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Innovation-Based Coaching: A Framework for Education in the AI Age

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Abstract

This article introduces Innovation-Based Coaching (IBC) as a strategic framework to bridge the growing divide between AI-driven work and education's predominantly content-focused nature. Drawing on insights from AI in education, coaching, innovation management, and employability studies, IBC uses a 3C mindset to cultivate an innovative mindset, a 3D skillset to build innovative skills, and a 3M toolset to manage innovative processes and outputs. The 3C mindset emphasizes being Curious, Critical, and Creative; the 3D skillset involves Detecting, Dissecting, and Discovering; and the 3M toolset incorporates Mapping, Measuring, and Monitoring. This approach positions AI as a collaborative partner that supports feedback, simulation, and experimentation while preserving human-centric skills such as ethical judgment, trust, and critical reflection. It also addresses major challenges in implementing IBC and offers solutions and recommendations. The conclusion focuses on the implications for policymakers, institutional leaders, program leaders, educators, and researchers.

Keywords: AI; coaching; education; innovation

1. Introduction

AI has driven a fundamental shift in how work is done across sectors. AI now matches or surpasses human performance in content creation, routine analysis, and problem-solving. Projections suggest that up to 60% of jobs in developed economies could be affected by AI, with about half experiencing higher productivity and the rest facing reduced demand, wage pressures, or job displacement (International Monetary Fund, 2024). The World Economic Forum (2023) forecasts a net reduction of 14 million jobs by 2027, despite the creation of 69 million new roles and the loss of 83 million, driven by automation, digitalization, and environmental efforts. According to McKinsey (Chui et al., 2023), 60–70% of current tasks could eventually be automated, potentially automating half of today's work around 2045.

In this context, employers increasingly value capabilities that are not easily codified or automated: creative problem-solving, ethical judgment, collaboration, systems thinking, and adaptability (World Economic Forum, 2023). However, many educational institutions remain wedded to industrial-age teaching models that emphasize content delivery, summative assessment, and individual performance on well-structured tasks. A parallel risk is that other institutions overcorrect by embracing AI tools primarily as productivity enhancers, using them to generate content or automate assessment without adequately safeguarding deeper learning, critical reflection, and student agency.

This dual risk—content-driven inertia on one side and uncritical AI adoption on the other—widens the gap between graduates' capabilities and the demands of AI-transformed

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labor markets. As systems such as ChatGPT approach human-level performance in essays, code, and routine analysis (Brynjolfsson, 2022), a pivotal question for education emerges:

What remains for education to provide in an AI-augmented world where AI systems are more intelligent and faster than humans across most areas?

Addressing this question requires moving beyond incremental curriculum adjustments or isolated technology pilots. It calls for a paradigm shift from didactic knowledge transfer to coaching-based approaches that cultivate innovative, resilient thinkers who can collaborate effectively with intelligent machines.

To answer that call, this conceptual article proposes Innovation-Based Coaching (IBC) as a coherent, theory-driven framework for this shift. Drawing on a narrative review of recent scholarship at the intersection of AI, coaching, innovation, and employability, the article argues that adopting Innovation-Based Coaching can elevate human curiosity, criticality, creativity, judgment, and human–AI co-intelligence and co-innovation, which constitute the fundamental and unique human values in an AI-augmented world. In practice, IBC applies the 3C mindset (Curious, Critical, Creative), the 3D skillset (Detect, Dissect, Discover), and the 3M toolset (Map, Measure, Monitor) within a 4I-phased (Ignite, Investigate, Illuminate, and Innovate) and CICI-oriented (Co-Intelligence and Co-Innovation) educational context. Before elaborating on how IBC can be applied in education in Sections 4–8, Sections 2 and 3 explain why innovation should be the ultimate learning outcome and why IBC can keep education relevant and valuable in an AI-augmented world.

2. Innovation as a Learning Outcome in Education in the AI Age

As AI fundamentally transforms education, learning outcomes should prioritize innovation over mere knowledge. As earlier studies show, innovation is an educational objective and a learnable practice. Entrepreneurship education can support its development. However, the lack of operationalization, assessment, and longitudinal evidence has seriously hindered its successful implementation in education.

2.1. Theoretical Foundations: Innovation as Learnable Practice

Innovation as an educational objective is rooted in broader traditions of creativity, entrepreneurship, and organizational learning. Early economic theorists argued that innovation is not random but a systematic, purposeful activity.

Drucker (1985) extended this line of thought, arguing that innovation is a discipline—a practice that can be taught and managed. He identified recurring sources of innovation (e.g., unexpected successes or failures, process needs, shifts in industry structure). He argued that innovators who systematically scan for and interpret these signals can learn to innovate more effectively. In education, Drucker's framing supports integrating innovation into curricula as a teachable, structured competency.

The organizational learning literature reinforced these ideas at the collective level. Senge (1990), in The Fifth Discipline, introduced the concept of the learning organization, defined as one capable of sustained innovation through systems thinking, shared vision, mental model revision, personal mastery, and team learning. He argued that organizations can cultivate these disciplines. Nonaka and Takeuchi (1995) further advanced a theory of the knowledge-creating company, emphasizing that innovation emerges from processes that convert tacit knowledge into explicit knowledge and recombine both in novel ways.

Together, these traditions converge on a core proposition: innovation is a learnable, socially situated capacity, driven by systematic opportunity recognition, knowledge creation, and reflective practice. This proposition underpins efforts to make innovation an explicit learning outcome in education.

2.2. Entrepreneurship Education and Innovation Competence

Entrepreneurship education has been a leading arena for operationalizing innovation as a learning outcome. Broadly construed, entrepreneurship involves identifying opportunities, mobilizing resources, and creating value under uncertainty, closely aligning with the competence of innovation.

Gibb (1993) argued that entrepreneurship education should extend beyond technical business skills to cultivate an entrepreneurial mindset that encompasses creativity, initiative, risk-taking, resilience, and problem-solving—capacities closely intertwined with innovation. Harkema (2003), drawing on Kolb's (1984) experiential learning theory and the work of Nonaka and Takeuchi (1995) and Senge (1990), proposed a constructivist model of entrepreneurial learning. In this model, innovation emerges through iterative cycles of experience, reflection, conceptualization, and experimentation, often in team-based, real-world contexts.

