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Entrepreneurial Attributes and Pedagogical Pathways in Higher Education: A Scoping Review (2022–2026)

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Abstract. This study presents a scoping review of recent empirical research on entrepreneurship education, examining how different pedagogical approaches develop entrepreneurial attributes among university students. Based on 45 peer-reviewed studies (2022–2026), a frequency-based analytical matrix was constructed to map the relationships between teaching strategies and entrepreneurial attributes. Grounded in the Theory of Planned Behaviour (TPB) and competency-based frameworks, the findings reveal a structural imbalance, characterized by a dominant focus on psychological constructs, such as entrepreneurial intention, mindset, and self-efficacy, relative to competency-based, digital, and sustainability-oriented attributes. Formal course-based approaches primarily reinforce intention-related outcomes, whereas experiential and innovation-driven pedagogies (e.g., project-based learning, STEM programs, and simulations) are more strongly associated with competency development, including creativity, problem-solving, and risk-taking. Digital and AI-based interventions enhance technological readiness, while sustainability-oriented education remains underrepresented. The study contributes an integrated analytical framework linking pedagogical approaches to entrepreneurial attributes and highlights the need for a shift toward capability-centered and sustainability-integrated entrepreneurship education, with implications for curriculum design and future research.

Keywords: Entrepreneurship education; Entrepreneurial attributes; Scoping review; Teaching strategies; Generation Z

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1. Introduction

Entrepreneurship is widely recognized as a key driver of economic growth, innovation, and societal transformation (Acs et al., 2004; Reynolds et al., 2003). In contemporary contexts, however, it extends beyond venture creation to include sustainability transitions, digital transformation, and adaptive career development. Universities therefore play an increasingly central role in cultivating entrepreneurial capability among Generation Z students navigating technologically disruptive and environmentally uncertain labour markets (Lans et al., 2014; Rauch & Hulsink, 2015). Entrepreneurship education has consequently evolved beyond business planning toward developing entrepreneurial attributes, such as opportunity recognition, resource mobilization, uncertainty tolerance, and value creation, across diverse professional pathways (Fayolle & Gailly, 2015; Nabi et al., 2017).

As digitalization and sustainability reshape entrepreneurial ecosystems, constructs including digital capability, resilience, and sustainable value orientation have gained prominence (Nambisan et al., 2019; Ploum et al., 2018). Empirical research on university students has been largely grounded in the Theory of Planned Behaviour (Ajzen, 1991; Kautonen et al., 2015), emphasizing attitude, subjective norms, and perceived behavioural control. Parallel trait-based perspectives highlight self-efficacy, risk-taking, and proactiveness (Brandstätter, 2011; Zhao et al., 2010), while competency and entrepreneurial mindset frameworks increasingly integrate dispositional and cognitive dimensions within structured pedagogical models (López-Núñez et al., 2022).

Despite this theoretical richness, post-2022 research reveals three key limitations (e.g., Ashraf et al., 2024; Mirhabibi et al., 2025; Hasan, 2026). First, entrepreneurial attributes, ranging from mindset and competencies to digital and sustainability constructs, are conceptualized and operationalized inconsistently across studies, leading to fragmented and non-cumulative knowledge development and limiting the ability to identify which dimensions robustly predict entrepreneurial intention and behaviour across contexts. Second, the relationship between educational interventions and entrepreneurial development remains theoretically fragmented, with limited integration between psychological constructs and pedagogical intervention mechanisms. While some studies focus on intention determinants, others examine experiential, sustainability-focused, or digital programs, yet few syntheses integrate psychological drivers and pedagogical mechanisms within a unified framework.

Consequently, it remains unclear whether education primarily influences intention through attitudinal change, self-efficacy enhancement, cognitive alertness, competency development, or multi-layered mediation pathways. Third, the rapid expansion of sustainability and digital entrepreneurship research has introduced new constructs without clarifying their structural relationship to established predictors such as self-efficacy and perceived behavioural control. Taken together, these limitations highlight a critical need for a systematic and integrative synthesis of recent empirical research that can simultaneously capture (1) the range of entrepreneurial attributes examined in contemporary studies and

(2) the pedagogical mechanisms through which these attributes are developed. A scoping review is particularly appropriate in this context, as it enables the mapping of heterogeneous constructs, identification of emerging patterns, and integration of fragmented theoretical and empirical streams across entrepreneurship education research.

Accordingly, this study conducts a scoping review of empirical research published between 2022 and 2026 to address the following research questions:
RQ1: What entrepreneurial attributes are most frequently identified in empirical studies as important for Generation Z and university students in higher education contexts?

RQ2: What pedagogical approaches and educational interventions are empirically shown to enhance entrepreneurial attributes among university students?

To address these questions, the study employs a structured scoping review methodology to systematically identify, categorize, and synthesize empirical evidence, enabling both descriptive mapping and conceptual integration of the literature. This approach enables the study to provide both a comprehensive mapping of the field and a theoretically informed synthesis of how entrepreneurship education shapes entrepreneurial development.

2. Literature Review

2.1 Entrepreneurial Intention and Psychological Foundations

Entrepreneurial intention is widely recognized as the most proximal predictor of entrepreneurial behaviour (Krueger et al., 2000; Kautonen et al., 2015). Ajzen's (1991) Theory of Planned Behaviour (TPB) remains the dominant framework in higher education research, proposing that intention is shaped by attitude, subjective norms, and perceived behavioural control (PBC). In entrepreneurial contexts, PBC, commonly operationalized as entrepreneurial self-efficacy, consistently shows the strongest predictive power (Kautonen et al., 2015), highlighting the importance of perceived capability alongside favourable attitudes.

