven mapping was drafted from each academic management subcomponent's operational definition to the four meta-skill domains. Second, experts rated the strength of each subcomponent→meta-skill linkage, and linkage scores were normalized to enable within-row ranking. Third, the dominant domain (Rank 1) was assigned using the highest linkage score under expert consensus; ties were resolved via brief consensus discussion with documented rationale. Table 3 reports the dominant meta-skill domain and the corresponding evidence basis used for ranking.

Table 3 Dominant meta-skill alignment by academic management subcomponent

Academic management subcomponent (PNI _{modified})	Highest-linked meta-skill domain (Rank 1)	Expert linkage score (Rank)
Need Assessment (0.46)	Adaptive Expertise	0.67 (Rank 1)
Curriculum Structuring (0.65)	Adaptive Expertise	0.55 (Rank 1)
Instructional Design (0.53)	Adaptive Expertise	0.48 (Rank 1)
Pedagogical Strategies (0.32)	Relational Dynamics	0.67 (Rank 1)
Learning Engagement (0.59)	Relational Dynamics	0.58 (Rank 1)
Comprehensive Assessment (0.20)	Adaptive Expertise	0.32 (Rank 1)
Outcome Analysis (0.33)	Adaptive Expertise	0.37 (Rank 1)

These results also provide the logic for the study’s visual outputs. Figure 3 below illustrates the model response to the diagnostic evidence: the E2E pathway culminating in a three-module execution architecture addressing curriculum, pedagogy, and assessment reform.

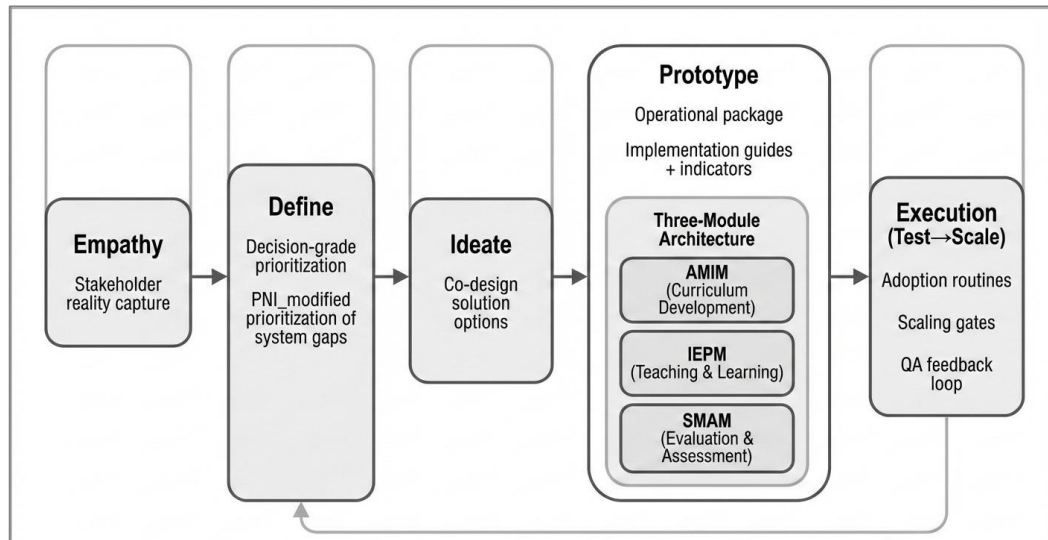


Figure 3 Empathy-to-Execution (E2E) model and three-module academic innovation architecture (AMIM–IEPM–SMAM)

Figure 3 depicts a five-phase academic transformation pathway—Empathy → Define → Ideate → Prototype → Execution (Test→Scale)—with Define driven by PNI_{modified} prioritization and Prototype delivering an implementable three-module package: AMIM (Curriculum), IEPM (Teaching & Learning), and SMAM (Assessment). Execution extends beyond pilots by adding adoption routines, scaling gates, and a QA feedback loop to support institutionalization.

Figure 4 then makes the diagnosis-to-design logic explicit by translating the top PNI_{modified} priorities (Curriculum Structuring, Learning Engagement) into module sequencing (AMIM and IEPM early), with SMAM anchoring measurement and feedback for sustained scaling.

