Thematic Synthesis and Future Outlook in Digital Entrepreneurial Education

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https://doi.org/10.34190/ejel.23.3.3910

Abstract: The rapidly evolving field of digital entrepreneurial education has been significantly shaped by advancements in technologies such as augmented reality (AR), virtual reality (VR), and artificial intelligence (AI). While these technologies have opened new possibilities for entrepreneurial learning, much of the existing research is fragmented, focusing on isolated tools or specific interventions. This piecemeal approach complicates efforts to identify overarching trends, theoretical frameworks, and practical applications relevant to educators, policymakers, and researchers. To address these challenges, this study employs a Bibliometric-Systematic Literature Review (B-SLR) methodology, combining quantitative bibliometric analysis with qualitative synthesis to offer a comprehensive and balanced perspective on the field. We reviewed 261 articles published between 2005 and 2024, capturing diverse geographical regions, subject areas, and publication outlets. This approach enabled us to identify prevalent research themes, uncover emerging methodologies, and highlight areas that warrant deeper investigation. Our analysis revealed four main clusters: (1) Technology-Enhanced Entrepreneurship Education, examining how AR, VR, AI, and digital platforms foster engagement and skill-building; (2) Experiential and Project-Based Learning Approaches, highlighting gamification, simulations, and collaborative projects that stimulate practical competencies and adaptability; (3) Entrepreneurial Competencies, Mindset, and Social Dimensions, exploring cultural, generational, and gender-related factors that shape learner readiness and intentions; and (4) Future-Oriented and Transformative Approaches, emphasizing sustainability, global collaborations, and ethical considerations that guide the long-term evolution of entrepreneurial learning. The findings indicate that technological tools alone do not guarantee enhanced entrepreneurial outcomes. Instead, successful digital entrepreneurial education relies on cultural relevance, supportive policies, comprehensive educator training, and inclusive pedagogical designs. The study proposes an integrative framework that synthesizes technological, experiential, socio-cultural, and forward-looking strategies, offering actionable insights for improving educational practices and advancing theoretical understanding in the field. This research highlights critical areas for future exploration, including the development of learner-centred curricula, investments in digital infrastructure, and the promotion of international collaborations. By addressing these gaps, stakeholders can establish adaptable, inclusive, and ethically grounded ecosystems that equip learners with the skills and mindset needed to navigate the complexities of entrepreneurship in an increasingly dynamic global environment.

Keywords: Digital entrepreneurial education, Bibliometric-systematic review, AR/VR learning, AI tools, Entrepreneurial mindset, Experiential learning

1. Introduction

The digital era has revolutionised education, reshaping the delivery and acquisition of knowledge across disciplines, including entrepreneurship. Traditional entrepreneurship training, which relied heavily on lectures and case studies, has evolved into digital, online, and blended modalities that leverage digital platforms, immersive technologies like augmented reality (AR) and virtual reality (VR), and artificial intelligence (AI)-driven tools. These advancements enhance accessibility, engagement, and interactivity in entrepreneurial learning (Sulistianingsih, 2023; Rosli, 2023). Such innovations create flexible, interactive environments that allow students to engage with dive resources and collaborate globally (Liguori & Winkler, 2020; Secundo et al., 2021; Manurung, Purwadi, and Sugiharto 2022).

Digital platforms play a pivotal role in modern entrepreneurial education by providing extensive resources and fostering collaboration. For example, platforms like Launchpad Albania enable university students to develop business ideas, connect with peers and mentors, and evaluate their concepts' viability (Begum, 2023; Pano & Gjika, 2020). Immersive technologies, including AR and VR, further enrich learning by simulating real-world entrepreneurial challenges, which enhance practical skills and foster essential entrepreneurial mindsets (Khan & Sethi, 2022; Vaičiukynaitė et al., 2022). AI-driven tools add another dimension by personalising learning experiences and providing real-time feedback. They analyse student performance to tailor content to individual

Cite this article: Fourqoniah, F., Aransyah, M.F., and Riani, L.P. 2025. "Thematic Synthesis and Future Outlook in Digital Entrepreneurial Education", *Electronic Journal of e-Learning*, 23(3), pp 30-44, https://doi.org/10.34190/ejel.23.3.3910

needs, improving engagement and learning outcomes (Williamson, 2020; Vargo et al., 2020). These tools also simulate market conditions and consumer behaviours, allowing students to experiment with business strategies in controlled environments (Chen & Yau, 2021; Cao, 2023).

