AI Integration in Entrepreneurship Education: A Systematic Review of the Mediating Role of Self-Efficacy

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Abstract
The integration of artificial intelligence (AI) in entrepreneurship education has expanded rapidly following the launch of ChatGPT however, empirical evidence regarding its effectiveness and implementation challenges remains fragmented. This study synthesizes empirical evidence on AI integration in entrepreneurship education through a systematic literature review following PRISMA 2020 guidelines. A Scopus database search yielded 186 articles, with 25 empirical studies meeting inclusion criteria. Findings reveal neural networks and generative AI as dominant technologies, with neural networks applied in nearly half of the studies and generative AI in more than a quarter. Experiential learning emerged as the most effective pedagogical approach. Entrepreneurial self-efficacy was confirmed as a key mediator between AI and entrepreneurial intention, with consistently strong path coefficients and large effect sizes across studies. AI integration consistently enhanced entrepreneurial intention, self-efficacy, and knowledge acquisition. However, a notable decline in self-perceived creativity indicates potential deskilling risk. Primary challenges include limited technical infrastructure, faculty readiness, and ethical concerns. The concentration of studies in China constrains cross-cultural generalizability. This study proposes the Integrated AI-Entrepreneurship Education Model (IAEEM) as a conceptual framework and provides practical recommendations for higher education institutions to optimize AI integration while mitigating potential risks in developing students' entrepreneurial competencies effectively.

1. Introduction

The adoption of artificial intelligence (AI) in higher education has undergone remarkably rapid evolution over the past decade, yielding transformative impacts on teaching, learning, and institutional administration processes. The integration of AI technology has enhanced operational efficiency, enabled personalized learning experiences, and fostered innovative pedagogical strategies that challenge traditional educational paradigms (Alangari, 2024; Chandiok & Yadav, 2025; Machaba & Age, 2025; Aripin et al., 2026). AI-driven systems facilitate customized educational experiences through adaptive learning technologies, early intervention systems, and real-time progress tracking, ensuring more inclusive and effective learning environments (Ellington, 2025; Ouariach et al., 2025). Intelligent tutoring systems and adaptive learning paths provide personalized and interactive learning experiences, thereby enhancing student engagement and learning outcomes (Rawas & Samala, 2025).

Concurrently, entrepreneurship education in higher education has undergone significant evolution driven by historical trends and shifting economic landscapes. The rise of globalization, digitalization, and the gig economy has necessitated a shift in educational focus, with universities increasingly expected to prepare students for dynamic labor markets that value entrepreneurial skills and adaptability (Ilie & Budac, 2025; Frolova et al., 2019). Traditional educational models are gradually being supplanted by more innovative approaches that emphasize lifelong learning and entrepreneurial thinking, reflecting broader societal changes wherein entrepreneurship is viewed as a viable career pathway not only for business students but across disciplines (Enebe et al., 2025; Rodrigues et al., 2024).

Entrepreneurship education significantly enhances employability through the development of specific skills and competencies. These programs focus on cultivating creativity, resilience, and adaptability qualities

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essential for navigating the modern labor market (Huang et al., 2025; Killingberg et al., 2021). Engagement in entrepreneurship courses, competitions, and projects enables students to apply theoretical knowledge in practical settings, thereby enhancing their competitiveness in the job market (Walmsley et al., 2022; Li et al., 2025). Research demonstrates that entrepreneurship education positively impacts employability by improving students' skills and providing them with unique narratives that appeal to employers (Aslan et al., 2025; Abbes, 2024; Sulistyowati, 2022).

The convergence of AI and entrepreneurship education creates both opportunities and challenges that require in-depth understanding. The emergence of generative AI tools such as ChatGPT in November 2022 has dramatically transformed the higher education landscape, including entrepreneurship education. Generative AI tools are revolutionizing entrepreneurship education by enabling personalized learning experiences and real-time feedback, supporting various educational strategies such as business model simulations and adaptive instruction that accommodate individual student needs and learning styles (Yu et al., 2025; Park & Sung, 2023). Studies indicate that the integration of AI tools in educational settings significantly enhances students' self-efficacy and interest in entrepreneurship, which may lead to increased entrepreneurial career intentions (Dunan et al., 2025).

However, AI integration also presents various challenges. Concerns exist regarding students becoming overly dependent on AI tools, which may diminish critical thinking skills and potentially lead to academic dishonesty (Ji et al., 2025; He et al., 2025). The use of generative AI in education also raises ethical issues, including data privacy and the potential for biased information (Jayaweera, 2025; Treceñe et al., 2025). The effectiveness of generative AI tools varies across different disciplines; while ChatGPT enhances creativity in marketing and management, its impact on entrepreneurship students is less pronounced due to their higher baseline creativity and intrinsic motivation (Fisher et al., 2025).

Several systematic reviews and meta-analyses have explored AI integration in education, including entrepreneurship education. Razouki et al. (2025) conducted a systematic literature review using the PRISMA method to identify opportunities and limitations of AI in educational environments, analyzing 1,248 publications and selecting 20 relevant studies. Park et al. (2025) conducted a systematic review focusing on the educational impact of Large Language Models (LLMs) in entrepreneurship education, finding that LLMs enhance self-efficacy, cognitive engagement, and creative problem-solving. Yu et al. (2025) conducted a scoping review to identify the status quo of AI in entrepreneurship education, with a focus on intelligent technology adoption and pedagogical design.

Nevertheless, several research gaps remain unaddressed. First, there is a lack of focus on specific AI tools; although the potential of AI tools such as ChatGPT to enhance entrepreneurial competencies is acknowledged, research on the specific impacts of various AI tools and technologies in entrepreneurship education remains limited (Qi et al., 2025; Marchena Sekli & Portuguez-Castro, 2025). Second, more empirical studies are needed to validate the theoretical models and frameworks proposed in existing reviews; the practical implementation and long-term effects of AI integration in entrepreneurship education require further exploration. Third, research on cross-cultural applications of AI in entrepreneurship education and ensuring inclusive access, particularly for underserved populations, remains limited. Fourth, hybrid models that integrate AI with traditional pedagogy to maximize the benefits of both approaches are needed.

Based on these gaps, this study aims to conduct a systematic literature review of empirical studies on AI integration in entrepreneurship education in higher education. This study is guided by five research questions: (1) What AI technologies are implemented in entrepreneurship education? (2) What pedagogical approaches are employed in AI integration? (3) What is the impact of AI integration on student learning outcomes? (4) What are the challenges and barriers to implementation? (5) What recommendations exist for future practice and research? This synthesis of empirical evidence is crucial for adapting pedagogical approaches to meet rapidly changing workforce demands while enabling educators to foster more engaging, effective, and equitable learning environments that prepare students for future entrepreneurial challenges.

2. Method

2.1. Research Design

This study employed a systematic literature review (SLR) approach following the PRISMA 2020 guidelines (Page et al., 2021). The review protocol was registered and developed prior to the search execution to ensure methodological transparency and reproducibility.

The literature search was conducted on the Scopus database in December 2025. The selection of Scopus as the sole database was based on several considerations: First, it is the largest abstract and citation database with tens of millions of records. Second, it provides comprehensive coverage of business, management, computer science, and social science journals relevant to the research topic. Third, it indexes peer-reviewed

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journals with rigorous selection criteria. Fourth, it offers advanced search features with Boolean and proximity operators that enable precise literature retrieval.

The search string was constructed using a combination of keywords encompassing three main domains: AI technology, entrepreneurship education, and higher education. The proximity operator (W/5) was employed to ensure contextual relevance between AI and education terms. The final search string was as follows:

TITLE-ABS-KEY((("artificial intelligence" OR "AI technolog*" OR "machine learning" OR "generative artificial intelligence" OR "ChatGPT" OR "GPT-4" OR "large language model*" OR "LLM" OR "deep learning" OR "neural network*" OR "natural language processing") W/5 ("education" OR "learning" OR "teaching" OR "pedagogy" OR "curriculum")) AND ("entrepreneurship" OR "entrepreneurial" OR "entrepreneur*") AND ("higher education" OR "university" OR "universities" OR "college" OR "undergraduate" OR "postgraduate" OR "student*")) AND PUBYEAR > 2018 AND PUBYEAR < 2026 AND (LIMIT-TO(DOCTYPE,"ar") OR LIMIT-TO(DOCTYPE,"re")) AND (LIMIT-TO(LANGUAGE,"English")).

2.2. Eligibility Criteria

The selection of articles followed a rigorous set of inclusion and exclusion criteria to ensure the relevance and quality of the reviewed literature. Table 1 summarizes the criteria applied during the screening process.