Recent frameworks further refine the concept of innovation competence as multidimensional, encompassing creativity, critical and systems thinking, collaboration, initiative, networking, and implementation skills (Marín-García et al., 2016; Marín-García, 2018). For example, studies of learning environments in universities of applied sciences identify behavioral indicators such as proposing multiple original solutions to ill-structured problems, critically evaluating evidence, coordinating teamwork, and engaging external stakeholders (Butter & van Beest, 2019).

2.3. Persistent Gaps: Operationalization, Assessment, and Longitudinal Evidence

Despite strong theoretical and conceptual foundations, a significant gap remains in translating abstract innovation models into empirically grounded, student-level educational designs. Three limitations are especially salient.

A. Limited operationalization of innovation outcomes. Many frameworks describe innovation competence in broad terms but stop short of specifying observable behaviors and performance standards that can be reliably assessed. Behaviorally anchored scales and competence profiles are emerging (Butter & van Beest, 2019; Marín-García et al., 2016), yet these tools remain underused and have been validated unevenly across disciplines.

B. Short-term and cross-sectional studies. Much of the empirical literature evaluates one-off courses, pilots, or cross-sectional snapshots of self-reported innovation skills, limiting the ability to draw robust conclusions about causal relationships between pedagogical approaches and the development of innovation competence over time (Marín-García et al., 2016). Longitudinal, mixed-methods studies that track competence growth across programs are scarce.

C. Weak integration of AI and coaching. While there is a rapidly growing body of work on AI in education—covering adaptive learning, personalized feedback, and AI literacy (Chen et al., 2020; Ng et al., 2024; Xu et al., 2025)—and a parallel body of research on coaching in education (Burtson et al., 2025; Villa et al., 2024), these literatures remain only weakly integrated, and innovation competence is neither an explicit nor an assessed outcome.

Addressing these gaps requires frameworks that link organizational and theoretical models of innovation (Nonaka & Takeuchi, 1995; Senge, 1990) to clear course- and program-level outcomes, behaviorally defined assessment tools, and longitudinal evaluation designs (Schaap et al., 2025). IBC is proposed as such a framework, explicitly connecting innovation theory, coaching practice, and AI-empowered learning.

3. Conceptualizing and Operationalizing Innovation in Education in the AI Age

Innovation in education in the AI age is not just about adopting new techniques. It is about systematically developing participants' thinking, capabilities, and the work they produce. This section conceptualizes and operationalizes innovation in education in the AI age to support Innovation-Based Coaching.

3.1. Conceptualizing Innovation

IBC conceptualizes innovation as comprising three interrelated dimensions: mindset, skillset, and toolset.

A. Innovation mindset (how learners think): IBC is grounded in curiosity, exploration, and continuous growth. Learners question assumptions, seek better ways to do things, and tolerate ambiguity. They take informed risks, treat setbacks as feedback, and maintain a forward-looking, opportunity-focused outlook. Rather than accepting the status quo, they identify unmet needs and imagine what could be.

B. Innovation skillset (how learners do): Learners learn to (1) frame and reframe complex, ambiguous problems to make them clear and actionable, (2) experiment and iterate through rapid prototyping, testing assumptions, and refining ideas based on feedback, (3) apply design thinking, using empathy, ideation, and user-centered design to create feasible and desirable solutions, and (4) recognize opportunities by scanning the environment for patterns, gaps, and signals of change, then turning them into innovation projects or ventures.

C. Innovation toolset (how learners manage their innovation processes and outputs): Learners produce tangible, testable results, such as startups, prototypes, digital tools, and redesigned services. They also develop social innovations—community initiatives, policy proposals, and inclusion projects—and implement new processes and practices across teams and institutions. These outputs demonstrate their ability to translate ideas into action and improve systems in meaningful, measurable ways.

Conceptually, these three dimensions intersect with the coaching process—goal setting, exploration, experimentation, reflection, and consolidation. IBC operates at these intersections: each coaching phase is deliberately used to strengthen innovation mindsets, build innovation skillsets, and leverage innovation toolsets to manage innovation processes and tangible outputs.

3.2. Operationalizing Innovation

The three dimensions of innovation can be operationalized using validated scales—the Creative Self-Efficacy Scale (Tierney & Farmer, 2002), the Torrance Tests of Creative Thinking (Torrance, 2008), the expert-rating paradigm for creative output used by Grant and Berry (2011), and the FINCODA innovation-competence framework (Marín-García et al., 2016)—supplemented by additional validated instruments that address specific construct gaps (curiosity, innovative work behavior, and innovation capacities) (see Table 1).

Table 1. Operationalization Matrix: Innovation Constructs, Indicators, and Instruments.

Constructs	Indicators	Instruments	Instrument Type & Scoring
Mindset—Curious	Generates original questions beyond assigned material; actively seeks novel, unfamiliar, or anomalous phenomena; embraces uncertainty in exploration	Curiosity and Exploration Inventory-II (Kashdan et al., 2009)	10-item self-report; two factors (Stretching, Embracing); 7-point Likert