Trait-based perspectives complement TPB by emphasizing dispositional factors such as risk-taking, proactiveness, innovativeness, and locus of control (Brandstätter, 2011; Zhao et al., 2010). Entrepreneurial self-efficacy bridges trait and cognitive approaches. Grounded in Social Cognitive Theory (Bandura, 1997), it captures beliefs in one's ability to perform entrepreneurial tasks and is strongly associated with both intention and behaviour (McGee et al., 2009). Collectively, these perspectives frame entrepreneurial intention within an integrated psychological architecture of cognition, disposition, and perceived competence.

2.2 From Traits to Entrepreneurial Mindset and Competency Frameworks

Early entrepreneurship research emphasized relatively stable personality traits, whereas recent scholarship focuses on dynamic and developable constructs, particularly entrepreneurial competencies and mindset. Competency-based frameworks conceptualize entrepreneurship as learnable capabilities, such as

opportunity recognition, resource mobilization, planning, and action orientation. The EntreComp framework, for example, integrates ideas and opportunities, resources, and into-action dimensions within a comprehensive competence model (López-Núñez et al., 2022). Entrepreneurial mindset extends this approach by incorporating cognitive, affective, and behavioural dimensions, emphasizing how individuals interpret opportunities, tolerate ambiguity, create value, and sustain agency under uncertainty. Distinctions between elaborative (planning-oriented) and implemental (action-oriented) mindsets suggest stage-based entrepreneurial cognition (Shiri et al., 2025). This shift reframes the field from fixed traits to developable thinking patterns shaped by education.

However, heterogeneous operationalizations, ranging from opportunity orientation to innovation and agency, highlight the need for greater conceptual integration. While these constructs, entrepreneurial traits, mindset, and competencies, are often used interchangeably in the literature, they represent conceptually distinct yet interrelated dimensions. Entrepreneurial traits typically refer to relatively stable dispositional characteristics (e.g., risk-taking propensity and locus of control), whereas entrepreneurial mindset reflects dynamic cognitive and affective orientations toward opportunity recognition, ambiguity tolerance, and value creation.

In contrast, competency-based frameworks conceptualize entrepreneurship as a set of learnable and developable capabilities, such as opportunity recognition, resource mobilization, and action execution. This distinction is critical, as it suggests that different pedagogical approaches may target different layers of entrepreneurial development, ranging from psychological predispositions to actionable competencies.

2.3 Entrepreneurship Education as an Intervention Mechanism

Entrepreneurship education has evolved from traditional business planning toward experiential, interdisciplinary, and technology-enhanced pedagogies (Nabi et al., 2017). Contemporary approaches include project-based learning, simulations, hackathons, sustainability modules, and digital entrepreneurship training. These interventions are theorized to influence entrepreneurial development through multiple pathways. Experiential learning, grounded in mastery experience, strengthens perceived behavioural control by engaging students in real-world problem-solving and venture simulation, thereby enhancing entrepreneurial self-efficacy (Souitaris et al., 2007).

Sustainability-oriented programs incorporate systems thinking and long-term value creation (Ploum et al., 2018), while digital and AI-enabled training links technological competence to entrepreneurial readiness (Nambisan et al., 2019). Despite this diversity, the mechanisms connecting education to entrepreneurial intention remain theoretically fragmented. Studies emphasize attitudinal change, competency development, or cognitive mediators such as entrepreneurial alertness, with limited integrative comparison across pathways.

2.4 Opportunity Recognition, Alertness, and the Intention–Behaviour Gap

Beyond attitudinal and competency models, recent research increasingly highlights entrepreneurial alertness and opportunity recognition as proximal cognitive drivers of entrepreneurial action. Alertness refers to individuals' sensitivity to environmental cues and their capacity to identify exploitable opportunities, which educational interventions, particularly those involving real market challenges, can strengthen. At the same time, the well-documented intention–behaviour gap complicates the assumption that heightened intention automatically results in venture creation (Adam & Fayolle, 2015). Commitment, resilience, and contextual support moderate the translation of intention into action, suggesting that intention alone provides an incomplete account of entrepreneurial outcomes. Accordingly, entrepreneurial development is best conceptualized as a multi-layered process integrating psychological reinforcement, cognitive transformation, and contextual embedding.

2.5 Toward an Integrative Perspective

Contemporary entrepreneurship education literature spans four interrelated streams: (1) intention-based cognitive models, (2) personality and trait-based determinants, (3) competency and mindset frameworks, and (4) pedagogical intervention models. Although each offers valuable insights, empirical studies often remain conceptually fragmented. This fragmentation is particularly evident in post-2022 research, where sustainability and digital entrepreneurship constructs have been incorporated without clarifying their structural relationship to established psychological predictors such as self-efficacy and perceived behavioural control. Accordingly, a structured synthesis of recent empirical evidence is needed to identify which entrepreneurial attributes consistently emerge across contexts and to clarify the pedagogical mechanisms through which higher education shapes entrepreneurial development among Generation Z students.

Building on these perspectives, this study adopts an integrative conceptual lens in which entrepreneurial development is understood as a multi-layered process. At the foundational level, psychological attributes (e.g., attitudes, self-efficacy, and risk tolerance) shape entrepreneurial intention, as suggested by the Theory of Planned Behaviour. At a second level, cognitive and mindset-oriented constructs (e.g., entrepreneurial mindset and opportunity recognition) influence how individuals interpret and act upon opportunities.

At a third level, competency-based attributes reflect the ability to translate intention into action through skills such as problem-solving, resource mobilization, and execution. These layers are further influenced by pedagogical interventions, which may differentially target psychological, cognitive, or competency-based dimensions. This integrative perspective provides a foundation for systematically mapping how teaching strategies align with specific entrepreneurial attributes. Recent studies further emphasize that bridging this gap requires not only intention enhancement but also capability development and contextual support mechanisms, particularly in university-based entrepreneurship ecosystems (e.g., Ashraf et al., 2024; Nayak et al., 2024).