Table 1. Inclusion and Exclusion Criteria for Article Selection

No.	Inclusion Criteria	Exclusion Criteria
1	Explicitly discussed the implementation of AI/ML/GenAI technologies	Merely mentioned AI without implementation details
2	Focused on the context of entrepreneurship education	Did not focus on entrepreneurship education
3	Situated in higher education settings (universities/colleges)	Situated in primary/secondary education settings
4	Examined aspects of teaching, learning, or curriculum	Purely technical AI articles without an educational component
5	Constituted empirical research or provided significant theoretical contributions	Editorials, opinion pieces, or conference abstracts
6	Presented clear methodology	Lacked clear methodology
7	Reported findings transparently	Full-text unavailable
8	—	Retracted by the publisher

2.3. Selection Process

The selection process followed the PRISMA flow consisting of four stages (Figure 1). The identification stage yielded 186 articles from the Scopus search. During the screening stage, all articles were screened based on title and abstract, resulting in 44 articles proceeding to the eligibility stage. In the full-text review stage, 19 articles were excluded with the following breakdown: 10 articles due to full-text unavailability, 6 articles for not meeting the criteria upon in-depth reading, and 3 articles due to retraction by Hindawi publisher in 2023 as a result of systematic manipulation in the publication process. Retraction status verification was conducted through the publisher's website, CrossRef, and the Retraction Watch database. The final stage yielded 25 articles that met all criteria for inclusion in the synthesis.

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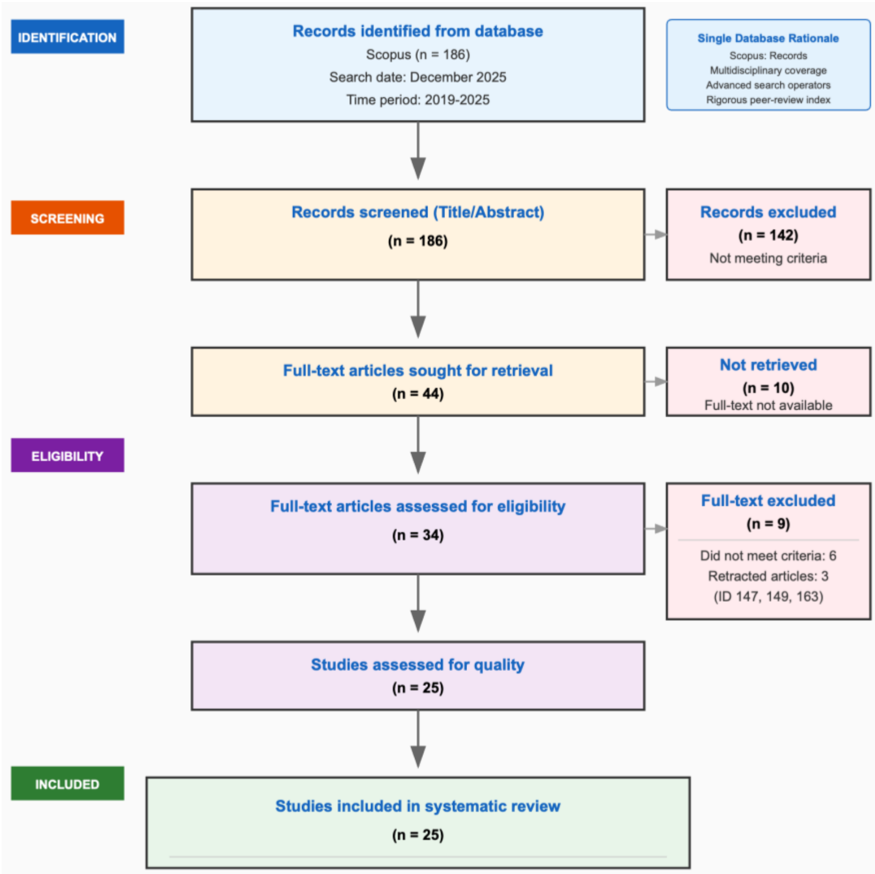

Figure 1. PRISMA Flow Diagram of the Article Selection Process

2.4. Data Extraction

Data were extracted using a standardized form encompassing: (1) study characteristics (authors, year, country, research design, sample size); (2) AI technology (type, specific tools, purpose of use); (3) pedagogical implementation (integration model, teaching approach, learning activities); (4) learning outcomes (measured variables, effect sizes); and (5) implementation challenges. Extraction was conducted independently with cross-verification to ensure accuracy.

2.5. Quality Assessment

The methodological quality of each article was assessed using criteria adapted from the Mixed Methods Appraisal Tool (MMAT). Five dimensions were evaluated: (1) clarity of research questions; (2) appropriateness of methodology; (3) validity of measurement; (4) rigor of analysis; and (5) clarity of results reporting. Each dimension was scored as 0 (not met) or 1 (met), yielding a total score of 0–5. Articles were categorized as high quality (score 4–5), moderate quality (2–3), or low quality (0–1). All 25 included articles were of moderate to high quality.

2.6. Data Analysis

Data synthesis was conducted narratively following the structure of the five research questions. Descriptive analysis encompassed the distribution of publications by year, country, and research design. Thematic analysis was performed to identify patterns in AI technologies, pedagogical approaches, learning outcomes, and implementation challenges. Quantitative findings (effect sizes, path coefficients) were synthesized to provide an overview of AI integration effectiveness. The synthesis results were used to develop a conceptual framework integrating findings across studies.

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3. Results and Discussion

3.1. Results

3.1.1. Characteristics of Included Studies

The selection process yielded 25 articles that met all inclusion criteria for analysis in this systematic review. Table 2 presents the complete list of included articles along with their main characteristics.

Table 2. Complete List of Articles Included in the Systematic Review (n=25)

No	ID	Author (Year)	Title	Journal	Country	Design
1	4	Zhang (2025)	Integrating AI with innovation and entrepreneurship education in universities	Discover Artificial Intelligence	China	Conceptual
2	7	Xie & Wang (2025)	Generative AI in entrepreneurship education enhances entrepreneurial intention through self-efficacy	Scientific Reports	China	Quantitative
3	10	Xie & Zhao (2025)	Entrepreneurship evaluation system for talent cultivation in artistic creativity and animation under AI	Scientific Reports	China	Technical
4	12	Lyu & Kamin (2025)	Digital-enhanced talent cultivation mechanisms in entrepreneurial universities	Future Technology	China	Quantitative
5	21	Zulfiqar et al. (2025)	AI-powered education: Driving entrepreneurial spirit among university students	Int. J. Management Education	Pakistan	Quantitative
6	29	Zhang & Hu (2025)	Research on Grade Point Innovation Based on Deep Learning for College Innovation Education	Sustainability	China	Quantitative
7	35	Yang et al. (2025)	A Deep Learning Model for Psychological Support in Student Entrepreneurship	IEEE Access	China	Quantitative
8	44	Tang et al. (2025)	The role of AI and entrepreneurial ecosystem in shaping digital entrepreneurship intentions	Asia Pacific J. Education	China	Quantitative
9	53	Niu (2025)	LSTM and Simulated Annealing for Entrepreneurship Path Planning in Smart Rural Contexts	Int. J. Agricultural & Env. Info Systems	China	Quantitative
10	79	Zhou et al. (2024)	Unveiling students' experiences and perceptions of AI usage in higher education	J. University Teaching & Learning Practice	UK	Mixed Methods
11	82	Fang et al. (2024)	An entrepreneurial education game for effectively tracing knowledge structure	Entertainment Computing	China	Quantitative
12	94	Somià & Vecchiarini (2024)	Navigating the new frontier: impact of AI on students' entrepreneurial competencies	Int. J. Entrepreneurial Behavior & Research	USA	Mixed Methods
13	100	Chen & Lu (2024)	Evaluating E-Learning Innovations Based on Neural Network for Entrepreneurship Systems	Computer-Aided Design & Applications	China	Quantitative
14	104	Yuan et al. (2024)	The impact of deep learning based-psychological capital with ideological and political education on entrepreneurial intentions	Scientiic Reports	China	Quantitative
15	106	Vecchiarini & Somià (2023)	Redefining entrepreneurship education in the age of artificial intelligence	Int. J. Management Education	USA	Quantitative
16	108	Wang (2023)	Organic integration of ideological and political education and entrepreneurship education based on ANN	Learning and Motivation	China	Quantitative
17	109	Hsieh & Maritz (2023)	Effects of flipped teaching on entrepreneurship students' learning motivation	Contemporary Educational Technology	Taiwan	Mixed Methods
18	121	Voronov et al. (2023)	Artificial Intelligence: A Catalyst for Entrepreneurship Education in the Baltics	Society. Integration. Education	Baltic States	Conceptual
19	124	Chen et al. (2023)	Intelligent decision support for quantified assessment of innovation ability via BP neural network	Mathematical Biosciences & Engineering	China	Quantitative