Despite these advancements, the literature on digital entrepreneurial education remains fragmented. Studies often focus on specific technologies or interventions without offering a comprehensive overview of digital-focused themes (Neck & Greene, 2010; Rosli, 2023). Furthermore, while research frequently evaluates program outcomes, there is a lack of systematic and bibliometric analyses to identify dominant themes, methodologies, and trends (Satalkina & Steiner, 2020; Kraus et al., 2018). This fragmentation limits educators, policymakers, and researchers in understanding the field comprehensively or guiding future innovations effectively (Li, 2023; Liguori et al., 2021).

A methodological approach capable of synthesising extensive research, uncovering patterns, and highlighting emerging areas is essential to address this gap. The Bibliometric-Systematic Literature Review (B-SLR) combines the quantitative precision of bibliometric analysis with the qualitative depth of systematic reviews, offering a comprehensive understanding of the research landscape (Alegre, Callahan, & Iszatt-White, 2023). This study applies the B-SLR approach to map existing literature on digital entrepreneurial education, identify key themes and trends, and highlight critical gaps for further exploration.

This study addresses three key research questions: What are the prevalent research themes in digital entrepreneurial education? What novel topics and methodologies are emerging, particularly concerning technological advancements? What critical gaps exist, and how can future studies advance the understanding and practice of digital entrepreneurial education? By answering these questions, this research provides an overview of key clusters, identifies cutting-edge developments, and proposes a conceptual framework to guide future research.

The anticipated contributions of this B-SLR are multifaceted. Educators can refine curricula and select effective digital tools to enhance entrepreneurial competencies. Policymakers can allocate resources and devise strategies that support the integration of digital technologies into entrepreneurial education. Researchers can identify under-explored areas and adopt innovative methodologies to enrich the scholarly discourse and drive innovation. Ultimately, this study bridges the gap between fragmented research and a cohesive understanding of how digital technologies reshape entrepreneurial education, fostering a responsive entrepreneurial mindset for the digital economy (Yu et al., 2022; Kolarov, 2023).

In responding to the need for entrepreneurial education to remain relevant amid uncertainty, global competition, and technological disruption, this research underscores that digital skills and entrepreneurial mindsets are essential. Educational institutions must rely on informed, evidence-based strategies to cultivate entrepreneurs capable of navigating complex, digitally driven markets (Neck & Greene, 2010; Chen & Yau, 2021). This synthesis clarifies existing knowledge while proposing innovative directions for research and practice, ensuring entrepreneurial education prepares students for modern business challenges (Satalkina & Steiner, 2020; Kraus et al., 2018).

2. Methodology

This study applies the Bibliometric-Systematic Literature Review (B-SLR) methodology to explore the integration of digital technologies in entrepreneurial education. The B-SLR combines bibliometric analysis with systematic literature reviews, offering a structured approach to identify key themes and trends while addressing gaps in existing research (Marzi, Balzano, Caputo, & Pellegrini, 2024). This approach is particularly suited for interdisciplinary fields such as digital entrepreneurship education, which spans business, social sciences, and technology (Zupic & Čater, 2015).

The rationale for employing the B-SLR lies in its transparent procedures and reproducible protocols, which help reduce bias and ensure consistency compared to traditional narrative reviews (Donthu et al., 2021; Tranfield, Denyer, & Smart, 2023). Bibliometric techniques enable the visual mapping of intellectual structures and collaboration networks, offering insight into influential contributions and emerging trends (Wijaya, Setiawan, and Shapiai, 2023).

Scopus was selected as the primary database, with Web of Science (WoS) used for supplementary validation, ensuring robust indexing standards and comprehensive coverage (Mongeon & Paul-Hus, 2016; Bascur et al., 2023). The search string *(TITLE-ABS-KEY(digital OR online OR virtual OR "E-learning") AND TITLE-ABS-KEY("entrepreneurial education" OR "entrepreneurship education" OR "entrepreneurship training" OR*

"entrepreneurial learning")) was used. Filters were applied for language, document type, year, and subject area, resulting in a refined dataset of 261 articles (Table 1).