Table 1. *Cont.*

Constructs	Indicators	Instruments	Instrument Type & Scoring
Mindset—Creative	Expresses confidence in producing creative outcomes; volunteers for ambiguous, open-ended creative tasks; persists after setbacks	Creative Self-Efficacy Scale (Tierney & Farmer, 2002)	Brief self-report scales validated in secondary students and working adults, respectively
Mindset—Critical	Requests evidence before accepting claims; identifies bias and blind spots in sources and in AI outputs; compares competing explanations unprompted	FINCODA critical-thinking behavioral indicators (Marín-García et al., 2016; Marín-García, 2018)	Behaviorally anchored self-assessment, coach-verified against submitted work
Mindset—Innovation capacity	Reports motivation and perceived capacity to innovate; intends to pursue innovation in future work	Innovation Capacities Scale (Selznick & Mayhew, 2018)	Validated undergraduate self-report scale (13 items)
Skillset—Creative production (Discover)	Produces ideas that are fluent (many), flexible (varied categories), original (statistically infrequent), and elaborated (detailed)	Torrance Tests of Creative Thinking, Figural & Verbal (Torrance, 2008)	Standardized performance test; normed scoring manuals
Skillset—Opportunity recognition & initiative (Detect)	Scans environments for patterns and gaps; converts signals into actionable problem framings; takes initiative without prompting	FINCODA creativity and initiative behavioral indicators (Marín-García et al., 2016); Innovation Capacities Scale subscales (Selznick & Mayhew, 2018)	Behavioral indicators scored via self-assessment + coach rating
Skillset—Analysis & teamwork (Dissect)	Decomposes cases into causal components; coordinates team analysis; engages external stakeholders	FINCODA critical-thinking, teamwork, and networking indicators (Marín-García et al., 2016), as validated for HE use by Keinänen et al. (2018)	Behavioral-indicator assessment in authentic learning environments
Skillset—Enactment (Discover → Innovate)	Generates, promotes, and realizes ideas in the team context	Individual Innovative Work Behavior scale (Janssen, 2000)	9-item behavior scale across three dimensions: idea generation, idea promotion, idea realization
Toolset for Processes and outputs—Artifact production (Mapping)	Number and type of tangible artifacts per cycle (prototypes, models, tools, dashboards, process redesigns) compiled in the Innovation Portfolio	IBC Innovation Portfolio audit, criterion-referenced	Portfolio assessment against explicit rubric
Toolset for processes and outputs—Quality of artifacts (Measuring)	Independent raters judge artifacts as novel (original relative to comparison set) and useful (appropriate, valuable to users)	Consensual expert-rating paradigm for creativity (Grant & Berry, 2011)	Independent expert/peer ratings of novelty and usefulness; inter-rater reliability reported
Toolset for processes and outputs—Implementation reach (Monitoring)	Artifact piloted, adopted, or deployed beyond the classroom; stakeholder uptake documented	Janssen (2000) idea-realization dimension + portfolio evidence	Behavioral checklist verified by coach and partners
Toolset for processes and outputs—Growth trajectory (Monitoring)	Improvement in artifact quantity/quality across successive 4I cycles; shift in individual competence profile	Repeated-measures 3M protocol; competence-profile modelling (Ojo & Volkova, 2023)	Longitudinal tracking; latent-profile or growth analysis

4. From Earlier Frameworks to Innovation-Based Coaching

Innovation-Based Coaching builds on earlier frameworks and addresses their limitations.

4.1. Antecedent Frameworks: Contributions, Limitations, Connections

Previous frameworks for innovation-based coaching include P21/4Cs, EntreComp, and CDIO. P21/4Cs gave education a durable vocabulary of transversal skills (Partnership for 21st Century Skills, 2009). Its "learning and innovation skills" strand is a direct ancestor of IBC's 3C mindset. However, the framework is taxonomic—attributes without a developmental mechanism—and treats technology as literacy, not a collaborator. EntreComp showed that innovation-relevant capacity is decomposable and assessable (Bacigalupo et al., 2016), the strongest precedent for IBC's mindset–skillset–output triad. However, it is a competence map without a pedagogy, predates generative AI, and lacked empirical validation at release (Bernadó & Bratzke, 2024). CDIO proved that a capability agenda can scale to entire degree programs (Crawley et al., 2014). However, it is engineering-bound, artifact-centric, leaves innovation implied rather than assessed and is silent on coaching and AI partnership.

Zawacki-Richter et al. (2019) mapped AI in higher education and found educators largely absent—"where are the educators?" Gaps in pedagogy and ethics persisted through the generative-AI turn (Bond et al., 2024). Adjacent streams supply the rest: innovation pedagogy targets innovation competence without formalizing coaching or AI partnership (Kettunen et al., 2013); coaching research contributes process technology (Whitmore, 1992/2017) yet focuses on performance, not innovation (Villa et al., 2024)—AI chatbots match human coaches on goal attainment but not on resilience (Terblanche et al., 2022); and human–AI collaboration theory targets learning regulation, not innovation (Hwang et al., 2020; Järvelä et al., 2023).

The tradition diagnoses but offers no model; IBC provides an operational answer: it treats innovation as the outcome of a developmental process featuring the 3C–3D–3M–4I cycle and positions educators as innovation coaches, with AI integration serving as a tutor, tool, and teammate (see Table 2).

Table 2. Comparative Positioning of Frameworks Related to IBC.

Framework	Innovation Outcome?	Developmental Process?	AI Integration
P21/4Cs (Partnership for 21st Century Skills, 2009)	Partial	No—attribute taxonomy	As literacy
EntreComp (Bacigalupo et al., 2016)	Yes—value creation	No—competence taxonomy	None
CDIO (Crawley et al., 2014)	Implicit—via artefacts	Partial—program standards	None
AIEd reviews (Zawacki-Richter et al., 2019; Bond et al., 2024)	No	No—diagnostic	Object of study
Innovation pedagogy (Kettunen et al., 2013)	Yes—innovation competences	Partial—no formal coaching	None
Coaching research (Whitmore, 1992/2017; Villa et al., 2024)	No—performance	Yes—GROW and cognates	Goal-attainment trials (Terblanche et al., 2022)
Human–AI collaboration (Hwang et al., 2020; Järvelä et al., 2023)	No	Partial—shared regulation	Core construct
IBC	Yes—primary, assessed	Yes—3C–3D–3M, 4I cycle	Tutor/tool/teammate

4.2. Previous Frameworks' Limitations and IBC's Responses

Across these frameworks, four continuities with IBC stand out. First, content continuity: IBC's innovation constructs (3C—curiosity, criticality, creativity; 3D—detect, dis-

sect, discover; 3M—map, measure, monitor) draw on P21/4Cs, EntreComp, and the FINCODA/innovation-pedagogy lineage. Second, process continuity: the 4I (Ignite, Investigate, Illuminate, Innovate) cycle is a disciplined recombination of GROW-style goal-to-action coaching (Whitmore, 1992/2017), experiential learning cycles inherited through innovation pedagogy (Kettunen et al., 2013), and regulation-of-learning dynamics (Järvelä et al., 2023). Third, structural continuity: IBC's program-level ambitions, workload/incentive recommendations, and portfolio assessment echo CDIO's lesson that capability agendas fail without institutional realignment (Crawley et al., 2014). Fourth, normative continuity: IBC operationalizes the AIEd review tradition's calls for educator involvement and ethical engagement (Zawacki-Richter et al., 2019; Bond et al., 2024; Holmes et al., 2022) by making the interrogation of AI outputs a coached learning task rather than a policy exhortation (see Table 3).