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No	ID	Author (Year)	Title	Journal	Country	Design
20	125	Li & Chen (2023)	VR-based Implementation System for Vocational Education using BP Neural Network	Computer-Aided Design & Applications	China	Quantitative
21	135	Wang et al. (2022)	Influence of College Students' Innovation and Entrepreneurship Intention	Frontiers in Psychology	China	Quantitative
22	138	Zou (2022)	Intelligent Course Recommendation Based on Neural Network for Innovation and Entrepreneurship	Informatica	China	Quantitative
23	154	Zhao et al. (2022)	Evaluation of Women's Entrepreneurship Education Based on BP Neural Network	Scientific Programming	China	Quantitative
24	156	Chen et al. (2022)	Innovation Farm: Teaching AI through gamified social entrepreneurship	Decision Sciences J. Innovative Education	USA	Technical
25	172	Chen & Yu (2020)	Adoption of Human Personality Development Theory Combined with Deep Neural Network	Frontiers in Psychology	China	Quantitative

Based on Table 2, the distribution of publication years demonstrates exponential growth, with 9 articles (36%) published in 2025, 4 articles (16%) in 2024, 6 articles (24%) in 2023, 5 articles (20%) in 2022, and 1 article (4%) in 2020. More than half of the articles (52%) were published within the 2024–2025 period, indicating significant acceleration in academic interest toward AI integration in entrepreneurship education, which can be attributed to the launch of ChatGPT in November 2022.

The geographical distribution reveals a very high concentration in Asia, particularly China, with 18 studies (72%). The United States contributed 3 studies (12%), while Pakistan, the United Kingdom, Taiwan, and the Baltic States each contributed 1 study (4%). China's dominance in this context reflects the Chinese government's focus on developing entrepreneurship education and innovation in higher education, as manifested in the national "Mass Entrepreneurship and Innovation" policy launched since 2015. This distribution also indicates an urgent need for cross-cultural studies in Western, African, Latin American, and Southeast Asian contexts. Figure 2 presents a more detailed visualization of the year and geographical distribution.

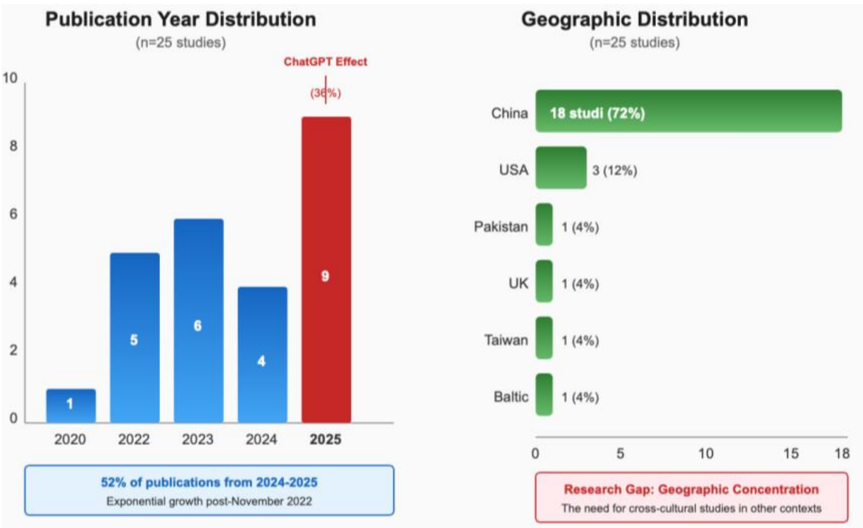

Figure 2. Distribution of Articles by Publication Year and Geographical Location

Regarding research design, quantitative studies dominated with 15 articles (60%), followed by mixed methods with 4 articles (16%), conceptual/framework studies with 4 articles (16%), and technical/computational studies with 2 articles (8%). The cumulative total of participants exceeded 5,500 students, with individual sample sizes ranging from n=28 to n=782. Studies with the largest samples were Lyu and Kamin (2025) with 782 respondents from eight universities in China, Zhang and Hu (2025) with 650 respondents from Yanshan University, and Chen and Yu (2020) with 518 respondents from several universities in China.

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3.1.1.1. AI Technologies in Entrepreneurship Education

Analysis of the 25 articles identified five main categories of AI technologies implemented in entrepreneurship education in higher education. Table 3 presents the distribution of technologies along with details of studies utilizing each category.

Table 3. Categories of Implemented AI Technologies

Technology Category	n	%	Studies
Neural Networks (BP, ANN, DNN)	12	48	Xie & Zhao (2025); Chen & Lu (2024); Wang (2023); Chen et al. (2023); Li & Chen (2023); Zou (2022); Zhao et al. (2022); Chen & Yu (2020); Zhang & Hu (2025); Yang et al. (2025); Niu (2025); Fang et al. (2024)
Generative AI (ChatGPT, LLM)	7	28	Xie & Wang (2025); Zulfiqar et al. (2025); Tang et al. (2025); Zhou et al. (2024); Somià & Vecchiarini (2024); Vecchiarini & Somià (2023); Chen et al. (2022)
Machine Learning (General)	4	16	Zhang (2025); Lyu & Kamin (2025); Hsieh & Maritz (2023); Voronov et al. (2023)
Deep Learning (LSTM, DKT)	3	12	Fang et al. (2024); Niu (2025); Wang et al. (2022)
Computer Vision (StyleGAN)	1	4	Xie & Zhao (2025)

Note: Some studies utilized more than one technology category

Neural networks, particularly Backpropagation Neural Network (BPNN), constituted the most dominant technology with implementation in 12 studies (48%). This technology was primarily used for automated evaluation and assessment systems. Chen et al. (2023) developed an improved BP Neural Network with 48 input nodes for quantitative assessment of students' innovation and entrepreneurship abilities with a maximum relative error of only 1.607%. Zhao et al. (2022) applied BPNN with momentum term ($\alpha=0.85$) for evaluating women's entrepreneurship education, yielding a comprehensive evaluation value of 92 points with high accuracy ($R=0.9207–0.9602$).

Generative AI, particularly ChatGPT, emerged as the second most utilized technology with 7 studies (28%). ChatGPT was employed for various pedagogical purposes including Business Model Canvas development, business idea generation, business plan feedback, and writing support. Xie and Wang (2025) found that Generative AI-Supported Entrepreneurship Education (GAISEE) significantly enhanced entrepreneurial self-efficacy ($\beta=0.523$, $p<0.001$) and entrepreneurial intention ($\beta=0.244$, $p<0.001$). Tang et al. (2025) conducted a multi-group comparison between ChatGPT and non-ChatGPT groups, finding that the ChatGPT group demonstrated stronger influence on digital entrepreneurial self-efficacy ($\beta=0.386$ vs $\beta=0.188$).

Specific tools identified in the studies included ChatGPT as the most frequently used (6 studies), IBM Watson AI Services encompassing Visual Recognition, Watson Assistant, Discovery, NLP, and Tone Analyzer for social entrepreneurship projects (Chen et al., 2022), Jasper AI for content generation (Zulfiqar et al., 2025), and Grammarly, QuillBot, and Canva AI for writing and design support (Zhou et al., 2024). Figure 3 presents a visualization of the distribution of AI technologies used in the studies.

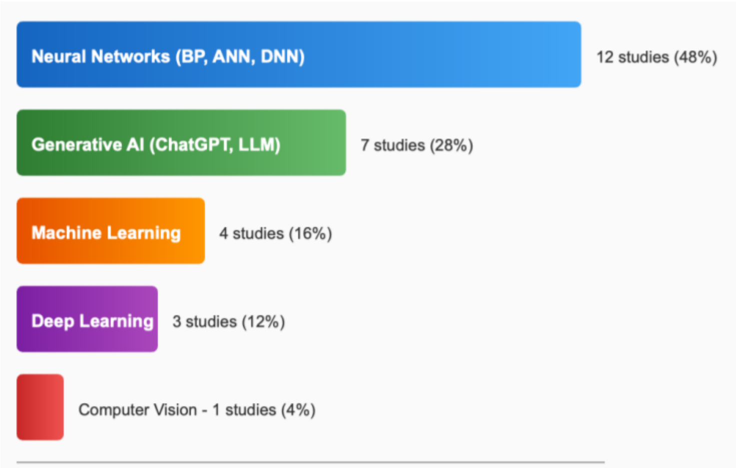

Figure 3. Distribution of AI Technologies in Included Studies

Temporal analysis revealed a clear evolution in AI technology adoption. The first phase (2020–2022) was dominated by traditional Neural Networks with a focus on evaluation systems, as demonstrated by studies from Chen and Yu (2020), Zou (2022), and Zhao et al. (2022). The second phase (2023) marked a transition to more

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complex Deep Learning approaches such as Deep Knowledge Tracing and LSTM for adaptive learning. The third phase (2024–2025) was characterized by an explosion in the use of Generative AI as a pedagogical tool that directly interacts with students.

