Original Research Article

From campus to career: Mechanisms through which AI empowerment and gamified industry-education collaboration drive individual innovation capability in the context of industrial digitalization

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Abstract: Industrial digitalization has restructured labor market demands, placing individual innovation capability at the center of human capital strategy in vocational education. Drawing on creative self-efficacy theory and self-determination theory, this study proposes a framework in which AI empowerment drives innovation capability through cognitive liberation, efficacy construction, and knowledge contextualization, while gamified industry-education collaboration (GIEC) amplifies these effects by fulfilling students' basic psychological needs.Furthermore, this study uses the "613" industrial system of Yangzhou City, China as an illustrative policy context to demonstrate the institutional activation effect of regional industrial strategies on these mechanisms. It also proposes three actionable practice models, offering practical guidance for vocational education administrators, policymakers, and corporate partners.
Keywords: AI empowerment; gamified industry-education collaboration; individual innovation capability; creative self-efficacy; industrial digitalization

1. Introduction

A structural paradox pervades vocational education in the digital era: classrooms are equipped with advanced Artificial Intelligence (AI) tools, yet students remain largely unable to generate innovative solutions to real industry problems, and have even led to some anxiety about career replacement.; enterprises sign partnership agreements in large numbers, yet the resulting graduates rarely bring the creative capacity that digitalized workplaces demand. This study argues that resolving this paradox requires reframing two widely misunderstood concepts. AI empowerment should not be understood as information overload, but rather as cognitive liberation—freeing higher-order cognitive abilities from daily tasks, thereby stimulating genuine creative thinking and addressing the anxieties arising from AI in a healthy way. Gamified industry-education collaboration (hereafter referred to as GIEC)should not be understood as institutional compliance but as motivational transformation—converting students' relationship with industry challenges from passive obligation into intrinsic engagement. The interaction of these two mechanisms, rather than either one alone, constitutes the core driver of individual innovation capability development among vocational undergraduate students.

2. Theoretical foundations and literature review

The theoretical foundation of this study rests on two complementary bodies of work. The first concerns creative self-efficacy (CSE)—An individual's belief in their capacity to produce creative outcomes. Tierney and Farmer (2002) established CSE as a construct with superior predictive validity for innovative behavior, and Newman et al. (2018) demonstrated that it mediates between contextual variables and innovation performance. The second concerns AI in education and gamified learning. Hwang et al. (2020) called for a shift from viewing AI as a content delivery accelerator toward understanding it as an activator of advanced competencies. In addition, some studies have found that the development of AI has also brought a double-edged sword effect to innovation capabilities. Crompton and Burke (2023) confirmed through systematic review that AI's effects on higher-order skills such as innovation remain theoretically underspecified. Sailer and Homner (2020) showed through meta-analysis that gamification enhances intrinsic motivation most robustly when game mechanics

are coupled with authentic task contexts. Vansteenkiste et al. (2020) extended self-determination theory (SDT) to show that satisfying autonomy, competence, and relatedness needs simultaneously generates nonlinear motivational effects, providing the theoretical basis for GIEC design. Building upon the aforementioned literature, this study explores the role of AI empowerment and GIEC in shaping individual innovation capabilities, thereby enriching the relevant research.

3. Mechanisms through which AI empowerment drives innovation capability

This study identifies three sequential mechanisms linking AI empowerment to individual innovation capability. The first is cognitive liberation. Human working memory is finite; when students must allocate substantial cognitive bandwidth to information retrieval and procedural execution, little remains for cross-domain synthesis, hypothesis generation, and iterative solution refinement. AI tools that handle execution-level tasks restructure this cognitive allocation, concentrating students' resources on the activities where creative ability is genuinely formed. A student majoring in business administration who uses AI to manage the analytical groundwork of a supply chain problem is placed in conditions where creative thinking becomes the primary—not a residual—Cognitive activity.