Table 3. Recurring Limitations of Antecedent Frameworks and IBC's Responses.

Recurring Limitations in Antecedents	Frameworks Affected	IBC's Responses
Attribute/taxonomy lists without a developmental mechanism	P21/4Cs; EntreComp	Coaching process (3C–3D–3M, 4I cycle) as the mechanism
Innovation implied, not named and assessed	CDIO; coaching research; AIEd	Innovation as the explicit, assessed primary outcome; portfolio of innovation artifacts
AI absent or treated as tool/literacy only	EntreComp; CDIO; P21; innovation pedagogy	AI as tutor/tool/teammate partner, with coached critical interrogation
Ethics as exhortation rather than practice	AIEd reviews; Holmes et al. (2022)	Bias/quality interrogation embedded in the 3C "Critical" and sample coaching prompts
Program-level incoherence; course-level pilots	Innovation pedagogy; coaching studies	Institutional recommendations (workload, incentives, phased roadmap) echoing CDIO's standards logic
Cross-sectional, short-term evidence	Innovation-competence research	3M (Map–Measure–Monitor) built-in continuous evaluation; research agenda for longitudinal study
Scalability of relational pedagogy	Villa et al. (2024); CDIO implementation studies	Peer coaching, AI-supported formative feedback, communities of practice

4.3. How IBC Differs from Standard Coaching and Innovative Teaching

Traditional coaching in education focuses on personal, academic, or career development. While it may incidentally foster innovation, it rarely treats innovation as the explicit outcome. Likewise, "innovative teaching" often prioritizes new techniques—such as flipped classrooms, digital tools, and gamification—without intentionally cultivating learners' capacity for innovation.

Reversing this logic, IBC (1) makes innovation the primary objective rather than a byproduct, (2) unifies existing coaching models under a single framework, ensuring that methods such as GROW and peer coaching explicitly support an innovation mindset, skills, and outputs, (3) names innovation skills—problem framing, experimentation, and opportunity recognition—as core learning goals, clarifying what progress looks like and how to assess it, and (4) anchors coaching in concrete outputs (e.g., prototypes, social ventures, process redesigns), so learners practice turning ideas into implementation rather than discussing innovation in the abstract.

Consequently, IBC links coaching conversations to tangible, innovation-focused accomplishments that matter to learners, institutions, and employers.

5. Elaborating on Innovation-Based Coaching

To illustrate how Innovation-Based Coaching can be implemented in course design, the author uses Brand Globalization, a course in which he implemented IBC, as an example.

5.1. The 3C (Curious, Critical, Creative) as Innovation Mindset

The 3C innovation mindset determines how learners think. The author defines the innovation mindset as grounded in curiosity, exploration, and continuous growth: questioning assumptions, tolerating ambiguity, taking informed risks, treating setbacks as feedback, and maintaining an opportunity-focused outlook.

5.1.1. Curious

Curiosity is the engine of learning. It begins with asking "why," "what if," and "how" about brands, markets, cultures, and consumer behavior. It drives us to explore unfamiliar markets, emerging trends, and unexpected brand phenomena rather than staying within the obvious or familiar.

Today, AI can significantly amplify this curiosity by expanding the search space. It helps uncover weak signals, niche cases, and non-obvious comparisons that humans might overlook. For instance, you can prompt AI to surface unusual brand campaigns across cultures, then ask why a campaign worked in one context but failed in another. You can also explore how a global brand is perceived across social platforms.

When practiced this way, curiosity yields a rich pool of questions, angles, and phenomena that you can later analyze and distill into sharp, actionable insights.

5.1.2. Critical

Staying critical means making disciplined, well-judged decisions. It involves evaluating the reliability of information, recognizing potential bias (including in AI-generated outputs), comparing competing explanations or strategies, and identifying assumptions, logical gaps, and missing perspectives.

In practice, this means asking whether an AI-generated analysis is genuinely supported by real data, examining the evidence behind it, and probing for what might be missing. It also includes comparing, for example, two brands' globalization strategies and identifying the specific elements that drive their success. The outcome is a reasoned, evidence-based understanding of brand phenomena rather than simply accepting surface-level narratives or uncritically following AI suggestions.

5.1.3. Creative

Staying creative means turning understanding into original value. It is about using insight as raw material to generate new ideas, models, and strategies—rather than simply repeating what is already known. Strong creativity shows up in the ability to make unexpected connections across brands, markets, and disciplines, revealing possibilities others overlook.

In practice, this means designing global campaign architectures that adapt intelligently to local culture or inventing new metrics and dashboards that capture what traditional measures miss—such as brand authenticity across markets. It also means using AI as a true creative collaborator: remixing ideas, generating scenarios, and rapidly prototyping concepts. The result is original, practical outputs—new frameworks, tools, and strategic options—that move work beyond imitation and build real competitive advantage.

5.2. The 3D (Detect, Dissect, Discover) Process as Innovation Skillset

The 3D innovation skillset shows how learners can achieve these outcomes. For example, across four skill domains—framing and reframing complex problems, experimenting and iterating, applying design thinking, and recognizing opportunities—the 3D principles are enacted behaviorally: Detect requires environmental scanning and opportunity recognition; Dissect requires decomposition, evidence evaluation, and causal reasoning; Discover requires divergent production and synthesis into novel, portable insights.

5.2.1. Detect

Detect is about deciding what is truly worth studying. It begins by scanning global markets for patterns, anomalies, and emerging trends that signal meaningful change. Rather than looking at data in isolation, Detect focuses on the stories the data suggests—where things are shifting, breaking down, or breaking through.

Using AI, we can aggregate and summarize vast volumes of information, from social media and news to reviews and industry reports. This enables us to quickly surface signals that would otherwise go unnoticed: sudden spikes in attention, shifts in sentiment, and recurring complaints and desires. From there, we identify the problems, tensions, and opportunities that matter most to branding practice.

In practical terms, Detect might mean using AI to analyze sentiment about a brand across countries to uncover unexpected negativity or enthusiasm. It could also involve asking AI to compile recent controversial brand moves in a specific region to identify where others have misstepped or broken through. The outcome is a sharply focused set of phenomena, issues, or cases that clearly warrant deeper analysis.