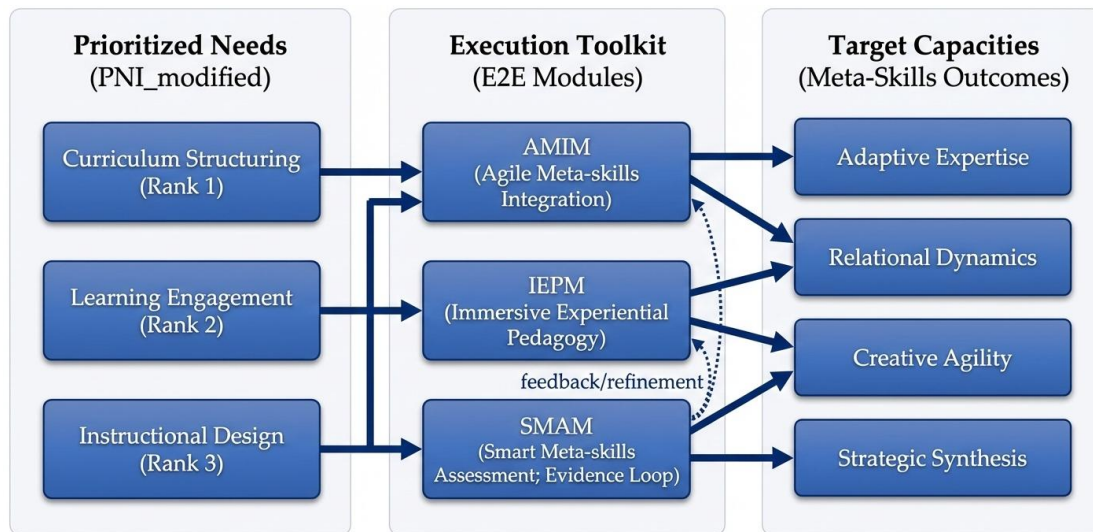


Figure 4 Execution pathway (PNI_{modified} priorities → modules → meta-skills outcomes)

This figure shows how top PNI_{modified} gaps (Curriculum Structuring, Learning Engagement, Instructional Design) map onto the E2E toolkit (AMIM, IEPM, SMAM) and then to meta-skills outcomes (Adaptive Expertise, Relational Dynamics, Creative Agility, Strategic Synthesis). Curriculum Structuring and Instructional Design primarily drive AMIM, Learning Engagement drives IEPM, and SMAM provides the assessment-and-evidence layer that supports Creative Agility and Strategic Synthesis while feeding refinement loops back to AMIM and IEPM for scaling readiness.

Figure 4 was constructed in three steps. (1) The top institutional constraints were selected from the PNI_{modified} ranking (Table 2). (2) Each selected constraint was linked to its dominant meta-skill domain using the explicit mapping rule reported in Table 3. (3) Constraints were translated into module sequencing by intervention locus: curriculum constraints were assigned to AMIM, engagement constraints to IEPM, and the evidence-and-feedback function to SMAM. The resulting pathway visualizes how prioritized constraints determine module order and how module outputs are expected to strengthen the four meta-skill domains through an execution-governed Test→Scale loop.

4. Execution Readiness: Expert Validation and Supporting Measurement Coherence

An expert panel ($n = 15$) evaluated the suitability and feasibility of the overall innovation and each module. Experts were purposively selected based on: (i) demonstrated expertise in higher education curriculum/pedagogy/assessment or academic management (≥ 5 years), (ii) leadership or quality assurance responsibility at program/college level, and (iii) familiarity with competency/meta-skills development and educational innovation. To support the model's executability claim, Table 4 reports expert readiness evidence: the overall innovation was rated high on suitability ($M = 4.26$, $SD = 0.63$) and feasibility ($M = 4.25$, $SD = 0.64$), with the weakest item being communication/positioning—the innovation name (feasibility: $M = 3.93$, $SD = 0.81$).

This indicates that execution risk may stem less from design quality than from adoption-facing clarity and institutional messaging that affect buy-in and diffusion.

Table 4 Expert evaluation of the overall innovation

Evaluation focus	Suitability M (SD)	Level	Feasibility M (SD)	Level
Total	4.26 (0.63)	High	4.25 (0.64)	High
Lowest noted item (communication/positioning)	4.19 (0.77)	High	3.93 (0.81)	Moderate

Table 5 shows consistently high second-draft expert ratings for all three execution modules: AMIM (suitability $M = 4.48$, $SD = 0.52$; feasibility $M = 4.47$, $SD = 0.54$), IEPM (4.47 , $SD = 0.56$; 4.47 , $SD = 0.53$), and SMAM (4.44 , $SD = 0.61$; 4.45 , $SD = 0.58$). This consistency supports E2E's claim that modular, artifact-driven packages with clear indicators are more likely to execute than broad reform slogans.