3.1.1.2. Implementation and Pedagogical Approaches

Models of AI integration in entrepreneurship curricula can be categorized into three levels: the integrated/embedded model as the most dominant with 15 studies (60%), the supplementary model with 7 studies (28%), and the core/central model with 3 studies (12%). Table 4 presents the identified pedagogical approaches along with study details.

Table 4. Pedagogical Approaches in AI Integration

Pedagogical Approach	n	Studies	Implementation Characteristics
Experiential Learning	8	Somià & Vecchiarini (2024); Chen et al. (2022); Xie & Wang (2025); Tang et al. (2025); Zulfiqar et al. (2025); Li & Chen (2023); Vecchiarini & Somià (2023); Zhou et al. (2024)	Direct hands-on learning experiences with AI; BMC with ChatGPT; business simulations
Personalized/Adaptive Learning	6	Fang et al. (2024); Lyu & Kamin (2025); Zou (2022); Niu (2025); Zhang & Hu (2025); Chen & Yu (2020)	Learning paths tailored to individual needs; DKT-based adaptive systems
Project-Based Learning	5	Chen et al. (2022); Zulfiqar et al. (2025); Zhang (2025); Voronov et al. (2023); Tang et al. (2025)	Real startup projects with AI support; social entrepreneurship projects
Self-Directed Learning	4	Zhou et al. (2024); Hsieh & Maritz (2023); Xie & Wang (2025); Lyu & Kamin (2025)	Independent exploration of AI tools by students; student-driven AI exploration
Gamification	3	Fang et al. (2024); Chen et al. (2022); Li & Chen (2023)	Game-based learning with AI components; entrepreneurial education game
Flipped Learning	2	Hsieh & Maritz (2023); Zhang (2025)	Flipped learning with AI analytics; pre-class AI-assisted preparation

Experiential learning was the most frequently employed approach (8 studies). Somià and Vecchiarini (2024) implemented Business Model Canvas development activities with ChatGPT, where 53 students used AI for iterating and improving their business models. Chen et al. (2022) developed "Innovation Farm," combining gamification with IBM Watson AI Services, where students completed six assignment-based social entrepreneurship projects over one semester with a pitch competition providing real funding.

Implementation frameworks identified from the studies encompassed several comprehensive models. Zhang (2025) proposed the "Five-in-One Framework" integrating AI technology platforms, innovation laboratories, industry collaboration, curriculum integration, and assessment systems. This model includes a tiered curriculum where first and second-year students acquire AI awareness and basic literacy, third-year students focus on AI application in entrepreneurial tasks, and fourth-year students work on AI-driven innovation projects. Lyu and Kamin (2025) developed a multi-level model distinguishing formal institutional factors and informal factors, with findings that AI-powered personalized learning pathways constituted a significant predictor of entrepreneurial intention ($\beta=0.28$, $p<0.001$).

3.1.1.3. Impact on Learning Outcomes

Analysis of learning outcomes demonstrated consistency of positive findings across all studies. Table 5 presents a summary of measured outcomes along with effect sizes and study details.

Table 5. Summary of Learning Outcomes

Outcome Variable	n	Direction	Effect Size	Studies
Entrepreneurial Intention (EI)	10	Positive	$\beta=0.244–0.562$	Xie & Wang (2025); Tang et al. (2025); Zulfiqar et al. (2025); Lyu & Kamin (2025); Chen & Yu (2020); Wang et al. (2022); Zhang & Hu (2025); Hsieh & Maritz (2023); Somià & Vecchiarini (2024); Zhou et al. (2024)
Entrepreneurial Self-Efficacy (ESE)	8	Positive	$\beta=0.28–0.523$; $f^2=0.442$	Xie & Wang (2025); Tang et al. (2025); Zulfiqar et al. (2025); Lyu & Kamin (2025); Chen & Yu (2020); Somià & Vecchiarini (2024); Hsieh & Maritz (2023); Zhou et al. (2024)
Knowledge/ Skills Acquisition	7	Positive	Pre-post Δ ($p<0.001$)	Chen et al. (2022); Zulfiqar et al. (2025); Hsieh & Maritz (2023); Vecchiarini & Somià (2023); Zhang (2025); Voronov et al. (2023); Wang (2023)

ISSN: 2797-3174

Outcome Variable	n	Direction	Effect Size	Studies
Learning Motivation	5	Positive	BF_{10}=1.881×10^{53}	Hsieh & Maritz (2023); Chen et al. (2022); Zhou et al. (2024); Lyu & Kamin (2025); Fang et al. (2024)
Creativity/ Innovation	4	Mixed	r=0.45; -8% self-perceived	Somià & Vecchiarini (2024); Xie & Zhao (2025); Chen et al. (2022); Wang et al. (2022)
AI Competency/ Literacy	3	Positive	Pre-post (p<0.001)	Chen et al. (2022); Tang et al. (2025); Zhang (2025)

Entrepreneurial intention was the most frequently measured outcome (10 studies) with consistently positive findings. Xie and Wang (2025) reported that GAISEE directly enhanced EI (β=0.244, p<0.001) and indirectly through ESE mediation (indirect effect=0.191, p<0.001), with the model explaining 54.2% of EI variance (R^2=0.542). Tang et al. (2025) found that digital entrepreneurial self-efficacy was the strongest predictor of digital entrepreneurial intention with a path coefficient of β=0.562 and large effect size (f^2=0.491).

Entrepreneurial self-efficacy consistently functioned as a key mediator in the AI-EI relationship. Cross-study findings demonstrated path coefficients ranging from β=0.28–0.523 for the GAISEE→ESE relationship, with effect sizes classified as large (f^2=0.442 in Xie & Wang, 2025). Zulfiqar et al. (2025) reported an increase in R^2 for EI from 0.215 (before AI implementation) to 0.328 (after AI implementation), indicating a 52.6% increase in model explanatory power.

Studies with experimental designs provided stronger causal evidence. Chen and Yu (2020) employed a quasi-experimental design with experimental (n=259) and control (n=259) groups, finding that the experimental group demonstrated significantly greater improvement across all five measured dimensions (p<0.05): entrepreneurial possibility (+3.59 vs +2.11), behavior tendency (+6.91 vs +2.97), tenacity (+6.13 vs +3.94), strength (+7.03 vs +4.66), and optimism (+5.08 vs +3.37).

Hsieh and Maritz (2023) applied Bayesian analysis in an 18-week study of 106 entrepreneurship students in Taiwan, finding extremely strong evidence for increased intrinsic motivation (BF_{10}=1.881×10^{53}). The developed machine learning model explained 59.1% of final exam score variance (R^2=0.591). Chen et al. (2022), through the "Innovation Farm" program, demonstrated significant improvement across all seven outcomes (all p<0.001): AI knowledge increased from 4.2 to 8.3 (+4.1 points), entrepreneurial confidence from 5.1 to 8.9 (+3.8 points), and social problem awareness from 4.8 to 8.6 (+3.8 points).

However, findings related to creativity revealed nuances that warrant attention. Somià and Vecchiarini (2024) reported an 8% decrease in self-perceived creativity following ChatGPT use, although objective BMC quality improved. This finding indicates potential "deskilling" risk if students become overly dependent on AI for creative tasks.

3.1.1.4. Challenges and Barriers

Analysis identified six main categories of challenges in AI implementation for entrepreneurship education. Table 6 presents the distribution of challenges along with study details.

Table 6. Categories of AI Implementation Challenges

Challenge Category	n	Studies	Specific Examples
Technical Challenges	8	Zhou et al. (2024); Zhang (2025); Chen & Lu (2024); Voronov et al. (2023); Li & Chen (2023); Niu (2025); Fang et al. (2024); Wang (2023)	Infrastructure limitations; high software costs; technical complexity; AI hallucination
Faculty Readiness	6	Voronov et al. (2023); Zhang (2025); Wang (2023); Lyu & Kamin (2025); Chen & Lu (2024); Hsieh & Maritz (2023)	Lack of AI literacy; training needs; resistance to change
Ethical Concerns	5	Somià & Vecchiarini (2024); Zhou et al. (2024); Xie & Wang (2025); Tang et al. (2025); Vecchiarini & Somià (2023)	Academic integrity; plagiarism; over-reliance on AI; deskilling risk
Student Challenges	4	Zhou et al. (2024); Zulfiqar et al. (2025); Somià & Vecchiarini (2024); Tang et al. (2025)	AI anxiety; digital divide; unequal access; fear of becoming lazy thinkers
Institutional Barriers	4	Zhang (2025); Lyu & Kamin (2025); Voronov et al. (2023); Chen et al. (2022)	Policy gaps; lack of guidelines; curriculum rigidity
Assessment Challenges	3	Vecchiarini & Somià (2023); Hsieh & Maritz (2023); Somià & Vecchiarini (2024)	Difficulty measuring AI-enhanced learning; attribution of student vs AI contribution

Technical challenges constituted the most frequently reported barrier (8 studies), encompassing technological infrastructure limitations, high software licensing costs, and technical complexity in

ISSN: 2797-3174

implementation. Zhang (2025) identified insufficient AI infrastructure in many institutions as a primary barrier. Zhou et al. (2024), through a qualitative study at Queen Mary University of London, found that students expressed concerns about AI hallucination and uncertainty regarding AI usage policies.