3. Methodology

3.1 Research Design

This study employed a scoping review approach to synthesize recent empirical quantitative evidence on entrepreneurial attributes and pedagogical interventions in higher education. A structured approach ensured transparency and rigor in line with established reporting standards (Moher et al., 2009; Page et al., 2021). While incorporating systematic screening and quality appraisal, the review adopts a scoping logic to map conceptual domains, identify thematic patterns, and examine emerging research (2022–2026).

The focus on quantitative and quasi-experimental studies enhances conceptual comparability and enables identification of statistically supported determinants and mechanisms. A scoping review approach was selected over a systematic review or meta-analysis due to the conceptual heterogeneity of entrepreneurial attributes and pedagogical interventions. Given the diversity of constructs, measures, and analytical models, a scoping review is more appropriate for mapping key concepts, identifying research gaps, and integrating fragmented theoretical and empirical evidence.

3.2 Search Strategy

A comprehensive literature search was conducted across five major academic databases: EBSCOhost, ERIC, SAGE Journals, ScienceDirect and Scopus. The search covered publications from January 2022 to February 2026, capturing recent developments in entrepreneurship education, sustainability-oriented entrepreneurship, and digital entrepreneurship research. Search strings combined population, construct, and educational context terms using Boolean operators. The core search structure was as follows: ("Generation Z" OR "Gen Z" OR "undergraduate students" OR "college students" OR "university students") AND ("entrepreneurial traits" OR "entrepreneurial characteristics" OR "entrepreneurial mindset") AND (education OR learning OR pedagogy OR teaching) Searches were conducted within titles, abstracts, and keywords. Only peer-reviewed journal articles written in English were included. Duplicate records were removed prior to screening.

3.3 Eligibility Criteria

Studies were included if they employed empirical quantitative or mixed-methods designs with inferential statistical analyses (e.g., regression, SEM, PLS-SEM, mediation/moderation, or quasi-experimental pre–post designs); focused on university or higher vocational students; examined entrepreneurial traits, mindset, competencies, intention, commitment, or behaviour; and investigated determinants of intention or the impact of entrepreneurship education interventions. Only peer-reviewed English-language journal articles were considered. Studies were excluded if they focused on established entrepreneurs or firm-level outcomes, targeted secondary school populations, were purely qualitative or conceptual, or lacked inferential statistical analysis.

3.4 Screening Procedure

The screening process followed the PRISMA 2020 framework (Page et al., 2021), covering identification, screening, eligibility, and inclusion stages. Titles and

abstracts were first assessed for relevance to entrepreneurial attributes and higher education interventions, followed by full-text evaluation against predefined criteria. After duplicate removal and multi-stage screening, 45 empirical quantitative studies met all inclusion criteria and were retained for synthesis. The process is illustrated in the PRISMA-ScR flow diagram (Figure 1). The screening process was conducted by multiple researchers to enhance reliability. Discrepancies in study selection were discussed and resolved through consensus. This collaborative approach helped ensure consistency in applying the inclusion and exclusion criteria.

3.5 Data Extraction

A standardized data extraction protocol was developed to ensure systematic comparison across studies. Extracted information included publication details, country context, sample characteristics, research design, entrepreneurial constructs examined, teaching strategies (if applicable), theoretical frameworks, and key findings. To enhance reliability, extraction procedures were pilot tested on a subset of studies and refined for consistency in construct categorization. Particular attention was given to identifying whether constructs functioned as predictors, mediators, moderators, or outcome variables within empirical models. To ensure consistency in data coding, the extraction framework was iteratively refined, and cross-checking procedures were applied among the researchers. Any ambiguities in construct classification were resolved through discussion to enhance coding reliability.

Table 1: Extracted Study Characteristics

Characteristic	Description
Author(s)	Author(s)' full names
Year	Year of publication
Country of Study	Country or region where the study was conducted
Sample Size and Population Characteristics	Total number of participants and key demographic or contextual characteristics (e.g., age range, major/discipline, gender distribution, prior entrepreneurial experience)
Educational Level	Level of education of participants (e.g., University, Vocational, or Mixed)
Research Design	Study design classification (e.g., quantitative, mixed methods, experimental, quasi-experimental, case study)
Entrepreneurial Traits Examined	Specific entrepreneurial traits investigated (e.g., creativity, risk-taking propensity, resilience, entrepreneurial mindset, self-efficacy)
Teaching strategies Described	Instructional approaches or interventions implemented (e.g., project-based learning, experiential learning, design thinking, simulation, mentorship programs)
Theoretical Frameworks	Underpinning theories or conceptual frameworks applied (e.g., experiential learning theory, theory of planned behaviour, social cognitive theory)
Key Findings	Main findings related to entrepreneurial traits development or teaching effectiveness

3.6 Data Synthesis

Given heterogeneity in constructs, measures, and statistical models, a quantitative meta-analysis was not feasible. A thematic and frequency-based synthesis was therefore conducted. Studies were organized using a predefined framework covering five domains: (1) Psychological Core Attributes, (2) Cognitive and Mindset Attributes, (3) Competency-Based Attributes, (4) Contextual and Social Attributes, and (5) Sustainability and Digital Attributes. Within each domain, studies were classified by analytical orientation (e.g., trait-based, TPB-based, competency-based, or intervention-focused). Frequency mapping identified recurring attributes, while conceptual integration examined mediating mechanisms and structural pathways linking education to entrepreneurial intention and related outcomes. This approach highlighted dominant psychological drivers, emerging domains, and underexplored dimensions in contemporary entrepreneurship education research.

3.7 Quality Considerations

Although a formal numerical quality scoring system was not applied, methodological rigor was systematically considered based on predefined criteria, including sample adequacy, use of validated instruments, reporting of reliability and validity, and transparency of analytical procedures. This approach aligns with the exploratory nature of scoping reviews, which prioritize conceptual mapping over effect-size aggregation.