Table 5 Expert evaluation totals for E2E modules

E2E module	Suitability (M, SD)	Level	Feasibility (M, SD)	Level
Module 1 — AMIM	4.48 (0.52)	High	4.47 (0.54)	High
Module 2 — IEPM	4.47 (0.56)	High	4.47 (0.53)	High
Module 3 — SMAM	4.44 (0.61)	High	4.45 (0.58)	High

Supporting evidence indicates coherent measurement frameworks: meta-skills and academic management subcomponents showed strong positive correlations ($p < .01$), with expert importance ratings in the 3.60–3.88 range for meta-skills and mean values around 3.45–3.80 for academic management, alongside acceptable internal consistency for expert ratings (Cronbach's $\alpha = 0.76$). Collectively, these indicators strengthen the credibility of the diagnostic results and support the E2E model as grounded in coherent constructs rather than idiosyncratic item effects.

Discussion

This study's claims are grounded in the previous foundational research's integrated design linking student meta-skills profiling, PNI_{modified} needs prioritization, and Design Thinking-based innovation development with expert validation, thereby connecting learner outcomes (Table 1) to institutional constraints (Table 2) and to implementable responses endorsed by experts (Tables 4–5; Figures 2–3). Although meta-skills levels were moderate-to-high overall, item-level evidence revealed an execution-relevant weakness under ambiguity, most clearly in low strategic recalibration ($M = 2.92$). PNI_{modified} identified Curriculum Structuring (Rank 1; 0.647),

Learning Engagement (Rank 2; 0.590), and Instructional Design (Rank 3; 0.532) as the strongest system constraints (Table 2), indicating that meta-skills are shaped by how learning is sequenced, experienced, and engineered; lower-ranked evaluation gaps therefore signal sequencing, since assessment must sustain gains after curriculum and engagement redesign. Alignment results (Table 3) further justify integrated reform: curriculum levers align with Adaptive Expertise and pedagogy/engagement with Relational Dynamics, while assessment remains dominated by Adaptive Expertise, implying under-measurement of Creative Agility and Strategic Synthesis. E2E translates these findings into an execution sequence—AMIM, then IEPM, with SMAM institutionalizing evidence loops—supported by high feasibility and suitability ratings (Tables 4–5) and tempered by an adoption risk around naming/positioning that reinforces the need for shared language and durable artifacts. Limitations include contextual specificity (Sichuan private HEIs), reliance on perceptual current–desired ratings, and the need for longitudinal adoption evidence; future work should track meta-skills growth (especially strategy updating), test transferability, and conduct fidelity studies to identify which execution artifacts predict sustained scaling.

Theoretical Contributions

First, E2E extends Design Thinking by specifying an institutional execution layer—decision-grade prioritization, artifact-based implementation, and governance-for-scaling—that operationalizes how prototypes become durable academic routines. Second, the study links meta-skills outcomes to academic management levers through a prioritization mechanism (PNI_{modified}), translating aspirational graduate attributes into sequenced redesign targets. Third, E2E contributes an execution sequence (AMIM→IEPM→SMAM) that couples curriculum, pedagogy, and assessment as a system, explaining why pilot reforms decay and what minimum routines support scaling.

AMIM (Agile Meta-skills Integration—Curriculum): (1) specify meta-skills outcomes by year level; (2) redesign curriculum sequencing and integration points; (3) translate outcomes into weekly objectives and performance criteria; (4) produce artifacts (curriculum map, task bank, rubrics); (5) assign module owners and a review cadence.

IEPM (Immersive Experiential Pedagogy—Teaching & Learning): (1) design engagement routines (participation protocols, collaboration roles); (2) implement experiential cycles (challenge–attempt–feedback–revision); (3) embed reflection prompts for uncertainty handling and strategy updating; (4) produce teaching artifacts (lesson scripts, facilitation guides); (5) monitor engagement indicators (attendance, participation, peer feedback).

SMAM (Smart Meta-skills Assessment—Assessment): (1) align assessments to meta-skills domains; (2) adopt performance tasks with evidence rubrics; (3) set moderation and outcome-analysis routines; (4) implement feedback loops to AMIM/IEPM adjustments; (5) define scaling gates based on indicator thresholds.

To clarify the distinct contribution of E2E, it is necessary to position the model against closely related implementation logics that are commonly used in higher education reform. Prior frameworks—such as

traditional Design Thinking cycles and constructive alignment—offer strong guidance for innovation design and coherence, yet they often under-specify the institutional mechanisms that convert pilots into routinized, scalable practice (e.g., ownership, indicators, QA cadence, and scaling gates). Table 6 therefore provides a concise comparative mapping that highlights where E2E overlaps with existing frameworks and where it adds a differentiated execution layer that is central to this study’s contribution.