Faculty readiness emerged as a significant challenge in 6 studies. Voronov et al. (2023) reported that faculty resistance and lack of training programs posed barriers in Baltic countries. Ethical concerns were identified in 5 studies, primarily related to academic integrity and plagiarism. Somià and Vecchiarini (2024) identified the ethical dilemma between AI assistance versus AI replacement, where the boundary between legitimate assistance and replacement of student capabilities becomes blurred.

3.1.1.5. Recommendations and Future Research Directions

Synthesis of recommendations from the 25 studies yielded implementation guidelines for various stakeholders. For educational institutions, recommendations include developing clear AI usage policies and ethical guidelines (Zhou et al., 2024; Somià & Vecchiarini, 2024), investing in AI literacy training programs for faculty (Voronov et al., 2023; Zhang, 2025), creating AI-integrated entrepreneurship curriculum frameworks (Zhang, 2025; Lyu & Kamin, 2025), and establishing innovation laboratories with adequate AI tool access (Chen et al., 2022).

For educators, recommendations encompass designing assignments that leverage AI as a collaborative tool rather than a replacement (Somià & Vecchiarini, 2024), implementing experiential learning with AI simulations (Fang et al., 2024), balancing AI assistance with critical thinking development (Zhou et al., 2024), and utilizing AI for personalized feedback and adaptive learning paths (Lyu & Kamin, 2025).

Identified research gaps include the need for longitudinal studies to track long-term impacts of AI integration on actual venture creation, cross-cultural studies beyond the dominant China context (72%), methodological diversification with more qualitative and mixed-methods studies, AI ethics frameworks in education, and comparative studies of the effectiveness of various specific GenAI tools.

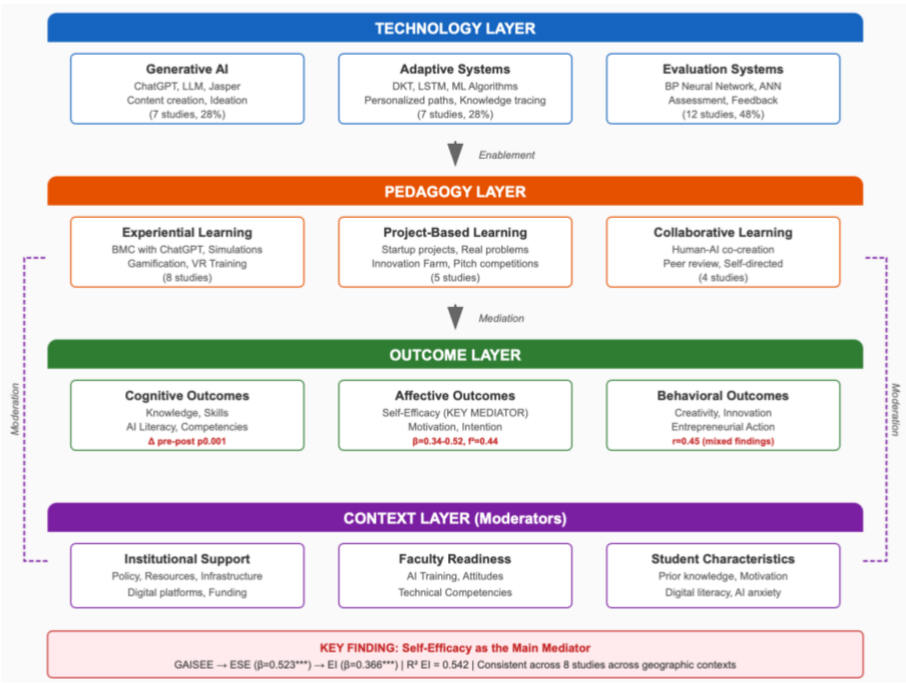

Figure 4. Integrated AI-Entrepreneurship Education Model (IAEEM)

Based on the synthesis of findings, this study proposes the Integrated AI-Entrepreneurship Education Model (IAEEM) comprising four layers as visualized in Figure 4: Technology Layer (Generative AI, Adaptive Systems, Evaluation Systems), Pedagogy Layer (Experiential, Project-Based, Collaborative), Outcome Layer (Cognitive, Affective, Behavioral), and Context Layer as moderator (Institutional Support, Faculty Readiness, Student Characteristics). Key relationships in the framework include Technology to Pedagogy (enablement), Pedagogy to Outcomes (mediation), and Context to All Layers (moderation), with Self-Efficacy as the key mediator consistently found across studies with path coefficients β=0.34–0.45.

ISSN: 2797-3174

3.2. Discussion

3.2.1. The Mediating Role of Self-Efficacy in the AI-Entrepreneurial Intention Relationship

The most consistent finding from this review is the crucial role of entrepreneurial self-efficacy (ESE) as a mediator in the relationship between AI-based educational interventions and entrepreneurial intention (EI). The analysis results demonstrate path coefficients ranging from $\beta=0.28–0.523$ for the GAISEE→ESE relationship with effect sizes classified as large ($f^2=0.442$). Xie and Wang (2025) reported that their model explained 54.2% of EI variance ($R^2=0.542$), with ESE significantly mediating the relationship (indirect effect=0.191, $p<0.001$).

This finding is consistent with recent research outside the review sample (Sulistyowati, 2022; Sulistyowati et al., 2024). Uzkurt et al. (2025) confirmed that ESE mediates the relationship between entrepreneurship education and EI, with government support serving as a moderator. Duong (2025), in a study of Vietnamese students, found a serial mediation model wherein AI literacy enhances e-entrepreneurial self-efficacy, which subsequently strengthens e-entrepreneurial intention. Pham and Le (2023) also demonstrated that ESE and family support significantly mediate the relationship between entrepreneurship education and EI in the Vietnamese context.

The psychological mechanisms underlying these findings can be explained through Social Cognitive Career Theory (SCCT), which emphasizes the role of self-efficacy beliefs in influencing career choices including entrepreneurial intentions (Dhali et al., 2025). The Stimulus-Organism-Response (SOR) Framework is also relevant in explaining how educational, psychological, and technological factors interact to foster EI, with ESE as the response mechanism to AI-based educational stimuli (Tandon et al., 2024). The practical implication of this finding is that AI-based entrepreneurship education programs should be explicitly designed to enhance student self-efficacy, not merely transfer technical knowledge.

3.2.2. Pedagogical and Ethical Challenges of Generative AI Integration

This review identified significant pedagogical and ethical challenges in integrating generative AI tools such as ChatGPT into entrepreneurship curricula. Eight studies (32%) reported technical challenges, six studies (24%) noted faculty readiness as a barrier, and five studies (20%) identified ethical concerns related to academic integrity.

These findings align with the broader literature. Guillén-Yparrea and Hernández-Rodríguez (2024) found that ChatGPT use can lead to unintentional plagiarism as students incorporate AI-generated content without proper attribution. Malik et al. (2025) revealed academicians' perspectives that there are risks of students becoming overly dependent on AI tools, thereby undermining the development of critical thinking and problem-solving skills essential in entrepreneurship. Troussas et al. (2026), in a comprehensive overview, underscored assessment credibility challenges as AI can generate responses that are difficult to distinguish from students' original work.

Regarding ethical concerns, data privacy and security constitute primary concerns as generative AI use involves handling large volumes of data (Cheng, 2025; Rożek, 2024). Algorithmic bias was also identified, wherein AI tools may perpetuate existing biases in training data, producing outputs that affect decision-making and learning outcomes (Jayatilake, 2025; Ortiz-Bonnin et al., 2025). This review recommends a balanced approach that combines technological innovation with ethical responsibility, encompassing the development of clear institutional policies, training programs for faculty and students, and continuous evaluation of AI's impact on learning.