5.2.2. Dissect

To dissect is to break down what has been detected into clear, actionable parts. It involves breaking brand cases into core components—positioning, messaging, channels, partnerships, cultural fit, timing, and more—so you can see what truly drives performance. From there, you analyze the causal factors: what specifically led to success or failure and how each element contributed.

AI plays a key role in this step by structuring complex information into clear dimensions and comparisons. For example, you might break a global campaign into audience segments, cultural references, and channel strategies, then test the role each element played. You can also have AI map out cause–effect chains: if the brand changed this element, what would likely follow? The outcome is a clear, structured understanding of how and why certain patterns emerge—turning vague intuition into precise, evidence-backed insight.

5.2.3. Discover

To discover involves synthesizing information to generate new, actionable insights. It means connecting patterns across multiple cases or markets and using those connections to formulate fresh principles, hypotheses, or playbooks for global branding. AI plays a key role in this stage by enabling teams to explore "what-if" scenarios and stress-test ideas before committing.

In practice, Discover might involve deriving a new principle for how brands should localize humor or symbolism across cultures or producing a clear conceptual model that explains when a brand should standardize versus localize. The outcome is a set of new, portable insights that can guide future brand decisions and lay the groundwork for meaningful innovation.

5.3. The 3M (Map, Measure, Monitor) as Innovation Toolset

The 3M innovation toolset focuses on managing innovation processes and outputs over time in complex, dynamic environments. The innovation processes and outputs are tangible, testable results—prototypes, digital tools, redesigned services, social innovations, and new processes—which, in the Brand Globalization case, are compiled into a team Innovation Portfolio that serves as the central assessment.

5.3.1. Map

Mapping is about seeing the landscape clearly. It means visualizing where a brand sits across markets, cultures, and its competitive set. This involves building conceptual and data-driven maps—such as positioning maps, stakeholder maps, cultural value maps, and ecosystem diagrams—to make complex dynamics easier to understand. AI can support this work by generating, refining, and annotating these maps at speed and at scale.

In practice, this might include creating perceptual maps that compare competing brands across key attributes (for example, premium vs. accessible or global vs. local). It can also involve mapping cultural narratives around a brand across regions, using text analysis to surface patterns, tensions, and opportunities. The outcome is a set of shared mental models and visual tools that cut through complexity, align stakeholders, and reveal clear strategic options.

5.3.2. Measure

Measuring means clearly defining what matters and rigorously tracking it over time. This involves designing meaningful KPIs that go beyond basic sales or follower counts and blend quantitative metrics with human insight. Quantitative metrics such as NPS, share of voice, and conversion rates should sit alongside qualitative indicators such as narrative tone and perceived authenticity. AI can play a key role here—helping design smarter metrics, clean and structure messy data, and run deeper, faster analyses.

In practice, this might look like building a "cultural resonance index" that measures how well campaigns align with local values or using AI to code and score customer reviews and social posts at scale. The result is a measurement system that rigorously tests strategies, shows what is working, and provides an ongoing read on brand health.

Monitor

Monitoring is about continuous vigilance and adaptation. It means setting up ongoing tracking, dashboards, and alert systems so you always know what is changing and where. Using AI as an early-warning system to flag shifts in sentiment, competitor moves, or emerging trends gives you the time and context to respond intelligently, not react. Regularly revisiting your maps and metrics ensures your strategies stay aligned with reality rather than drifting on outdated assumptions.

In practice, this could look like an AI-assisted dashboard that highlights notable changes in customer sentiment by region each week, helping teams quickly identify where to lean in or course-correct. You can also set clear rules: when certain metrics cross a threshold, the team automatically reviews and adjusts campaigns. The result is a living, adaptive management process that keeps global brand strategy responsive, informed, and consistently ahead of the curve.

5.4. The Role of AI as a Collaborative Partner in 3C, 3D, and 3M Architecture

When combined, the 3C mindset, the 3D skillset, and the 3M toolset form a powerful architecture for Innovation-Based Coaching. Within Innovation-Based Coaching, the 3C–3D–3M framework serves as a continuous, semester-long innovation cycle. Each component

reinforces the others, collectively developing learners' innovation mindset, skillset, and toolset and producing tangible outputs.

In this way, "monitor" activities within 3M trigger new Detect cycles in 3D, which in turn reshape subsequent 3C exploration. As a result, the mindset, skillset, and toolset for outputs co-evolve intentionally, and each innovation is deliberately mapped, measured, and monitored rather than left to chance.

Across the 3C, 3D, and 3M architecture, humans and AI are partners. To strengthen AI's standing as a collaborative partner, it helps to clearly differentiate its roles and map them to the 3C–3D–3M architecture. In this context, AI serves as a tutor (providing feedback on writing and explanations), a tool (supporting data processing and dashboard development), and a teammate (for co-ideation, role-play, and simulation). Mapping these roles to the phases of curiosity, creativity, and collaboration—and to discovery, design, and delivery, as well as to metrics, methods, and mindsets—clarifies when and how to engage AI and what learners should gain from each interaction.

Crucially, learners must also learn to evaluate AI outputs critically. IBC treats this as a core coaching task: learners are guided to question, analyze, and interpret AI-generated suggestions by assessing their quality, bias, and trustworthiness. This reframes AI from a black-box tool into a genuine thinking partner and strengthens learners' critical and ethical reasoning.

Critical AI literacy is not only an ethical safeguard; it also drives innovation across mindset, skillset, and toolset for outputs. At the mindset level, it cultivates healthy skepticism and ethical sensitivity; at the skillset level, it builds the capacity to design effective prompts, evaluate models, and creatively repurpose tools for novel problems; and at the toolset for output level, it supports the development of more robust, inclusive, and explainable solutions. Making these links explicit will help learners see AI not as a shortcut but as a disciplined partner in responsible innovation.

5.5. The Cultivation Process: 3C × 3D × 3M Across the 4I Cycle

In IBC, the three components are not parallel checklists but interlocked layers of a single developmental engine: the 3C mindset is cultivated, the 3D skillset is the behavioral routine through which that cultivation occurs, and the 3M toolset is the measurement-and-governance layer that makes growth visible and repeatable. Table 4 maps this logic to the four coaching phases of each unit cycle.