Table 1: PRISMA Flow Diagram for Study Selection

Stage	Number of Records	Notes
Identification	849	Initial search in Scopus
Records after duplicates	849	No duplicates in initial search
Screening	420	Applied language, document type, publication years, and subject areas filters
Eligibility	420	Reviewed for relevance based on inclusion criteria
Articles excluded	159	Focused solely on general entrepreneurship education, lacked methodological rigor, or provided only descriptive analyses
Included	261	Final dataset for analysis

Bibliometric analysis was conducted using VOSviewer, incorporating co-word analysis, bibliographic coupling, and overlay visualisation techniques (van Eck & Waltman, 2010). Co-word analysis identified clusters of frequently co-occurring keywords that represent conceptual linkages across studies. In parallel, overlay visualisation was employed to map the temporal evolution of key research topics, thereby providing insight into the development of the field over time.

To address the methodological limitation of relying solely on keyword clustering, an additional layer of validation was incorporated. Each thematic cluster generated through co-word analysis was independently reviewed by two researchers. These reviewers examined the content of the source articles associated with each cluster to verify alignment between the keyword groupings and the actual thematic content. Any discrepancies in interpretation were resolved through structured discussion and consensus-building, thereby strengthening the reliability and conceptual validity of the thematic labelling.

In addition to the bibliometric procedures, a qualitative synthesis of the selected articles was undertaken to extract deeper thematic insights. This synthesis focused on identifying theoretical frameworks, dominant methodologies, and recurring conceptual patterns across the corpus (Breslin & Gatrell, 2023; Marzi et al., 2024). The integration of bibliometric and qualitative approaches enabled a richer interpretation of how digital technologies influence entrepreneurial learning, offering both breadth and depth in the analysis.

The review adhered to the PRISMA guidelines to ensure methodological rigour and transparency (Page et al., 2021). Inclusion and exclusion criteria were consistently applied throughout the review process. To ensure objectivity, inter-coder reliability was assessed using Krippendorff's Alpha (Krippendorff, 2019). While the study includes a broad and diverse selection of sources, the exclusion of non-English articles is acknowledged as a limitation. The integrated findings led to the development of four thematic clusters and an overarching conceptual framework, offering practical and theoretical contributions for educators, policymakers, and researchers (Schmiedel, Muller, & vom Brocke, 2018; Thomas & Tee, 2022).

3. Results

3.1 Descriptive Analysis

This section provides a detailed overview of the research corpus on digital entrepreneurial education, offering insights into its key characteristics. The final selection process resulted in a dataset comprising 261 articles published between 2005 and 2024 (Figure 1). This analysis highlights the temporal distribution of publications, authorship patterns, citation metrics, leading publication sources, and geographic spread.

The dataset consists of 261 academic articles authored by 725 contributors from diverse institutions and countries. On average, each article has 3.04 authors, reflecting a collaborative research culture. The average citation count per article is 11.95, with a total of 13,426 references cited. Such metrics underscore the growing scholarly engagement and the knowledge base supporting digital entrepreneurial education.

The corpus is internationally diverse, with 15.33% of publications involving cross-country collaboration, and an average article age of 2.79 years, indicating that research in this field remains current and rapidly evolving. An annual growth rate of 25.06% further underscores the increasing academic interest and relevance of digital entrepreneurial education in a technology-driven era. Focusing on key temporal patterns, the number of

publications surged notably from 2018 onwards, peaking at 70 articles in 2024. This upward trend aligns with the proliferation of online platforms, immersive learning tools, and the demand for digitally savvy entrepreneurs.