3.8 Methodological Limitations

Certain methodological constraints should be noted. The predominance of cross-sectional designs limits causal inference, and construct heterogeneity precluded statistical aggregation. Publication bias cannot be fully excluded, and the restriction to English-language journal articles may affect generalizability. Nevertheless, the systematic synthesis provides a robust conceptual mapping of recent empirical evidence. A formal review protocol (e.g., PROSPERO or OSF) was not registered, as the study follows a scoping review design focused on conceptual mapping rather than clinical or intervention-based outcomes. However, all procedures were conducted systematically and transparently in accordance with PRISMA-ScR guidelines.

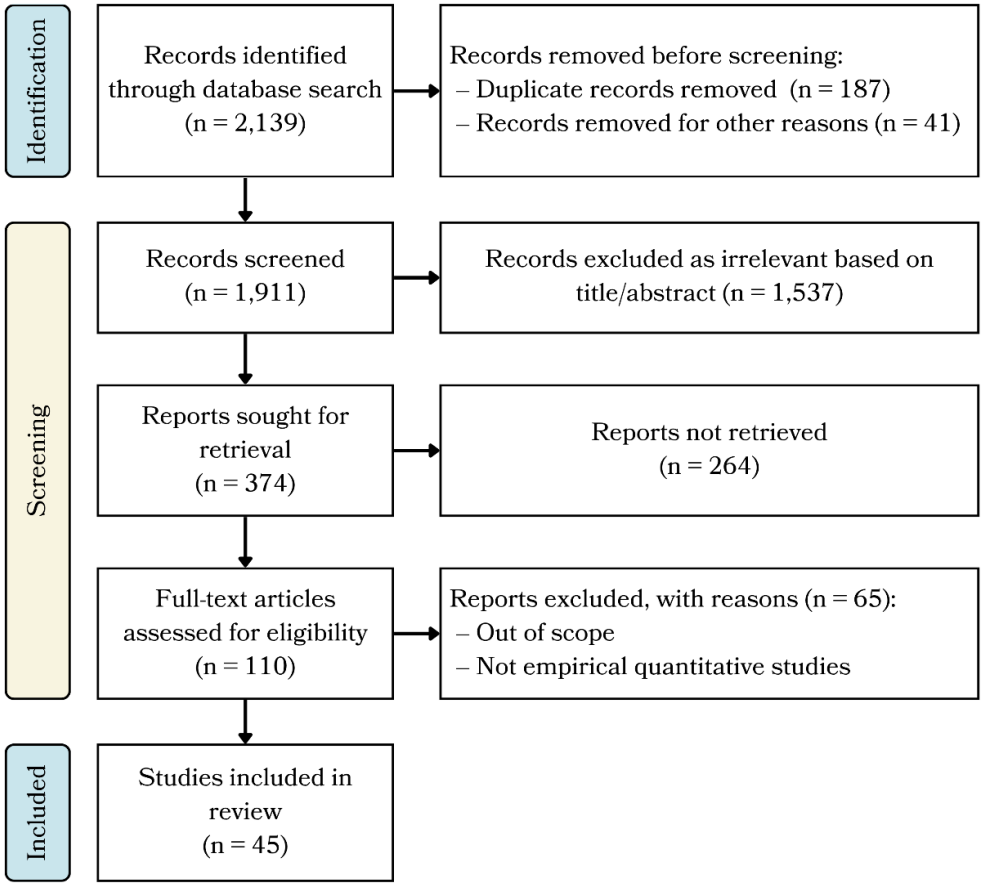

Figure 1: PRISMA-ScR Flow Diagram

Figure 1 presents the PRISMA-ScR screening process. Of 2,139 records identified, 187 duplicates and 41 additional records were removed, leaving 1,911 for title and abstract screening. After excluding 1,537 records, 374 reports were sought for retrieval; 264 were not accessible. A total of 110 full-text articles were assessed, and 65 were excluded for being out of scope or not meeting the empirical quantitative criteria. Ultimately, 45 studies were included in the final review.

4. Results

4.1 Characteristics of Included Studies

This section presents the characteristics of the included studies. Figure 2 illustrates the yearly distribution of publications from 2022 to 2026, providing an overview of recent trends in entrepreneurship education research.

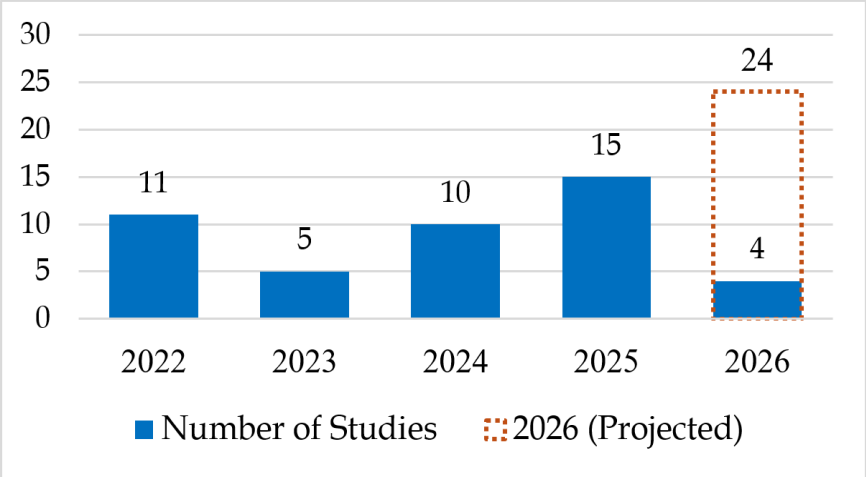

Figure 2: Yearly Distribution of Included Studies (2022-2026)

The distribution of studies demonstrates a steady increase in publications over time, peaking in 2025 (n = 15), which accounts for 33.3% of the total included studies. The year 2022 contributed 11 studies (24.4%), followed by 2024 with 10 studies (22.2%). In contrast, 2023 recorded five studies (11.1%). The four publications identified in 2026 (8.9%) reflect partial-year publication activity. Overall, the findings indicate a marked upward trend in entrepreneurship education research after 2023, culminating in a peak in 2025. If the current trajectory continues, the projected number of publications in 2026 is expected to reach 24 studies.