3.2.3. Dominance of Studies from China and Implications for Cross-Cultural Generalization

Findings reveal a very high geographical concentration, with 72% of studies (18 of 25) originating from higher education institutions in China. This dominance reflects China's national policies such as "Mass Entrepreneurship and Innovation" launched since 2015, as well as the New Generation Artificial Intelligence Development Plan that emphasizes AI integration across various educational levels (Huang et al., 2024; Kshetri, 2025).

However, this geographical concentration raises serious questions about the generalizability of findings to other cultural contexts. Lyu et al. (2021) emphasized that entrepreneurship teaching in China is strongly influenced by cultural factors, with an emphasis on collective learning and teacher authority that differs from individualistic approaches in Western countries. Wang et al. (2024), in a critical study, demonstrated how "West as method" approaches often fail when applied to Chinese entrepreneurship education contexts without local adaptation.

ISSN: 2797-3174

Cao and Kusakabe (2025), in a China-Japan cross-cultural study, found that although core constructs such as the Technology Acceptance Model (TAM) remain robust, cultural variables significantly influence perceived ease of use and usefulness of AI tools. Factors such as digital literacy, resistance to AI, and resource allocation vary significantly across countries (Wang et al., 2025; Yan et al., 2025). The implication of this finding is an urgent need for cross-cultural studies that adapt AI implementation strategies to the local context of each country, considering differences in educational philosophy, cultural values, and institutional systems.

3.2.4. Superiority of Neural Networks in Entrepreneurial Competency Assessment

This review found that neural network-based assessment systems, particularly BP Neural Network, dominated with 12 studies (48%) utilizing this technology for entrepreneurial competency evaluation. Neural network-based systems demonstrated high accuracy with a maximum relative error of only 1.607% (Chen et al., 2023) and a comprehensive evaluation value of 92 points with R=0.9207–0.9602 (Zhao et al., 2022).

The advantages of neural network systems compared to traditional methods encompass several aspects. In terms of accuracy and objectivity, one study reported prediction accuracy of 92.3% with Mean Squared Error (MSE) of 0.016, demonstrating superior nonlinear learning and generalization capabilities (Li, 2025). Neural networks also offer discrimination rates exceeding 0.90 and user-friendliness reaching 97.75%, with the ability to process complex and non-linear data for more nuanced evaluation (Liu & Li, 2025). Regarding scalability, neural network models trained on data from more than 1,000 students across various institutions provide a scalable framework for assessing entrepreneurial competencies (Xu et al., 2025). These systems can also adapt to individual learning patterns and provide personalized feedback through frameworks such as the Entrepreneurial Skill Augmented Neural Network (ESANN), which uses deep learning for adaptive real-time feedback (Li, 2025).

Nevertheless, implementation challenges persist, including the need for technical expertise, algorithm transparency, and continuous validation. Wang et al. (2023) noted that although neural networks offer substantial advantages, challenges such as model interpretability and the need for large training datasets must be addressed.

3.2.5. AI's Impact on Creativity and Critical Thinking

Findings related to creativity revealed nuanced results. Somià and Vecchiarini (2024) in this review reported an 8% decrease in self-perceived creativity following ChatGPT use, although objective Business Model Canvas quality improved. This paradoxical finding indicates potential "deskilling" risk if students become overly dependent on AI for creative tasks.

Recent literature provides deeper perspectives. Fisher et al. (2025), in a randomized controlled trial, found that ChatGPT's impact on business students' creativity varies based on discipline and students' baseline characteristics, emphasizing the need for tailored approaches. Park et al. (2025), in a systematic review of LLM applications, concluded that AI tools can scaffold ideation, support inquiry, and provide formative feedback crucial for creative problem-solving and opportunity recognition in entrepreneurship. However, Zaky (2025) cautioned that AI applications can impose rigid frameworks that constrain creative thinking and innovation, potentially causing emotional disengagement and performance anxiety.

Regarding critical thinking, findings also demonstrated mixed results. AI-assisted collaborative learning (CCL) was proven to enhance learning performance, AI awareness, and reduce cognitive load; however, non-AI-assisted collaborative learning (NCCL) groups excelled in critical thinking (Ahmed et al., 2025). Dunan et al. (2025) found that AI in e-entrepreneurship training enhances digital skills and innovation diffusion in Indonesia but emphasized the importance of balance between AI assistance and independent thinking skill development. Revised educational frameworks incorporating AI-specific competencies are required to foster critical thinking in AI-driven environments, with key elements such as ethical reasoning, collaboration, and reflective thinking (Weng et al., 2025).

3.2.6. Theoretical and Practical Implications

Based on the synthesis of findings, this study proposes the Integrated AI-Entrepreneurship Education Model (IAEEM), which integrates four layers: Technology Layer, Pedagogy Layer, Outcome Layer, and Context Layer as moderator. This model extends existing theoretical frameworks by incorporating the specific role of AI in entrepreneurship education contexts while acknowledging the complexity of interactions between technology, pedagogy, and contextual factors.

Practical implications encompass three levels. At the institutional level, the development of comprehensive AI policies, investment in technological infrastructure, and AI literacy training programs for faculty are required. At the curricular level, recommendations include integrating AI as a collaborative tool rather than a replacement,

ISSN: 2797-3174

implementing experiential learning with AI simulations, and balancing AI assistance with critical thinking development. At the individual level, students need to be equipped with AI literacy, ethical awareness, and the ability to critically evaluate AI-generated outputs.

3.2.7. Limitations and Future Research Agenda

This review has several limitations. The use of a single database (Scopus) may have missed relevant studies from other databases. The dominance of studies from China (72%) limits generalizability to other cultural contexts. The majority of studies employed cross-sectional designs; thus, causality cannot be definitively confirmed. Publication bias may also result in under-representation of studies with negative or null findings.

The future research agenda includes the need for longitudinal studies to track long-term impacts of AI integration on actual venture creation, cross-cultural studies that test the generalizability of findings across various cultural contexts and educational systems, mixed-methods research combining quantitative and qualitative approaches for deeper understanding, and the development of comprehensive AI ethics frameworks for entrepreneurship education.

4. Conclusion

This systematic literature review of 25 empirical studies on AI integration in entrepreneurship education in higher education yielded several substantive findings. Neural networks (48%) and generative AI (28%) were the dominant technologies, with experiential learning as the most effective pedagogical approach. Entrepreneurial self-efficacy was confirmed as a key mediator between AI-based educational interventions and entrepreneurial intention, with path coefficients β=0.28–0.523 and large effect sizes (f^2=0.442). AI integration consistently enhanced entrepreneurial intention, self-efficacy, and knowledge acquisition. However, an 8% decline in self-perceived creativity indicates potential deskilling risks. Primary challenges include technical infrastructure limitations, faculty readiness, and ethical concerns regarding academic integrity. The geographical concentration in China (72%) limits cross-cultural generalizability. This study proposes the Integrated AI-Entrepreneurship Education Model (IAEEM) as a conceptual framework. Future research should prioritize longitudinal studies tracking actual venture creation, cross-cultural investigations, and AI ethics framework development. These findings provide an empirical foundation for higher education institutions to optimize AI integration while mitigating potential risks in preparing students for an increasingly digital entrepreneurial ecosystem.

Author Contributions

Jejen Jaenal Aripin: Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft. Suryana: Supervision, Validation, Writing – review & editing. Heny Hendrayati: Supervision, Validation, Writing – review & editing, Project administration. Raya Sulistyowati: Writing – review & editing, Validation. Amirul Afif Muhamat: Writing – review & editing, Validation. Farizki Maulana Rafliansyah: Data curation, Visualization, Writing – review & editing. All authors have read and approved the final manuscript.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability

All data supporting the findings of this study are derived from published articles indexed in the Scopus database. The complete list of included studies (n=25) and the data extraction results are available within the article. Additional data are available from the corresponding author upon reasonable request.

Declaration on AI Use

The authors declare that AI-assisted tools (e.g., ChatGPT) were used solely for language editing and readability improvement during manuscript preparation. All intellectual content, including research design, data collection, analysis, interpretation, and writing, was conducted entirely by the authors. The authors take full responsibility for the accuracy and integrity of the work.

References

Abbes, I. (2024). Shaping entrepreneurial intentions through education: An empirical study. *Sustainability, 16*(22), 10070. https://doi.org/10.3390/su162210070

Ahmed, F., Lo, Y. T., & Chen, S. (2025). Developing entrepreneurial mindset among non-business majors through experiential learning and AI tools. In *Proceedings of the 25th European Conference on Knowledge Management* (Vols. 1–2). Academic Conferences and Publishing Limited.