Secondly, there is the efficacy construction: a well-designed AI learning system can dynamically adjust the difficulty of tasks according to students' ability levels, continuously strengthen their innovative self-efficacy through the accumulation of progressive success experiences, and provide students with personalized visualization of ability growth, offering recognition of their abilities from "objective algorithms." Simultaneously, through cognitive guidance, students can correctly view the impact of AI development on employment, rationally address "displacement anxiety," and transform "anxiety" into motivation for learning AI and innovation.

The third mechanism is knowledge contextualization. Innovation capability transfers to workplace contexts only when it is cognitively indexed to situations resembling real industry settings. AI tools that surface industry-specific data patterns and simulate competitive scenarios build this contextual indexing during learning itself. Lim et al. (2023) argue that generative AI's deepest educational value lies here: co-constructing experiential contexts within which transferable practical judgment is formed.

4. Gamified industry-education collaboration: Contextual activation effects

Gamified industry-education collaboration (GIEC) is the systematic redesign of the motivational architecture of industry-education cooperation using game design psychology—Not to make education entertaining, but to convert authentic industry challenges into intrinsically engaging experiences. When students compete to solve a genuine enterprise digitalization problem, the competitive and achievement dynamics of gamification amplify motivation for the underlying task. GIEC amplifies AI empowerment effects nonlinearly by simultaneously satisfying all three SDT needs. In the autonomy dimension, open-ended industry challenge frameworks give students genuine decision-making latitude over problem framing and AI tool deployment—A contrast to AI-guided procedural tasks, which are motivationally equivalent to rote execution. In the competence dimension, progressive challenge structures combined with real-time professional feedback from industry mentors create a dual-channel reinforcement of CSE: a mentor's judgment that a student's AI-assisted solution has commercial relevance confirms real-world capability, not merely academic correctness. In the relatedness dimension, team competition and industry expert engagement validate students' creative efforts against genuine external stakes, reinforcing both intrinsic motivation and CSE in ways that classroom grading cannot replicate.

Based on this, This study proposes three implementation models to operationalize GIEC in practice. The first is the Industry Digitalization Sandbox Challenge, which presents a enterprise problem as a structured sequence: students use AI tools for diagnostic analysis, develop solution proposals, and receive "clearance commentary" from industry mentors rather than grades at each stage. The second is the Management Innovation Sprint, a 48-hour cross-disciplinary team challenge around a real enterprise problem, with periodic checkpoint reviews at which professionals provide immediate feedback and vote on the most promising solution, with the leading team earning enhanced AI resources or data access. The third is the Digital Enterprise Simulation Project, which establishes a simulated company within the college to handles real, lightweight business tasks

commissioned by partner companies; students are compensated in internal "project tokens" redeemable for industry visits, expert coaching, or internship recommendations. Each model integrates AI empowerment and gamified design as inseparable, mutually reinforcing components.

This study argues that these measures can effectively enhance students' interest in learning, even their willingness to apply for vocational undergraduate programs, and improve their self-efficacy, innovation capabilities, and creative resilience in the digital and AI era.

5. Institutional context: Yangzhou's "613" industrial system

Yangzhou's "613" industrial strategy designates software and information services, high-end equipment manufacturing, and new energy—Among other sectors—As the structural pillars of the city's digital economic transformation. The local software and information services cluster provides an immediately feasible entry point for GIEC pilots: its enterprises have both the technical capacity and the institutional motivation to share real operational data and business challenges with vocational college partners. The manufacturing and new energy sectors, undergoing active digitalization, generate genuine demand for business and management graduates capable of cross-domain creative problem-solving, supplying the authentic challenges that give GIEC its motivational power. Yangzhou's municipal policy has incorporated requirements for vocational colleges to embed digital innovation capability in talent development objectives, with dedicated funding for joint enterprise-college platforms—a policy posture that creates favorable conditions for the mechanisms proposed here. Based on this, this study believes that the innovation capability enhancement mechanisms proposed in this paper can be effectively applied in Yangzhou and ultimately contribute to the development of Yangzhou's "613" industrial system. It should be noted that the theoretical effectiveness of the above mechanism does not depend on the unique industrial conditions of Yangzhou. Verhoef et al. (2021) have pointed out that digital transformation is making the demand for innovative talents converge among various types of organizations. Therefore, the framework of this paper has universal applicability across specific regions.