This upward trend suggests a growing scholarly interest in entrepreneurship education, particularly in response to rapid technological and sustainability transitions. The increase in publications after 2023 may reflect the expanding integration of digital transformation and sustainability into entrepreneurship education research agendas.

As shown in Figure 3, the geographical distribution of the included studies demonstrates a broad international scope, with Europe representing the largest regional concentration (n = 13), followed by the Middle East (n = 8). East Asia (n = 6) and Southeast Asia (n = 5) also show substantial representation, indicating strong research activity across Asian contexts. North America and Africa each contributed four studies, while South Asia accounted for three studies and South America for two studies.

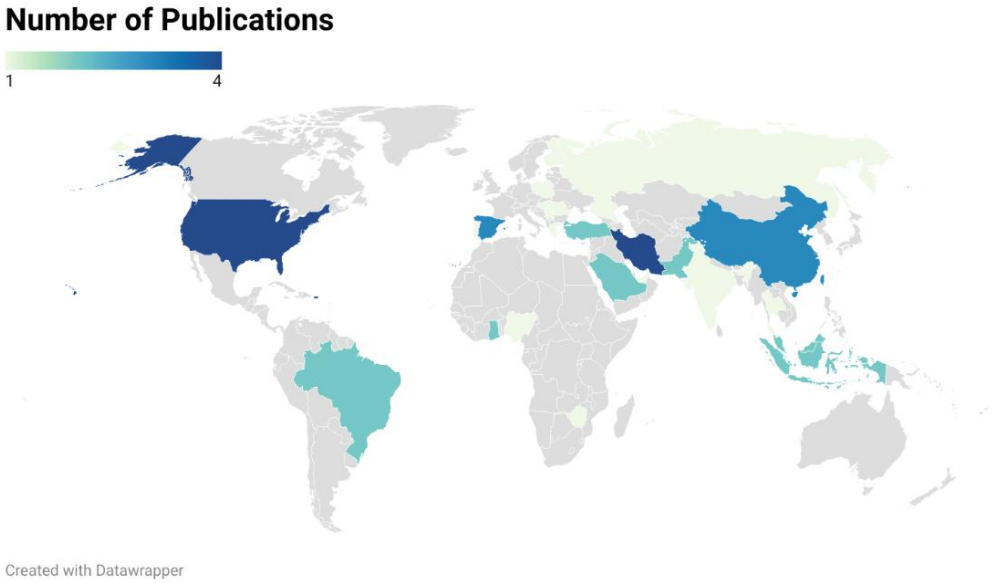

Figure 3: Geographical Distribution of Included Studies (2022–2026) (n = 45)

Figure 4 further illustrates the regional distribution, highlighting a concentration of studies in Europe and the Middle East, which together account for nearly half of the total sample (46.7%). Overall, these findings suggest that while entrepreneurship education research between 2022 and 2026 is geographically diverse, it remains unevenly distributed across regions.

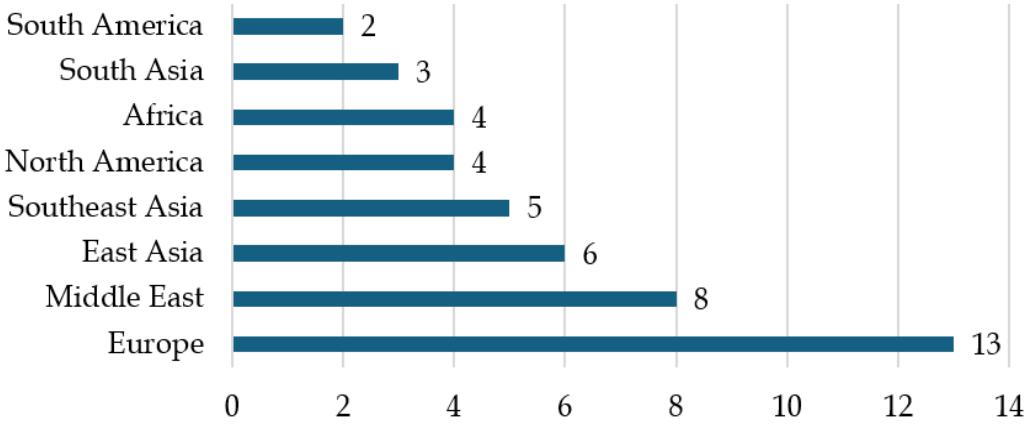

Figure 4: Number of Studies by Region

4.2 Entrepreneurial Attributes identified

This section examines the distribution of entrepreneurial attributes identified across the included studies. Table 2 presents the frequency and percentage of each attribute, highlighting the relative prominence of different entrepreneurial constructs in recent research.