ISSN: 2797-3174

Alangari, H. (2024). *Disrupting education: Artificial intelligence in higher education*. https://doi.org/10.1108/978-1-83549-486-820241004

Aripin, J. J., Hendrayati, H., Suryana, S., Jusoh, A., Marimon, F., & Marhadi, M. (n.d.). Psychological mediation mechanisms in entrepreneurship education and entrepreneurial intention: A comparative analysis of business and engineering students. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.5868128

Aslan, M., Indiran, L., Vivekananth, S., Wiyata, W., Yanamandra, R., Abdul Kohar, U. H., & Quanzhen, B. (2025). Factors influencing entrepreneurial intention: A cross-country comparison of five countries. *Studies in Higher Education*. https://doi.org/10.1080/03075079.2025.2519787

Cao, L., & Kusakabe, T. (2025). Understanding how the entrepreneurship education portfolio affects undergraduates' entrepreneurial intentions: A cross-cultural study of China and Japan. *The International Journal of Management Education, 23*(3), 101259. https://doi.org/10.1016/j.ijme.2025.101259

Chandiok, S., & Yadav, A. (2025). Unveiling the influence of artificial intelligence on advancing higher education. In S. K. Singh (Ed.), *Industry 4.0: Agriculture, rural and women development* (pp. 215–234). Springer.

Choi, H., & Kim, S. (2023). Proposal of smart guide system for cultural heritage of archaeological sites using IoT: Focusing on Hoeamsa temple site in Yangju, Korea. *Mathematical Biosciences and Engineering, 20*(5), 8745. https://doi.org/10.3934/mbe.2023384

Chen, Y., & Lu, Z. (2024). Evaluating e-learning innovations in education management based on neural network for entrepreneurship systems. *Computer-Aided Design and Applications, 21*(S5), 127–142.

Chen, Y., & Yu, X. (2020). Adoption of human personality development theory combined with deep neural network in college students' entrepreneurship education. *Frontiers in Psychology, 11*, 1493.

Chen, Y., Zhang, H., Liu, Y., Jiang, Y., & Lu, J. (2022). Innovation farm: Teaching artificial intelligence through gamified social entrepreneurship. *Decision Sciences Journal of Innovative Education, 20*(4), 214–228. https://doi.org/10.1111/dsji.12253

Cheng, E. C. K. (2025). Pedagogies involving the use of AI generative tools for teaching and learning in higher education institutions. In *Signals and Communication Technology* (pp. 123–140). Springer. https://doi.org/10.1007/978-3-031-96855-6_5

Dhali, S., Al Masud, A., Islam, M. F., Rahman, S., & Szabó, K. (2025). Fostering entrepreneurial mindset: Examining the synergy of education, social networks, and growth in emerging economies. *International Journal of Community Well-Being, 8*, 45.

Dunan, A., Mudjiyanto, B., Setiawan, A. B., Awaluddin, E., & Hartiningsih, H. (2025). Artificial intelligence in e-entrepreneurship training: Enhancing digital skills and innovation diffusion in Indonesia. *International Journal of E-Entrepreneurship and Innovation, 13*(1), 1–18. https://doi.org/10.4018/IJEEI.386065

Duong, C. D. (2025). AI literacy and higher education students' digital entrepreneurial intention: A moderated mediation model of AI self-efficacy and digital entrepreneurial self-efficacy. *Industry and Higher Education*.

Ellington, L. M. (2026). Personalized education in the age of AI: Innovations and implications. In *AI, personalization, equity, and the future of learning* (pp. 369–390). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3373-5097-4.ch013

Enebe, N. B., Mahlaule, C., Segotso, T., & Sobopha, Z. (2025). Exploring the role of higher education in fostering entrepreneurship education among undergraduate students in South Africa. In *Springer proceedings in business and economics* (pp. 145–162). Springer.

Fang, M., Chen, Y., & Liu, J. (2024). An entrepreneurial education game for effectively tracing the knowledge structure of college students. *Entertainment Computing, 50*, 100634. https://doi.org/10.1016/j.entcom.2023.100632

Fisher, R., Gogan, T., Williams, J., Pham, T., & Nguyen, J. (2025). Can ChatGPT enhance business student creativity? Evidence from a randomised controlled trial. *Studies in Higher Education, 50*(4), 678–695.

Frolova, Y., Zotov, V. B., Mukhin, K. Y., Kurilova, A. A., & Tyutrin, N. O. (2019). Discussion on key concepts in modern entrepreneurship education. *Journal of Entrepreneurship Education, 22*(4), 406–406.

Guillén-Yparrea, N., & Hernández-Rodríguez, F. (2024). Unveiling generative AI in higher education: Insights from engineering students and professors. In *Proceedings of the IEEE Global Engineering Education Conference* (pp. 1–8). IEEE. https://doi.org/10.1109/EDUCON60312.2024.10578876

He, Y., Xiao, K., Shi, Z., & Zhao, L. (2025, May). "Dependence" or "critical thinking"? The thinking choices of education doctoral students in generative AI environment: Qualitative research based on interview. In *Proceedings of the 5th International Conference on Artificial Intelligence and Education (ICAIE)* (pp. 498–503). IEEE.

Hsieh, H.-M., & Maritz, A. (2023). Effects of flipped teaching on entrepreneurship professional students' learning motivation: Bayesian analysis and machine learning predictions. *Contemporary Educational Technology, 15*(4), ep458.

Huang, Q., Kumarasinghe, P. J., & Jayarathna, G. S. (2024). Navigating the future: Exploring AI adoption in Chinese higher education through the lens of diffusion theory. *Interdisciplinary Journal of Information, Knowledge, and Management, 19*, 567–589.

Huang, Y., Yuan, Y., Sun, W., & Li, P. (2025). From classroom to workplace: How entrepreneurship education influences university students' employability. *Humanities and Social Sciences Communications, 12*, 156. https://doi.org/10.1057/s41599-025-05316-7

ISSN: 2797-3174

Ilie, L., & Budac, C. (2025). An overview of the effectiveness of entrepreneurship education in universities. *Studies in Business and Economics, 20*(1), 293–303.

Jayatilake, T. (2025, July). Designing an ethical framework for the integration of generative AI in higher education: Balancing stakeholder interests and enhancing learning outcomes. In *Proceedings of the International Conference on Artificial Intelligence in Education* (pp. 334–339). Springer Nature Switzerland.

Jayaweera, I. G. U. D. (2025, February). Revolutionizing education: Generative AI as a catalyst for personalized learning and innovative teaching practices. In *Proceedings of the International Conference on Advanced Research in Computing (ICARC)* (pp. 1–6). IEEE.

Ji, Y., Zhan, Z., Li, T., Wang, Y., & Lyu, S. (2025). Human–machine cocreation: The effects of ChatGPT on students' learning performance, AI awareness, critical thinking, and cognitive load in a STEM course toward entrepreneurship. *IEEE Transactions on Learning Technologies, 18*(2), 345–360.

Killingberg, N. M., Kubberød, E., & Blenker, P. (2021). Preparing for a future career through entrepreneurship education: Towards a research agenda. *Industry and Higher Education, 35*(5), 528–540.

Kshetri, N. (2025). Artificial intelligence in China's education: Policy agendas, innovation drivers, and global consequences. *IT Professional, 27*(1), 45–52. https://doi.org/10.1109/MITP.2024.3456789

Li, H., Ma, H., Hui, X., & Wang, Q. (2025). Exploring the impact of entrepreneurship module on employability development among non-business students. *The International Journal of Management Education, 23*(2), 100978.

Li, J. (2025). Entrepreneurial skill augmented neural network (ESANN): A deep learning approach for enhancing entrepreneurial competencies in teachers. *International Journal of Computational Intelligence Systems, 18*, 45.

Li, J., & Chen, R. (2023). Development of a virtual reality-based implementation system for vocational education using BP neural network. *Computer-Aided Design and Applications, 20*(S6), 78–92.

Liu, J., & Li, T. (2025). Evaluation college students' innovation and entrepreneurship ability using MLP-based neural network model. In *Proceedings of the 3rd IEEE International Conference on Networks, Multimedia and Information Technology* (pp. 1–6). IEEE.

Lyu, J., Shepherd, D. M., & Lee, K. (2021). Teaching entrepreneurship in China: Culture matters. *International Journal of Entrepreneurial Behavior & Research, 27*(5), 1285–1310.

Lyu, Z., & Kamin, Y. (2025). Digital-enhanced talent cultivation mechanisms in entrepreneurial universities: An AI-integrated multi-level analysis of student entrepreneurial intentions. *Future Technology, 4*(4), 117–130.

Machaba, F., & Age, T. J. (2026). The impact of artificial intelligence on administration, teaching, and learning functions. In *AI smart-enabled architecture and infrastructure for higher education* (pp. 151–180). IGI Global Scientific Publishing.

Malik, A., Khan, M. L., Hussain, K., Hashmi, S., & Tarhini, A. (2025). AI in higher education: Unveiling academicians' perspectives on teaching, research, and ethics in the age of ChatGPT. *Interactive Learning Environments, 33*(3), 456–475.