Table 4. Process Operationalization of 3C–3D–3M as an Innovation-Cultivation Cycle.

4I Phase	3C Mindset	3D Skillset	3M Toolset	Primary Construct	Coaching/AI Role
Ignite	Curious	Detect: Scan markets/environments for patterns, anomalies, weak signals; frame high-impact questions	Map: Baseline positioning maps; baseline self-assessments of mindset and competence	Innovative mindset	Coach frames challenge; AI as tool expands the search space (surfacing non-obvious cases, signals)
Investigate	Critical	Dissect: Decompose cases into components; run causal analysis; interrogate evidence and AI outputs for bias and blind spots	Measure: Mid-cycle rubric scoring of analyses; checklist verification of AI-output critique	Innovative skillset (analytical)	Coach runs Socratic probing; AI as tutor provides feedback on reasoning
Illuminate	Creative	Discover: Synthesize cross-case patterns into novel principles, hypotheses, playbooks	Measure: Score divergent production and synthesis quality	Innovative skillset (creative synthesis)	AI as teammate for co-ideation, scenario generation, stress-testing

Table 4. *Cont.*

4I Phase	3C Mindset	3D Skillset	3M Toolset	Primary Construct	Coaching/AI Role
Innovate	Integrated 3C	Discover extended into implementation: prototypes, models, dashboards, redesigned processes	Monitor: Portfolio audit, dashboards, threshold-triggered review; findings trigger the next Detect cycle	Innovation outputs	Coach gates quality and ethics; AI as tool for prototyping and monitoring design

The regenerative logic is essential: Monitor feeds new Detect cycles, so mindset, skillset, and toolset co-evolve throughout the semester rather than being assessed only once at the end. Each unit of the course therefore runs four full cultivation phases, and each unit cycle must leave a measurable residue—a baseline shift (Map), a scored performance (Measure), or a portfolio artifact (Monitor).

5.6. The Risks of AI Overreliance: Why Coaching Is Needed

Recent empirical work has begun documenting the consequences of learners and workers delegating too much cognitive work to AI, findings that directly bear on the rationale for Innovation-Based Coaching. A mixed-methods study of more than 600 learners found that heavier reliance on AI tools was significantly associated with weaker critical-thinking performance, with cognitive offloading mediating this relationship. Younger learners showed the greatest dependence and the least critical engagement (Gerlich, 2025). A systematic review of studies on overreliance on AI dialogue systems similarly concluded that excessive dependence erodes students' cognitive abilities—including decision-making, critical thinking, and analytical reasoning—and recommended pedagogical designs that keep learners cognitively engaged rather than automating thought (Zhai et al., 2024).

Experimental evidence sharpens the concern. In a preregistered experiment on scientific inquiry, students using a general-purpose LLM invested less mental effort. They produced shallower inquiry than peers using a scaffolded system or no LLM—"cognitive ease at a cost" (Stadler et al., 2024). In a large field experiment with nearly a thousand high-school students, an unrestricted ChatGPT4-style tutor improved in-task performance, but when access was removed, those students performed worse on unaided exams than students who never had AI support; a guardrailed version that gave hints rather than answers avoided the harm (Bastani et al., 2024). Fan et al. (2025) coined the term metacognitive laziness for the underlying mechanism: when generative AI takes over the monitoring and regulation of learning, learners disengage from managing their own cognitive processes, with consequences for motivation, learning processes, and performance. In the workplace, a survey of 319 knowledge workers found that greater confidence in generative AI was associated with less self-reported critical-thinking effort—shifting the worker's role toward overseeing and verifying AI output rather than thinking itself—while confidence in one's own abilities predicted more critical engagement (Lee et al., 2025). Preliminary neurophysiological evidence points the same way: in an EEG study of essay writing, learners relying on an LLM assistant showed weaker brain connectivity, poorer recall of their own text, and reduced sense of ownership—an accumulation of "cognitive debt"—although the study is a small-sample preprint and its authors caution against alarmist readings (Kosmyna et al., 2025).

When students engage with ChatGPT as an object of active, reflective engagement rather than a shortcut, complex critical thinking can improve (Suriano et al., 2025). This is precisely the distinction IBC institutionalizes: the framework's Critical mindset, its coached interrogation of AI outputs, its differentiated tutor/tool/teammate roles, and its 3M measurement loop are designed to transform AI from a substitute for thinking into a partner in thinking—directly addressing the risks documented above.

5.7. Key Contributions of Innovation-Based Coaching

The key contributions of Innovation-Based Coaching can be summarized as follows:

1. Teleological re-founding—Innovation takes precedence as the primary, measurable goal; success is defined by artifacts rather than grades.
2. First, triadic integration—AIEd (Zawacki-Richter et al., 2019), coaching (Villa et al., 2024), and innovation-competence research (Kettunen et al., 2013)—was pairwise disconnected; IBC makes all three load-bearing.
3. Phase-indexed AI-role theory—Tutor/tool/teammate mapped onto the 4I phases, each with a coached critical counter-practice, elaborating static taxonomies (Hwang et al., 2020).
4. Critical AI literacy as an innovation driver—Beyond ethics-as-safeguard (Bond et al., 2024), skepticism fuels the Critical mindset and strengthens outputs.
5. Regenerative cycle—Monitoring triggers new Detect cycles, a closed loop absent from linear GROW (Whitmore, 1992/2017).
6. Institutional theory of change—A challenge-by-challenge response map, discipline-agnostic, whereas CDIO is engineering-bound.
7. Equity-by-design—Countermeasures for unevenly distributed innovation capacity (Ojo & Volkova, 2023) built in as components.
8. Portability—A discipline-agnostic innovation engine designed for transfer.

6. Challenges of Implementing IBC

Implementing IBC in education is challenging across conceptual, cultural, pedagogical, institutional, and equity dimensions.

Conceptually, ambiguity about what "coaching" means—and how it differs from mentoring, advising, or supervision—leads to inconsistent practices and expectations. Without clear definitions and a shared language, stakeholders interpret IBC in different ways, undermining coherent implementation.