Table 2: Entrepreneurial Attributes Frequency across Included Studies

Entrepreneurial Attributes	n	Percentage
Self-efficacy / Perceived Behavioural Control (PBC)	23	50.0%
Entrepreneurial Intention	22	47.8%
Entrepreneurial Mindset	18	39.1%
Attitude toward Entrepreneurship	16	34.8%
Risk-taking / Risk Tolerance	15	32.6%
Opportunity Recognition / Alertness	14	30.4%
Entrepreneurial Competencies	12	26.1%
Social Norms	11	23.9%
Innovation Capability	10	21.7%
Leadership Orientation	8	17.4%
Entrepreneurial Motivation / Motives	8	17.4%
Family Entrepreneurial Background	7	15.2%
Resilience	5	10.9%
Fear of Failure	4	8.7%
Locus of Control	3	6.5%
Technological Confidence / Digital Capability	6	13.0%
Sustainability Orientation	7	15.2%

As presented in Table 2, self-efficacy (or perceived behavioural control) emerged as the most frequently examined construct (n = 23; 50.0%), followed closely by entrepreneurial intention (n = 22; 47.8%) and entrepreneurial mindset (n = 18; 39.1%). Attitude toward entrepreneurship (n = 16), risk-taking (n = 15), and opportunity recognition (n = 14) were also prominently represented. Other constructs, including entrepreneurial competencies (n = 12), social norms (n = 11), and innovation capability (n = 10), appeared with moderate frequency. In contrast, resilience (n = 5), fear of failure (n = 4), and locus of control (n = 3) were examined less frequently. Overall, the distribution suggests a stronger emphasis on cognitive and motivational determinants of entrepreneurial intention in recent literature, with comparatively less attention given to dispositional factors.

Counts represent the aggregated number of trait occurrences identified through deductive coding across the 45 included studies; because individual studies may report multiple traits, category frequencies exceed the total number of studies. The distribution indicates a strong concentration on psychological core attributes, particularly self-efficacy, risk-taking, and motivational constructs, followed by cognitive and mindset-related dimensions. Competency-based and contextual factors appear moderately represented, whereas sustainability- and digital-oriented attributes remain comparatively underexamined.

Taken together, the pattern reflects a continued psychological emphasis in entrepreneurship education research, with emerging but still limited integration of sustainability and digital capability perspectives.

Table 3: Predefined Entrepreneurial Attribute Categories Used for Data Extraction

Categories	Representative Traits
A. Psychological Core Attributes	Self-efficacy / PBC, Attitude, Risk-taking, Fear of failure, Locus of control, Resilience, Entrepreneurial motivation
B. Cognitive & Mindset Attributes	Entrepreneurial mindset, Entrepreneurial alertness / opportunity recognition, Innovation capability, Proactivity, Agency, Metacognition
C. Competency-Based Attributes	Entrepreneurial competencies, Planning competence, Resource mobilization, Action orientation, Entrepreneurial knowledge
D. Contextual & Social Attributes	Social norms, Family entrepreneurial background, Institutional support, Cultural orientation, Academic discipline
E. Sustainability & Digital Attributes	Sustainability orientation, Digital capability, Technological confidence

Table 3 outlines the predefined trait categories used to structure the data extraction process, grouping traits into five conceptual domains: psychological core, cognitive and mindset, competency-based, contextual and social, and sustainability and digital attributes.

Figure 5 presents the aggregated frequency of these categories across the included studies. Psychological Core Attributes (n = 74) and Cognitive and Mindset Attributes (n = 62) were most prominent, followed by Competency-Based Attributes (n = 41) and Contextual and Social Attributes (n = 34). Sustainability and Digital Attributes appeared least frequently (n = 20). Overall, the distribution indicates a stronger emphasis on psychological and cognitive dimensions in recent entrepreneurship education research.

This distribution indicates that contemporary entrepreneurship education research remains heavily grounded in intention-based and psychological frameworks. The relatively lower representation of competency-based and sustainability-oriented attributes suggests a gap between traditional theoretical models and emerging demands for capability-driven and sustainability-focused entrepreneurship.

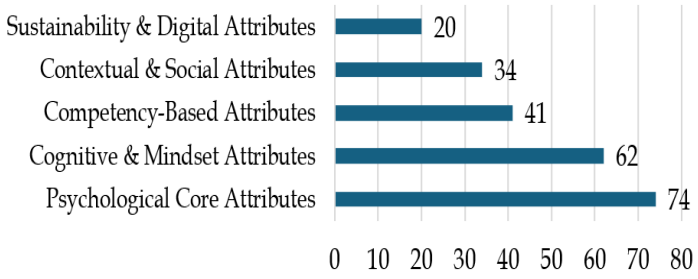

Figure 5: Aggregated Frequency of Attribute Categories

4.3 Teaching Strategies Identified in Included Studies

Table 4: Summary of Teaching Strategies and Targeted Entrepreneurial Attributes

Teaching Strategy	Targeted Entrepreneurial Attributes	n
Formal Entrepreneurship Education (course-based)	Entrepreneurial intention	6
	Entrepreneurial mindset	5
	Self-efficacy	4
	Entrepreneurial attitude	3
	Entrepreneurial behavior	2
AI / Digital-Based Training	Digital entrepreneurial intention	3
	AI capability / Digital competence	2
	Opportunity recognition	1
Gamification / Simulation	Entrepreneurial intention	2
	Entrepreneurial orientation	1
	Technological confidence	1
Entrepreneurial Minded Learning (EML)	Value creation mindset	2
	Curiosity & innovation thinking	1
Innovation Competitions / Project-Based	Innovation mindset	2
	Problem-solving	2
	Teamwork	1
STEM-based EE	Creativity	2
	Risk-taking	2
	Self-confidence	1
Sustainability-oriented EE	Sustainable entrepreneurial intention	2
	Sustainability mindset	2
Nature-based experiential learning	Sustainability attitude	1
Story-driven / Narrative pedagogy	Entrepreneurial identity / Agency	1
High-tech Simulation (VR / advanced tech)	Problem-solving	1
	Entrepreneurial thinking	1

The synthesis of 24 empirical intervention-based studies reveals a dominant concentration of formal entrepreneurship education programs targeting psychological and intention-based attributes. Entrepreneurial intention (n=6), mindset (n=5), and self-efficacy (n=4) emerge as the most frequently developed constructs, suggesting that traditional course-based approaches continue to emphasize cognitive and motivational dimensions rather than applied competencies. In contrast, AI- and digital-based interventions demonstrate a distinct pattern, primarily enhancing digital entrepreneurial readiness and technology-oriented opportunity recognition.