Marchena Sekli, G., & Portuguez-Castro, M. (2025). Fostering entrepreneurial success from the classroom: Unleashing the potential of generative AI through technology-to-performance chain: A multi-case study approach. *Education and Information Technologies, 30*, 1–25.

Niu, T. (2025). LSTM and simulated annealing for entrepreneurship path planning in smart rural contexts. *International Journal of Agricultural and Environmental Information Systems, 16*(1), 1–18.

Ortiz-Bonnin, S., Rejón-Guardia, F., & Blahopoulou, J. (2025). Artificial intelligence at university: A training to promote the responsible use of ChatGPT among students. *Praxis Educativa, 20*(1), 1–18. https://doi.org/10.5212/PraxEduc.v.20.23456.012

Ouariach, S., Ouariach, F. Z., & Khaldi, M. (2025). Artificial intelligence as a harbinger of engagement and collaboration. In M. Khaldi (Ed.), *Ethics and AI integration into modern classrooms* (pp. 78–98). IGI Global.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*. https://doi.org/10.1136/bmj.n71

Park, J.-H., Kim, S.-J., & Lee, S.-T. (2025). AI and creativity in entrepreneurship education: A systematic review of LLM applications. *AI, 6*(2), 34.

Park, J. Y., & Sung, C. S. (2023). The impact of generative AI tools on the development of entrepreneurial career intentions. In *Proceedings of the Australasian Conference on Information Systems* (pp. 1–12). ACIS.

Pham, H. H., & Le, T. L. (2023). Entrepreneurial education and entrepreneurial intention among higher education students in Vietnam: Do entrepreneurial self-efficacy and family support matter? *Higher Education, Skills and Work-Based Learning, 13*(5), 912–930.

Qi, A., Wang, Y., & Wang, Z. (2025). Research on innovation and entrepreneurship education in universities based on artificial intelligence technology. In *Lecture notes on data engineering and communications technologies* (pp. 345–358). Springer.

Rawas, S., & Samala, A. D. (2025). From chalkboards to chatbots: AI in modern education. In A. D. Samala (Ed.), *Education, future jobs and smart systems in the age of artificial intelligence: Part B* (pp. 56–78). IGI Global.

Razouki, H., Hair, A., Cherradi, B., & Razouki, A. (2025). Assessing the impact of artificial intelligence on the role of the teacher, student learning and the transmission of knowledge in education. *International Journal of Modern Education and Computer Science, 17*(1), 1–15. https://doi.org/10.5815/ijmecs.2025.05.04

ISSN: 2797-3174

Rodrigues, A. L., Correia, A. B., Rego, C., & Quaresma, R. (2024). Entrepreneurship education: A tool for a new paradigm in higher education? In *Interdisciplinary approaches for educators' and learners' well-being: Transforming education for sustainable development* (pp. 189–208). Springer.

Rożek, K. (2024). GPT models in higher education: Challenges and opportunities. In *Proceedings of the International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management* (pp. 345–352). SGEM.

Somià, T., & Vecchiarini, M. (2024). Navigating the new frontier: The impact of artificial intelligence on students' entrepreneurial competencies. *International Journal of Entrepreneurial Behavior & Research, 30*(8), 1852–1876.

Sulistyowati, R., Djatmika, E. T., Hermawan, A., & Rahayu, W. P. (2022). The linkage of entrepreneurship education and students' entrepreneurial readiness: The mediating role of entrepreneurship ecosystem. *Journal of Higher Education Theory and Practice, 22*(14), 28–35.

Sulistyowati, R., Maula, F. I., Mahendra, A. M., & Fahrullah, A. R. (2024). Ecosystems and entrepreneurial intention among students: The mediating role of Islamic values. *Perspektivy nauki i obrazovania, 3*(69), 113–129.

Tandon, V., Jain, D., Joseph, D., & James, B. V. (2024). The mediating role of self-efficacy and networks in entrepreneurial intentions: Entrepreneurial education, university support, and user innovation in rural India. *New Practices for Entrepreneurship Innovation, 12*, 234–256.

Tang, L., Zhang, Y., & Wang, H. (2025). The role of AI and entrepreneurial ecosystem in shaping students' digital entrepreneurship intentions. *Asia Pacific Journal of Education, 45*(1), 56–78. https://doi.org/10.1080/02188791.2025.2577334

Treceñe, J. K. D., Patiga, R. O. A., Odal, B. B., Peña, C. M., & Dayaon, M. C. (2025). The emergence of generative AI in higher education: Exploring the perceived challenges among teachers and students. In J. K. D. Treceñe (Ed.), *Pitfalls of AI integration in education: Skill obsolescence, misuse, and bias* (pp. 123–145). IGI Global. https://doi.org/10.4018/979-8-3693-7890-1.ch007

Troussas, C., Krouska, A., Mylonas, P., & Sgouropoulou, C. (2025). ChatGPT in education: A critical overview of breakthroughs and challenges. In *Novel & intelligent digital systems conferences* (pp. 152–170). Springer Nature Switzerland. https://doi.org/10.1007/978-3-032-10824-1_12

Uzkurt, C., Ekmekcioglu, E. B., Ceyhan, S., & Pampal, A. S. (2025). Entrepreneurial self-efficacy as a mediator in the entrepreneurship education–entrepreneurial intention nexus: The moderating role of government-based support and financial concerns. *Entrepreneurship Education, 8*(1), 131–156.

Vecchiarini, M., & Somià, T. (2023). Redefining entrepreneurship education in the age of artificial intelligence: A participatory approach. *The International Journal of Management Education, 21*(3), 100854. https://doi.org/10.1016/j.ijme.2023.100854

Voronov, V. V., Lavrinenko, O., & Stashane, J. (2023). Artificial intelligence: A catalyst for entrepreneurship education in the Baltics. *Society. Integration. Education. Proceedings of the International Scientific Conference, 1*, 724–735.

Walmsley, A., Decker-Lange, C., & Lange, K. (2022). Conceptualising the entrepreneurship education and employability nexus. In A. Walmsley (Ed.), *Theorising undergraduate entrepreneurship education: Reflections on the development of the entrepreneurial mindset* (pp. 45–68). Palgrave Macmillan.

Wang, M., Liu, Y., & Chen, J. (2022). The influence of college students' innovation and entrepreneurship intention based on deep learning. *Frontiers in Psychology, 13*, 990169.

Wang, X., Liu, S., & Zhang, L. (2024). How the "West as method" fails: A study of entrepreneurship education from the perspective of China. *The International Journal of Management Education, 22*(3), 100912.

Wang, X., Zhao, S., Xu, X., Chen, Y., & Lei, V. N.-L. (2025). AI adoption in Chinese universities: Insights, challenges, and opportunities from academic leaders. *Acta Psychologica, 243*, 104567. https://doi.org/10.1016/j.actpsy.2025.104567

Wang, Y. (2023). Organic integration of ideological and political education and entrepreneurship education based on artificial neural network. *Learning and Motivation, 83*, 101912.

Weng, X., Gu, M. M., Xia, Q., & Chiu, T. K. F. (2025). SWOT analysis of AI empowered entrepreneurship education: Insights from digital learners in higher education. *Thinking Skills and Creativity, 55*, 101678.

Xie, H., & Zhao, Z. (2025). The analysis of entrepreneurship evaluation system for talent cultivation in artistic creativity and animation under AI. *Scientific Reports, 15*, 2847.

Xie, Y., & Wang, S. (2025). Generative artificial intelligence in entrepreneurship education enhances entrepreneurial intention through self-efficacy and university support. *Scientific Reports, 15*, 4521.

Xu, C., Liu, R., & Li, H. (2025). An association analysis and assessment model of college students' entrepreneurial ability based on graph neural network. *Discover Internet of Things, 5*, 23. https://doi.org/10.1007/s43926-025-00243-0

Yan, Y., Wu, B., Pi, J., & Zhang, X. (2025). Perceptions of AI in higher education: Insights from students at a top-tier Chinese university. *Education Sciences, 15*(2).

Yang, T., Liu, Y., & Zhang, W. (2025). A deep learning model for psychological support in student entrepreneurship. *IEEE Access, 13*, 15678–15692.

Yu, G., Ramayah, T., & Lin, Z. (2025). Toward understanding the role of generative AI in entrepreneurship education: A systematic review. *Computers and Education: Artificial Intelligence*, 100470.

ISSN: 2797-3174

Yuan, R., Chen, Y., & Zheng, Y. (2024). The impact of deep learning-based psychological capital with ideological and political education on entrepreneurial intentions. *Scientific Reports, 14*(1), 18132.

ISSN: 2797-3174