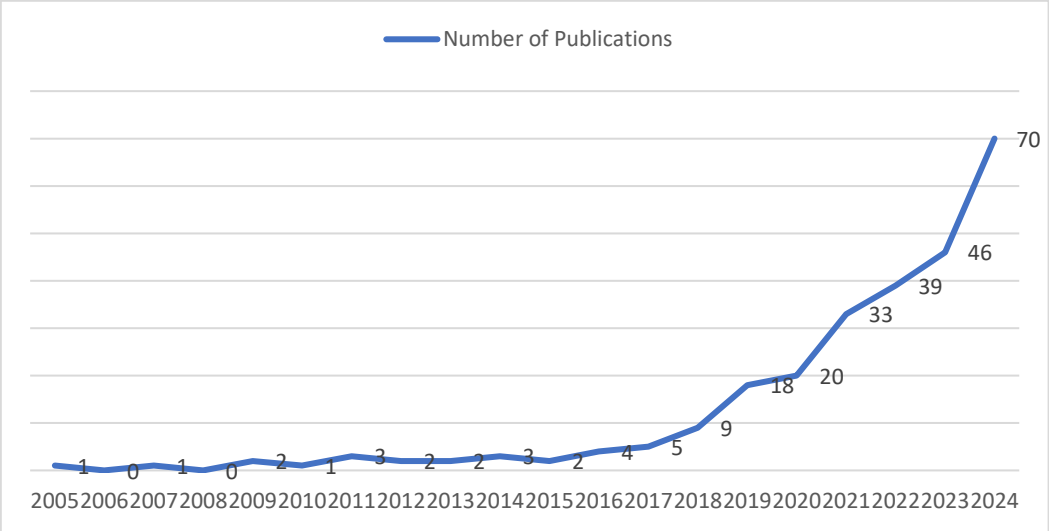

Figure 1: Temporal distribution of publications

Geographically, China and Indonesia dominate the landscape, possibly due to robust policy support and infrastructure development. In contrast, the United States, Italy, and the United Kingdom, with strong research ecosystems, bring diverse theoretical and methodological perspectives (Table 2).

Table 2: Geographic spread

Country	Number of Articles
China	120
Indonesia	77
United States	68
Italy	51
United Kingdom	41

Major publication outlets range from specialized journals focusing on entrepreneurship and education (e.g., International Journal of Management Education, Journal of Entrepreneurship Education) to more interdisciplinary sources (e.g., Sustainability, Technological Forecasting and Social Change). This mix suggests that the field's intellectual roots extend into sustainability, technological innovation, and global educational reforms (Table 3).

Table 3: Leading Journals Publishing in the Domain

Journal/Publication Scope	Number of Articles
International Journal of Management Education	14
Journal of Entrepreneurship Education	13
Applied Mathematics and Nonlinear Sciences	12
Entrepreneurship Education and Pedagogy	8
Industry and Higher Education	7
Sustainability (Switzerland)	7
Education Sciences	6
Technological Forecasting and Social Change	6
Education and Training	5
International Journal of Emerging Technologies in Learning	5

The field of digital entrepreneurial education demonstrates a highly collaborative and international nature, with an average of 3.04 authors per article and 15.33% involving cross-country collaborations. Research trends reveal a significant surge in publications since 2018, reflecting the increasing relevance of this field in the context of technological advancements. Geographically, major contributions from China, Indonesia, and the United States highlight the global importance of fostering digital skills through entrepreneurial education. Additionally, the field's interdisciplinary scope is evident in its diverse publication outlets, ranging from specialised entrepreneurship journals to broader interdisciplinary platforms, showcasing its wide-ranging impact across multiple domains.

3.2 Bibliometric Clustering

3.2.1 Co-Word analysis

In the following sections, we map co-word occurrences and bibliographic couplings. Beyond identifying keywords, we also note the theoretical orientations and methodologies characterizing each cluster to provide deeper insights into their intellectual structures. The co-word network offers a thematic map of digital entrepreneurial education, with "entrepreneurship education" at the centre, connected to key terms like "entrepreneurial learning," "digital entrepreneurship," "e-learning," and "student." Figure 2 illustrates the emphasis on integrating entrepreneurial skills with digital tools. Below are the key clusters:

- Core Entrepreneurial Pedagogy Cluster (Red/Blue Nodes): This cluster, anchored by "entrepreneurship education," focuses on integrating digital competencies, critical thinking, and technological fluency. Research here often employs experiential learning models and mixed-method case studies to evaluate digital curriculum innovations.
- Technological and Pedagogical Integration Cluster (Green Nodes): Highlighting terms like "education computing," "curricula," and "universities," this cluster explores the integration of digital tools in education. Studies blend quantitative assessments of digital platform effectiveness with qualitative evaluations of institutional readiness, reflecting the intersection of pedagogical theory and technology adoption.
- Experiential and Behavioral Dimensions Cluster (Purple Nodes): Keywords such as "experiential learning" and "entrepreneurial self-efficacy" focus on immersive environments and learner psychology. Research here often leverages behavioral theories and experimental designs to examine how digital simulations and gamified experiences influence entrepreneurial intentions.