Table 6 Comparative positioning of E2E versus related implementation logics

Framework	Core focus	Typical output	Common failure point in HEI reform	What E2E adds
Traditional Design Thinking (Empathize–Test)	Human-centered innovation cycle	Prototype/pilot	Pilot decay: unclear ownership/indicators/scaling rules	Adds execution gates, artifacts, governance routines (Test→Scale)
Constructive Alignment	Alignment of outcomes–teaching–assessment	Course/program alignment map	Often remains local; limited institution-level scaling governance	Extends alignment into execution routines + QA feedback loops
Curriculum alignment models	Coherence across curriculum components	Sequencing/coverage plan	Engagement routines and evidence loops are weak	Couples sequencing with engagement engineering + SMAM measurement loops

As summarized in Table 6, E2E does not replace existing reform logics; rather, it operationalizes the “missing middle” between innovation design and durable institutional practice. Specifically, E2E retains the strengths of human-centered design and alignment thinking, but adds execution-critical specifications—artifact-based implementation packages, decision rights and ownership, indicator systems, QA-driven feedback cadence, and explicit scaling gates—that govern institutionalization beyond initial pilot success. This positioning supports the interpretation that the model’s novelty lies less in generating reform ideas and more in making reform executable and scalable within academic management systems. Building on this comparison, the following subsection outlines practical implications for HEIs and research directions for testing transferability and longitudinal impact.

To illustrate how E2E can be operationalized in practice, the following scenario is presented as an implementation example (not as an evaluated outcome). A private HEI program used E2E to address weak learning engagement and fragmented curriculum sequencing. Using PNI_{modified} , the program prioritized Curriculum Structuring and Learning Engagement. AMIM redesigned prerequisites and introduced an integrated

“strategy-under-uncertainty” task sequence across Year 1–2 modules. IEPM implemented weekly collaboration roles and a challenge–feedback–revision routine tied to authentic briefs. SMAM introduced a performance rubric for strategy updating and a monthly outcome-analysis meeting that triggered minor curriculum adjustments. After one cycle, staff reported clearer ownership, stable routines, and evidence artifacts that supported scaling to a second department. For practical implementation, the minimum conditions required before scaling are summarized in Appendix B (Table B1).

Limitations

Limitations and boundary conditions should be noted. Findings are context-specific to Sichuan private HEIs and rely partly on perceptual current–desired ratings. E2E may be less applicable where institutions lack autonomy to redesign curriculum/assessment, where QA infrastructure is absent, or where resource constraints prevent artifact-based implementation and monitoring. Transferability should therefore be tested across public/private types, disciplines, and governance conditions using longitudinal adoption and fidelity evidence.

Implications

Implications for practice and research follow directly from the E2E logic advanced in this study. For practice, the findings support treating academic reform as an execution-governed operating system—sequencing curriculum (AMIM), engagement routines (IEPM), and assessment evidence loops (SMAM) with clear ownership, artifacts, indicators, and scaling gates. For research, the framework provides testable propositions for longitudinal adoption and fidelity studies, including whether execution readiness predicts sustained scaling and whether performance-based measures can better capture Creative Agility and Strategic Synthesis across diverse institutional governance contexts.

Conclusions

This study contributes an execution-oriented extension of Design Thinking—Empathy-to-Execution (E2E), which translates stakeholder needs into decision-grade priorities, artifact-based implementation, and governance-for-scaling across curriculum, pedagogy, and assessment. Empirically, students reported moderate-to-high meta-skills overall, but item-level patterns revealed weaknesses in uncertainty handling and continuous strategic recalibration (Table 1). At the institutional level, PNI_{modified} ranked Curriculum Structuring, Learning Engagement, and Instructional Design as the highest-priority constraints shaping meta-skills development (Table 2), indicating that structural sequencing and experiential conditions are primary leverage points. E2E operationalizes this evidence into an execution sequence—AMIM $\rightarrow$ IEPM $\rightarrow$ SMAM—so that curriculum and engagement reforms are stabilized and sustained through assessment-and-feedback loops (Figures 3–4; Tables 4–5), supported by measurement-coherence evidence reported in Appendix A. For implementation, minimum pre-scaling conditions are summarized in Appendix B (Table B1). Future work should test longitudinal adoption

and fidelity, incorporate behavioral learning traces, and examine transferability across institutional types and governance conditions.

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