Similarly, experiential formats such as innovation competitions and STEM-based entrepreneurship education show stronger associations with creativity, risk-taking, and problem-solving skills. Sustainability-oriented entrepreneurship education, although less frequent, exhibits a focused impact on sustainability mindset and sustainable entrepreneurial intention, indicating the emergence of a distinct pedagogical sub-stream within entrepreneurship education. Overall, the distribution matrix highlights a structural imbalance in the literature, with psychological constructs significantly outweighing competency-based and

sustainability-oriented attributes. Importantly, the distribution also reveals a systematic alignment between pedagogical approaches and the types of entrepreneurial attributes developed. While formal education predominantly targets motivational and cognitive constructs, experiential and innovation-driven approaches are more strongly associated with applied competencies. This pattern highlights the need for more deliberate pedagogical design that aligns teaching strategies with desired learning outcomes.

Teaching Strategy ↓	Intention	Mindset	Self-Efficacy	Attitude	Creativity	Risk	Digital	Sustainability	Problem-solving	Total (n)
Formal EE	6	5	4	3	0	0	0	0	0	18
AI/Digital	3	1	0	0	0	0	2	0	1	7
Gamification	2	1	0	0	0	0	1	0	0	4
EML	0	2	0	0	1	0	0	0	0	3
Innovation Competitions	0	2	0	0	0	0	0	0	2	4
STEM	0	0	1	0	2	2	0	0	0	5
Sustainability EE	2	0	0	0	0	0	0	2	0	4
Nature-based	1	0	0	0	0	0	0	1	0	2
Story-driven	0	1	0	0	0	0	0	0	0	1
High-tech simulation	0	1	0	0	0	0	0	0	1	2
Total (Attribute Count)	**14**	**13**	**5**	**3**	**3**	**2**	**3**	**3**	**4**	—

Figure 6: Distribution of Entrepreneurial Attributes Across Teaching Strategies

4.4 Structural Patterns and Pedagogical Imbalance in Entrepreneurship Education

The synthesis of intervention-based studies reveals a pronounced structural imbalance within contemporary entrepreneurship education research. A dominant pattern emerges in which formal course-based programs primarily target psychological constructs, particularly entrepreneurial intention, mindset, and self-efficacy, while comparatively fewer interventions emphasize applied competencies such as creativity, opportunity recognition, digital capability, and sustainability-oriented skills. This intention-centric orientation reflects the strong theoretical influence of the Theory of Planned Behavior, where intention functions as the central explanatory variable.

However, the distribution matrix indicates that experiential and innovation-based strategies, such as STEM programs, innovation competitions, and simulation-based learning, demonstrate stronger alignment with competency development. These approaches tend to cultivate performance-based attributes rather than purely cognitive or motivational constructs. A second emerging pattern concerns sustainability-oriented entrepreneurship education. Although sustainability-

focused programs show a clear and consistent impact on sustainability mindset and sustainable entrepreneurial intention, they remain underrepresented in the overall literature. This suggests that sustainability integration, while growing, has not yet become mainstream within entrepreneurship education research. Taken together, the findings expose a pedagogical imbalance: entrepreneurship education research remains predominantly psychological and intention-driven, with limited emphasis on capability-centred and sustainability-integrated outcomes. Addressing this imbalance represents a critical research and policy priority. This imbalance suggests that entrepreneurship education research has not yet fully transitioned from intention-oriented paradigms toward performance and capability-oriented frameworks, despite increasing recognition of the importance of entrepreneurial competencies in practice.

5. Discussion

5.1 Overview of Key Findings

This study set out to examine how entrepreneurial attributes are conceptualized in recent empirical research and how different pedagogical approaches contribute to their development among university students. The findings reveal three major patterns.

First, the literature demonstrates a strong concentration on psychological core attributes, particularly entrepreneurial intention, self-efficacy (perceived behavioural control), and attitudes toward entrepreneurship. As shown in Table 2, these constructs remain the most frequently examined across studies, indicating the continued dominance of intention-based models such as the Theory of Planned Behaviour in entrepreneurship education research. Second, the findings highlight a divergence between pedagogical approaches and the types of attributes they develop.

As illustrated in Table 4 and Figure 6, formal course-based entrepreneurship education primarily targets psychological and intention-related constructs, whereas experiential and innovation-driven approaches, such as project-based learning, STEM-based programs, and simulations, are more strongly associated with competency-based attributes, including creativity, problem-solving, and risk-taking. Third, the analysis reveals the emergence of digital and sustainability-oriented attributes as distinct but underrepresented domains. While AI- and digital-based interventions contribute to technological readiness, and sustainability-focused education enhances sustainability-oriented intention and mindset, these domains remain less integrated into mainstream entrepreneurship education research.

Taken together, these findings indicate a structural imbalance in the literature, characterized by a predominant focus on intention-driven psychological constructs and comparatively limited attention to capability-oriented and sustainability-integrated outcomes.

5.2 Interpreting the Dominance of Intention-Based Constructs

The strong emphasis on entrepreneurial intention and self-efficacy reflects the enduring influence of intention-based frameworks, particularly the Theory of Planned Behaviour. Across the reviewed studies, perceived behavioural control and self-efficacy consistently emerge as central predictors of entrepreneurial intention, reinforcing prior findings in entrepreneurship research. However, the current synthesis suggests that this dominance may also constrain the conceptual development of the field. While intention-based models effectively explain motivational precursors to entrepreneurship, they provide a limited account of how individuals develop the capabilities required to translate intention into action.