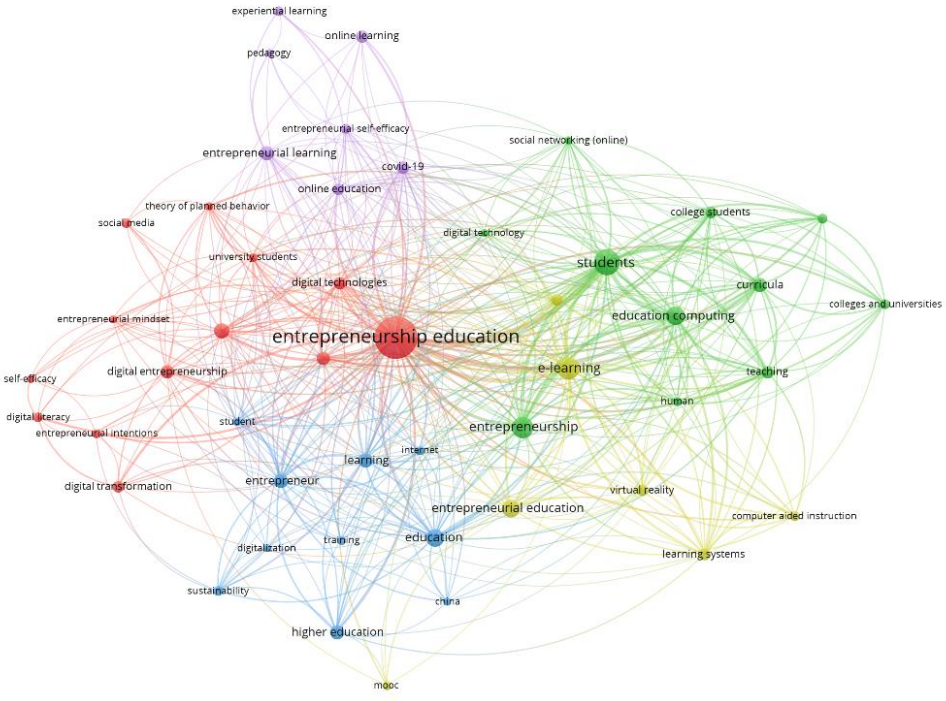

Figure 2: Co-Word Analysis

3.2.2 Bibliographic coupling by country

The visualisation in Figure 3 highlights how nations cluster based on shared references. Countries like China, Indonesia, India, and Australia (Asia-Pacific cluster) focus on digital entrepreneurship education in rapidly developing markets, often emphasising capacity-building and economic development. In contrast, European nations form a distinct cluster characterised by strong collaborative research traditions, prioritising policy frameworks, comparative analyses, and international partnerships. These clusters reflect regional priorities shaped by unique socio-economic and institutional contexts.

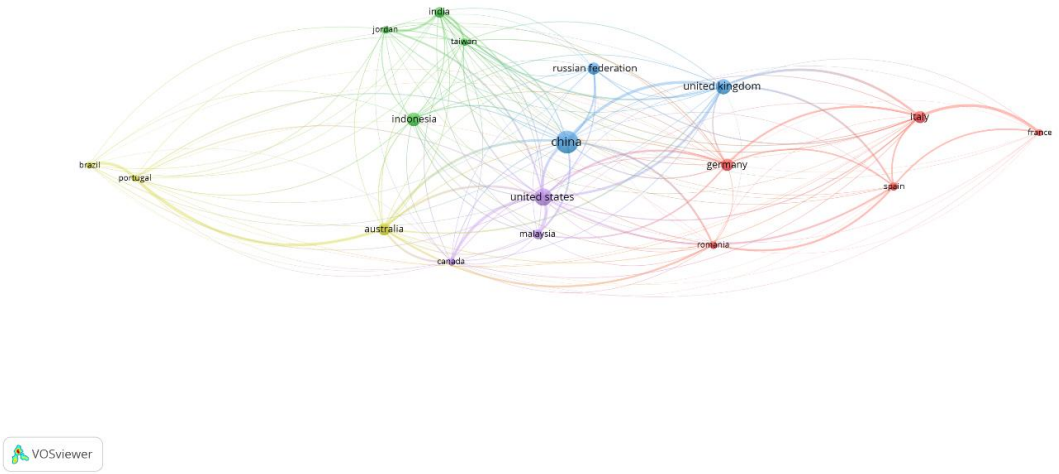

Figure 3: Bibliographic Coupling by Country

3.2.3 Bibliographic coupling by sources (journals)

Figure 4 illustrates how journals cluster into communities based on their disciplinary focus. Some clusters emphasise educational theory and entrepreneurial pedagogy, consistently publishing theory-driven research, while others concentrate on interdisciplinary or quantitative methods, prioritising data-driven studies on the technical aspects of digital tools. This pattern reflects a diverse methodological landscape, enabling a holistic understanding of digital entrepreneurial education's evolution.