6. Management implications and policy recommendations

For college administrators, AI tool acquisition is a necessary but insufficient condition for innovation capability development. Tools must be embedded in authentic industry challenge contexts rather than deployed as standalone skill modules, and faculty development must prioritize creative challenge design competencies over content delivery expertise. Assessment architecture should shift from terminal examinations toward process portfolios documenting how students' creative reasoning evolves in response to industry feedback, thereby enhancing students' interest in applying to their chosen majors. For policymakers, the most important structural reform is supplementing compliance metrics—Partnership agreements, internship quotas—With efficacy-oriented indicators: contextual authenticity ratios, industry mentor feedback frequencies, and innovation behavior activation rates. Linking these to funding allocation would incentivize qualitative deepening of partnerships. For corporate partners, participation in GIEC should be framed not as social responsibility but as a strategic talent investment: co-creating gamified challenges provides AI-assisted collective exploration of real business problems while building a structured pipeline for identifying candidates who perform well under authentic creative stakes.

7. Conclusions and future research directions

This paper proposes an integrated framework centered on "cognitive liberation—Efficacy construction—Knowledge contextualization," revealing the intrinsic mechanism by which AI empowerment and GIEC synergistically drive the individual innovation capabilities of business and management students in vocational undergraduate colleges, and presents this in a specific institutional context using Yangzhou's "613" industrial system. The core conclusions are: the true value of AI empowerment lies in cognitive liberation and efficiency accumulation rather than information expansion; the core value of engaging industry-education collaboration lies in transforming institutional participation into intrinsically driven innovative exploration; and the synergistic design of both can generate an integrated effect that surpasses the sum of their individual effects. This paper focuses on theoretical construction and proposition extraction. Subsequent research can employ a multi-stage

tracking design to empirically test these propositions and further analyze the specific impacts of this mechanism.

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References

[1] CHAN C K Y, HU W. Students' voices on generative AI: perceptions, benefits, and challenges in higher education[J]. International Journal of Educational Technology in Higher Education, 2023, 20(1): 43.

[2] CROMPTON H, BURKE D. Artificial intelligence in higher education: the state of the field[J]. International Journal of Educational Technology in Higher Education, 2023, 20(1): 22.

[3] HWANG G J, XIE H, WAH B W, et al. Vision, challenges, roles and research issues of artificial intelligence in education[J]. Computers and Education: Artificial Intelligence, 2020, 1: 100001.

[4] LIM W M, GUNASEKARA A, PALLANT J L, et al. Generative AI and the future of education: Ragnarok or reformation? A paradoxical perspective from management educators[J]. International Journal of Management Education, 2023, 21(2): 100790.

[5] NEWMAN A, HERMAN H M, SCHWARZ G, et al. The effects of employees' creative self-efficacy on innovative behavior: the role of entrepreneurial leadership[J]. Journal of Business Research, 2018, 89: 1-9.

[6] SAILER M, HOMNER L. The gamification of learning: a meta-analysis[J]. Educational Psychology Review, 2020, 32(1): 77-112.

[7] TIERNEY P, FARMER S M. Creative self-efficacy: its potential antecedents and relationship to creative performance[J]. Academy of Management Journal, 2002, 45(6): 1137-1148.

[8] VANSTEENKISTE M, RYAN R M, SOENENS B. Basic psychological need theory: advancements, critical themes, and future directions[J]. Motivation and Emotion, 2020, 44(1): 1-31.

[9] VERHOEF P C, BROEKHUIZEN T, BART Y, et al. Digital transformation: a multidisciplinary reflection and research agenda[J]. Journal of Business Research, 2021, 122: 889-901.