Recent empirical studies (e.g., Ashraf et al., 2024; Nayak et al., 2024) indicate that intention alone is insufficient to predict entrepreneurial behaviour, particularly in complex and uncertain environments. This pattern reinforces the importance of moving beyond intention-centric models toward frameworks that integrate capability development, including cognitive, behavioural, and contextual dimensions of entrepreneurship.

5.3 Pedagogical Pathways and Attribute Alignment

A key contribution of this study lies in identifying the alignment between teaching strategies and entrepreneurial attributes. The findings suggest that entrepreneurship education is not pedagogically neutral; rather, different instructional approaches systematically target different layers of entrepreneurial development.

Formal entrepreneurship education, typically delivered through lecture-based or business plan-oriented courses, is primarily associated with attitudinal and motivational outcomes, such as entrepreneurial intention and mindset. While these approaches are effective in shaping perceptions and aspirations, they appear less effective in developing applied competencies. In contrast, experiential and innovation-driven pedagogies, including project-based learning, innovation competitions, and STEM-based entrepreneurship education, demonstrate stronger associations with competency-based attributes. These approaches engage students in problem-solving, iterative experimentation, and real-world application, thereby fostering skills such as creativity, opportunity recognition, and risk-taking.

Digital and AI-based interventions represent a third emerging pathway, primarily contributing to digital entrepreneurial readiness, including technological confidence and opportunity recognition in digital contexts (e.g., Mirhabibi et al., 2025; Zulfiqar et al., 2026). However, these approaches are still relatively isolated and not yet fully integrated into broader pedagogical frameworks. This differentiation suggests that effective entrepreneurship education requires intentional alignment between pedagogical design and desired learning outcomes, rather than relying on a one-size-fits-all approach.

5.4 Reframing the Intention–Behaviour Gap

The findings of this review provide new insight into the widely recognized intention–behaviour gap in entrepreneurship. While previous research has primarily framed this gap as a psychological issue, the current synthesis suggests that it may also be a pedagogical gap. Specifically, the dominance of intention-oriented educational approaches may contribute to a situation in which students develop strong entrepreneurial intentions but lack the competencies and contextual support necessary to act on them.

Studies included in this review (e.g., Wang et al., 2025; Partonezhad et al., 2025) indicate that entrepreneurial behaviour is more strongly associated with competency-based attributes and environmental support mechanisms than with intention alone. This suggests that bridging the intention–behaviour gap requires a shift toward capability-centered education, complemented by ecosystem-level support structures such as mentorship, incubation programs, and access to resources.

5.5 Implications for Entrepreneurship Education

The findings of this study have several important implications for higher education. First, curriculum design should move beyond an exclusive focus on intention formation toward a balanced integration of psychological, cognitive, and competency-based learning outcomes. This requires incorporating experiential learning components, such as simulations, project-based learning, and real-world problem-solving, into traditional course structures.

Second, the results highlight the need to integrate digital and sustainability competencies into entrepreneurship education. Rather than treating these domains as peripheral, universities should embed digital tools, AI-based learning, and sustainability challenges into core entrepreneurship curricula.

Third, the findings suggest that entrepreneurship education should be context-sensitive and discipline-specific. Different academic fields may require different pedagogical approaches, for example, STEM-based programs may benefit from innovation-driven models, while social sciences may benefit from narrative or community-based approaches. Accordingly, institutions should avoid uniform program designs and instead tailor interventions to disciplinary contexts. Finally, to address the intention–behaviour gap, universities should complement curricular interventions with post-curricular support systems, including incubators, mentorship networks, and access to funding opportunities, enabling students to transition from intention to action.

5.6 Limitations and Future Research

Several limitations should be acknowledged. First, this review focused exclusively on quantitative and quasi-experimental studies, which may limit insight into the contextual and process-oriented dimensions of entrepreneurship education. Future research should incorporate qualitative evidence to better understand how pedagogical interventions are implemented in practice. Second, the analysis did not systematically differentiate between academic disciplines due to limitations in reporting across studies. Future research should examine how

entrepreneurship education varies across fields such as engineering, business, and the social sciences. Third, the predominance of cross-sectional designs in the reviewed studies limits causal inference. Longitudinal research is needed to better understand how entrepreneurial attributes develop over time and how they translate into actual venture creation. Despite these limitations, this study provides a comprehensive and integrative synthesis of recent empirical research, offering a robust foundation for advancing both theory and practice in entrepreneurship education.

6. Conclusion

This study provides a systematic synthesis of intervention-based entrepreneurship education research and highlights a dominant intention-centric paradigm within the field. The findings demonstrate that formal entrepreneurship education continues to prioritize psychological constructs, particularly entrepreneurial intention, mindset, and self-efficacy, while comparatively less emphasis is placed on applied competencies such as opportunity recognition, digital capability, creativity, and sustainability-oriented attributes. By mapping the distribution of entrepreneurial attributes across teaching strategies, the study identifies three distinct pedagogical clusters: (1) psychological-intention dominant approaches, (2) competency-oriented experiential approaches, and (3) sustainability-focused pedagogies.

The results indicate that experiential and innovation-driven methods are more strongly associated with competency development, suggesting that future entrepreneurship education should move beyond intention formation toward capability cultivation. The study contributes theoretically by exposing a structural imbalance between intention-based and performance-based outcomes in entrepreneurship education research. Practically, it calls for curriculum redesign that integrates digital readiness, sustainability thinking, and problem-solving competence as core learning objectives. Shifting toward a capability-centered framework may enhance the translation of entrepreneurial intention into entrepreneurial action. Future research should further explore longitudinal effects of teaching strategies on venture creation outcomes and examine the integration of sustainability and digital transformation competencies into mainstream entrepreneurship education.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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