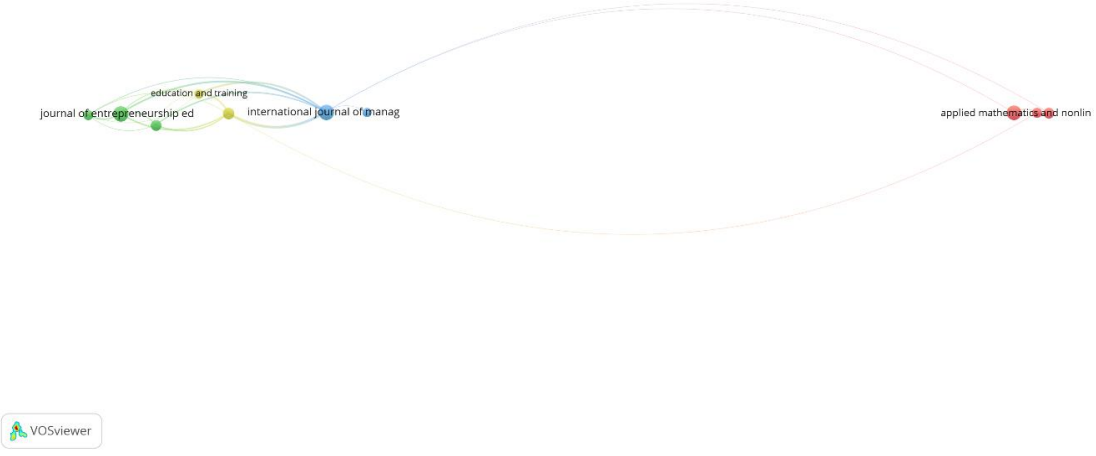

Figure 4: Bibliographic Coupling by Sources (Journals)

3.3 Overlay Visualization and Trend Analysis

3.3.1 Historical perspective on topic evolution

Overlay visualization (Figure 5) shows changes in keyword prominence over time. Foundational themes like "entrepreneurship education" and "digital entrepreneurship" were prominent early on (2018–2020), focusing on basic online methods and conceptual frameworks. By 2021–2023, "entrepreneurial mindset," "e-learning," and "digital literacy" gained traction, reflecting a move toward learner-centric and skill-oriented paradigms.