Culturally, IBC clashes with traditions that prioritize content delivery and instructor authority. Faculty accustomed to directive teaching may view coaching as a threat to disciplinary rigor or to their professional identity, leading to resistance, tokenistic adoption, or uneven quality across programs and disciplines.

Pedagogically, IBC requires advanced skills—dialogic facilitation, reflective inquiry, design thinking, and iterative learning—that many educators have not been trained to apply. Without sustained professional development and supervision, coaching can devolve into routine instruction. Learners, often unaccustomed to ambiguity and self-directed inquiry, may feel anxious or disengage, especially when assessment systems do not explicitly reward innovation.

Institutionally, IBC is time- and labor-intensive, requiring space for feedback, prototyping, and deep dialogue. However, workload models, promotion criteria, and curriculum structures often undervalue these efforts and favor standardized, summative assessment. This misalignment discourages faculty investment and diminishes coaching's impact on learning.

Equity concerns further complicate implementation. Innovation-oriented learning can privilege learners with higher cultural capital—those who are more confident, independent, and familiar with creative problem-solving—while disadvantaging international, first-generation, and disabled learners, as well as those with limited access to collaborative spaces and digital tools.

Finally, evaluating IBC is methodologically challenging. Conventional metrics such as grades, retention, and satisfaction rarely capture creativity, risk-taking, or iterative reasoning. Inadequate evaluation frameworks make it difficult to demonstrate IBC's unique value and to justify sustained institutional support.

Taken together, these challenges show that IBC cannot be implemented through isolated teaching innovations alone; it requires systemic shifts across definitions, culture, pedagogy, evaluation, and institutional structures.

7. Solutions and Recommendations

To embed IBC in education, institutions must address the conceptual, cultural, pedagogical, structural, assessment, equity, and evaluation challenges outlined in Section 6. The following recommendations align with these challenges, pairing each major barrier with targeted solutions that clarify concepts, build support, develop capabilities, realign structures and assessment, promote equity, strengthen evaluation, and enable strategic scaling.

The challenges in Section 6 are implementation problems, not pedagogical. Two bodies of implementation research are directly relevant. Fixsen et al. (2005) synthesized implementation research across human services and education, showing that practices succeed or fail based on a small set of core implementation components—practitioner selection, training, coaching, fidelity assessment, and facilitative organizational supports—and that implementation proceeds through discernible stages (exploration, installation, initial and full implementation). Bryk et al. (2015) translated improvement science into education, arguing that reforms fail when systems "implement fast and learn slow" and recommending disciplined inquiry through networked improvement communities (NICs) organized around six principles, including making the work problem-specific and user-centered, measuring outcomes and key drivers, anchoring practice improvement in Plan–Do–Study–Act cycles, and accelerating learning through networks. Read together, these traditions prescribe what must be built (Fixsen's drivers) and how learning should be organized (Bryk's improvement science). The recommendations below retain only responses directly anchored to a specific IBC mechanism (3C, 3D, 3M, the 4I cycle, AI partnership, or the Innovation Portfolio) and grounded in one or both sources.

7.1. Define IBC as a Usable Intervention

Define IBC as a usable intervention before scaling it (Exploration and Installation). Fixsen et al. (2005) warn that poorly operationalized programs cannot be implemented with fidelity. IBC's architecture is an asset: the 3C–3D–3M components, the Ignite–Investigate–Illuminate–Innovate cycle, and the Innovation Portfolio already constitute an unusually well-specified intervention. Institutions should therefore (1) codify the framework in an implementation guide—including observable coaching behaviors, phase-by-phase protocols, AI-usage rules (including mandatory human verification for high-stakes outputs), and Portfolio criteria—and (2) adopt Bryk et al.'s (2015) discipline of starting problem-specific and user-centered: frame adoption around a concrete local problem (e.g., weak opportunity-recognition or thin output portfolios) rather than the framework in the abstract.

7.2. Build Coaching Capability

Build coaching capability as a core implementation driver (Selection, Training, Coaching). IBC's bottleneck is the coach: its outcomes depend on facilitators with dialogic, reflective-inquiry, design-thinking, and AI-fluency skills. Fixsen et al. (2005) show that practitioner training and—especially—ongoing coaching of practitioners are among the strongest predictors of faithful, sustained implementation, whereas one-off training is not. The IBC-specific response is to (1) deliberately select and prepare coaches, (2) use the 3C–3D–3M approach itself as the scaffold for coach development, and (3) institutionalize "coach-the-coach" structures—supervised practice, peer observation, and structured feedback—so coaching remains developmental rather than reverting to directive instruction.

7.3. Fidelity Assessment

Assess fidelity to the 3C–3D–3M and 4I mechanisms. A framework can be adopted in name while its active ingredients are dropped. Fixsen et al. (2005) identify fidelity assessment as a core driver because outcomes track how closely practice aligns with the model. For IBC, fidelity means that each unit runs all four 4I phases, coaching conversations genuinely subordinate technique to innovation goals, AI engages in its differentiated tutor/tool/teammate roles with coached critical interrogation, and every cycle produces a Portfolio artifact. Institutions should therefore adopt a short fidelity checklist keyed to these mechanisms and use the 3M tool's Monitor function as the fidelity-assessment instrument—measuring whether the coaching process itself (not only student outcomes) aligns with the model.

7.4. Disciplined-Inquiry Rollout

Run IBC as a disciplined inquiry, not a fixed rollout. Bryk et al. (2015) recommend anchoring practice improvement in rapid Plan–Do–Study–Act cycles and measuring both outcomes and key drivers. IBC already embeds this logic pedagogically—its 3M tool (Map, Measure, Monitor) is, in effect, a PDSA-style measurement layer—and the recommendation is to apply the same logic to implementation: pilot IBC in one course or capstone; use Map to baseline learners' innovation mindsets and competence profiles; use Measure to score artifacts and skill indicators each cycle; and use Monitor to review results and trigger the next Detect round. Institutions should start small, generate local evidence on what works and for whom, and iterate the framework before scaling—Bryk et al.'s (2015) "learn fast to implement well" rather than an institution-wide launch.

7.5. Networked Scaling

Scale through a networked improvement community, not isolated adopters. Both literatures converge on the insufficiency of lone, enthusiastic practitioners. Bryk et al. (2015) make networked improvement communities their central mechanism for accelerating learning and achieving scale at quality; Fixsen et al. (2005) likewise emphasize organizational supports and facilitative administration over individual heroics. The IBC-specific form is an interdisciplinary community of practice in which coaches share 3C–3D–3M designs, AI-prompt protocols, rubrics, and Portfolio exemplars across disciplines—a NIC for innovation coaching—supplemented by peer- and near-peer coaching to relieve capacity constraints and by targeted AI tools that provide low-stakes formative feedback to complement scarce human coaching time.

7.6. Facilitative Supports

Provide facilitative organizational supports for the mechanisms to function. Fixsen et al. (2005) show that even well-trained practitioners cannot sustain a practice when organizational structures work against it. Two supports are mechanism-specific for IBC: (1) time and recognition—coaching-intensive formats (innovation studios, capstones, clinics) need explicit workload credit and visibility in promotion and review, or the 4I cycle's feedback, prototyping, and dialogue collapse under competing demands; (2) assessment alignment—because IBC's assessed outcome is innovation (mindset, skillset, and Portfolio outputs), summative systems that reward only content mastery actively undermine its risk-taking and iteration, so rubrics must explicitly score problem framing, experimentation, iteration, and output quality. Both are prerequisites for fidelity, not optional enhancements.

Taken together, as shown in Table 5, these six recommendations treat IBC adoption as an implementation problem with known solutions: a well-specified intervention (Section 7.1), deliberate development of the coaching driver (Section 7.2), fidelity assessment tied to the

framework's active ingredients (Section 7.3), a staged, inquiry-driven rollout using IBC's own 3M measurement logic (Section 7.4), networked scaling (Section 7.5), and facilitative supports (Section 7.6) (Bryk et al., 2015; Fixsen et al., 2005).

Table 5. Recommendations, IBC Mechanisms, and Implementation.

Recommendations	IBC Mechanisms	Implementations
Section 7.1. Define IBC as a Usable Intervention	3C–3D–3M, 4I cycle, Portfolio specification	Fixsen's exploration/installation stages + Bryk's "problem-specific, user-centered"
Section 7.2. Build Coaching Capability	The coach as IBC's bottleneck	Fixsen's core drivers: selection, training, ongoing coaching of practitioners
Section 7.3. Fidelity Assessment	4I phases, AI tutor/tool/teammate roles, Portfolio artifacts—monitored via 3M itself	Fixsen's fidelity-assessment driver
Section 7.4. Disciplined-Inquiry Rollout	3M (Map–Measure–Monitor) used as the PDSA layer; Monitor triggers new Detect	Bryk's "learn fast to implement well"
Section 7.5. Networked Scaling	Interdisciplinary community of practice sharing 3C–3D–3M designs, AI protocols, rubrics	Bryk's networked improvement communities; Fixsen's facilitative administration
Section 7.6. Facilitative Supports	Workload/time for the 4I cycle; assessment rubrics scoring problem framing, experimentation, outputs	Fixsen's facilitative organizational supports

Collectively, these mirrored recommendations address the challenges outlined in Section 6, extending IBC's reach and quality while keeping human judgment and relationships central. When introduced gradually and tailored to local contexts, they position IBC not as isolated experiments but as a coordinated, institution-wide shift across definitions, culture, pedagogy, assessment, evaluation, and resourcing—better preparing universities to navigate AI-driven change and to graduate professionals who can innovate responsibly and collaboratively in complex real-world settings.

From an implementation standpoint, the recommendations can be phased across short-, medium-, and long-term horizons, providing a practical roadmap rather than a single disruptive overhaul. In the short term, universities can clarify concepts, secure academic buy-in, and launch targeted pilots that leverage existing resources. Over the medium term, they can expand capability-building, enhance student preparation, realign assessments and workloads, and embed equity-focused design. In the longer term, institutions can consolidate these changes through robust mixed-methods evaluation and by scaling peer networks, AI-enabled support, and communities of practice, progressively reconfiguring core systems around innovation-based coaching rather than treating it as a peripheral initiative.

8. Conclusions and Implications

Innovation-Based Coaching addresses a pressing challenge: education remains deeply rooted in knowledge-transfer models even as AI reshapes work, learning, and employability. IBC offers a structured, innovation-focused approach that cultivates learners' curiosity, critical judgment, creativity, and human capacity for AI collaboration through the 3C–3D–3M architecture.

To realize IBC's promise, however, it must be embedded within aligned systems of incentives, curricula, assessment, staff development, equity, and evaluation. This entails responsibilities and opportunities for multiple stakeholder groups.

8.1. Implications for Policymakers and Institutional Leaders

For policymakers and senior leaders, IBC has strategic implications.

A. Align funding, promotion, and quality-assurance mechanisms with innovation-focused outcomes rather than solely with traditional academic metrics.
B. Invest in physical, digital, and AI-enabled infrastructure to support experiential, coached learning.
C. Embed IBC principles into institutional strategies, graduate attributes, and external partnership agendas.

When leadership visibly values coaching, interdisciplinary collaboration, and inclusive innovation, IBC can move from isolated experiments to a system-level driver of transformation.

8.2. Implications for Program Leaders and Educators

For program leaders and educators, IBC offers a design blueprint:

A. Redesign curricula and assessments around 3C–3D–3M so that curiosity, criticality, creativity, experimentation, and continuous improvement are explicit learning outcomes.
B. Integrate AI tools as collaborative partners for feedback, simulation, and reflection, while keeping human judgment and ethics central.
C. Build coaching capability through ongoing professional development, peer observation, and communities of practice.

Doing so will shift teaching from content delivery to coached, innovation-oriented learning that yields outputs valued by learners, employers, and communities.

8.3. Implications for Researchers

For researchers, IBC sets an agenda at the intersection of AI, coaching, and innovation. Priority areas include:

A. Empirically testing individual components of the 3C–3D–3M model across disciplines and institutional contexts.
B. Examining the long-term effects of IBC on students' identity, employability, critical AI literacy, and lifelong learning.
C. Investigating equity impacts, including differential experiences and outcomes among student groups.
D. Developing and validating metrics and instruments to assess creativity, risk-taking, ethical reasoning, and collaborative competence.

Such work is needed to move beyond proof-of-concept studies toward a cumulative, evidence-based understanding of IBC's effectiveness and limitations.

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