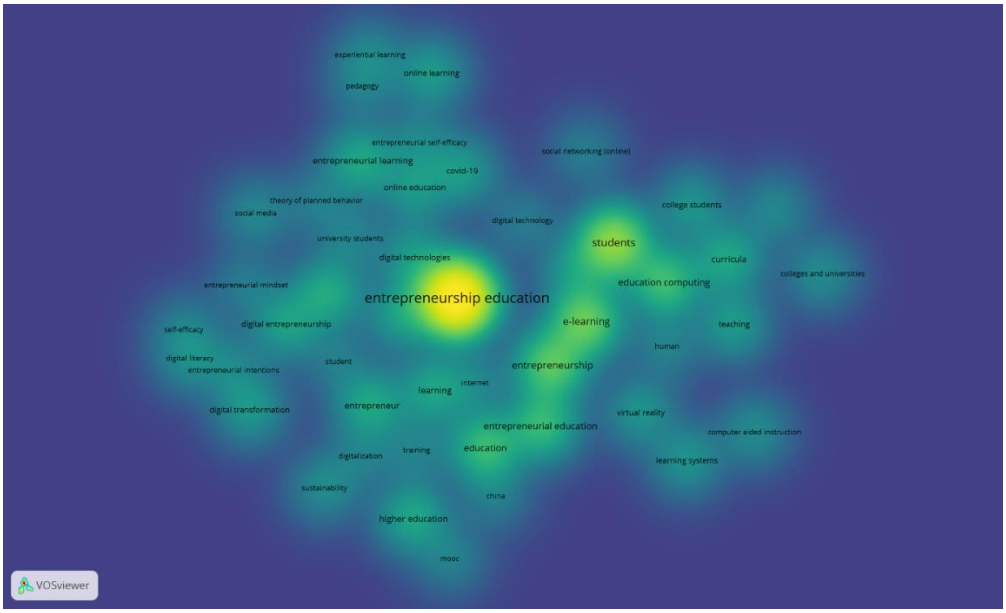

Figure 5: Density Visualization of Co-Word Analysis

Over time, as research matured and diversified (2021–2023), the nodes associated with more nuanced concepts started to gain prominence. Terms like *"entrepreneurial mindset"*, *"e-learning"*, and *"university students"* shifted towards the center of the thematic network, suggesting a growing emphasis on learner-centered approaches and the psychological and behavioral dimensions of digital entrepreneurship training. In parallel, keywords such as *"digital literacy"* and *"entrepreneurial intentions"* highlight an increasing interest in the skill sets and motivational factors that learners require to thrive in a technology-driven entrepreneurial ecosystem.

3.3.2 Identification of emerging areas

As highlighted in Figure 6 (Overlay Visualization of Co-Occurrence of Keywords), recent trends toward immersive technologies (e.g., VR), learner engagement strategies, and context-specific research emerge as digital infrastructure and AI-based tools advance. These shifts may be driven by educational policy reforms promoting digital inclusion, global entrepreneurship trends demanding adaptable skill sets, and rapid technological progress in AI-driven personalization. Such insights are valuable for practitioners. For example, knowing that immersive learning environments and culturally contextualized approaches are on the rise can guide educators and policymakers to invest in VR equipment, develop localized entrepreneurship modules, or tailor curricula to learners' backgrounds.

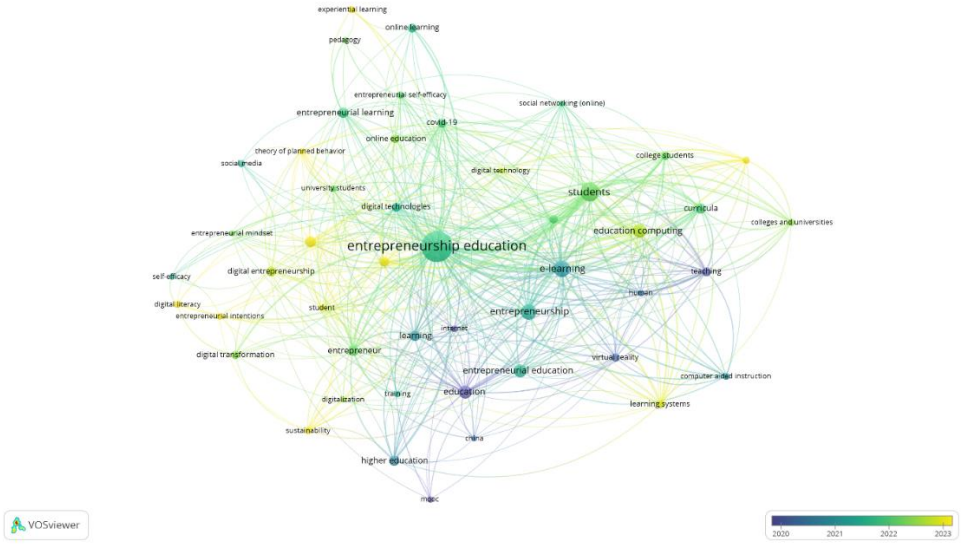

Figure 6: Overlay Visualization of Co-Occurrence of Keywords

While foundational literature established the potential of digital entrepreneurial education, the current emphasis is on immersive, adaptive, and learner-focused methods. Trends highlight the relevance of context-specific strategies, advanced technologies, and evaluation metrics that capture learner engagement and entrepreneurial outcomes. By considering these emerging themes, scholars can deepen theoretical models, and practitioners can leverage these insights to develop programs that resonate with diverse learner populations and technological ecosystems.

3.4 Systematic Literature Review and Thematic Synthesis

3.4.1 Holistic thematic analysis

This review of 261 articles on digital entrepreneurial education identified four main clusters of research themes and findings (Table 4).

Table 4: Key Clusters and Insights in Digital Entrepreneurial Education Research

Cluster	Key Insights	References
Technology-Enhanced Entrepreneurship Education	Explores diverse technologies such as metaverse platforms, VR-based training, AI-driven ideation tools, and semantic knowledge graphs, enhancing learning personalization and engagement. However, effective implementation requires well-trained educators, ethical guidelines, cultural relevance, supportive policies, and stable infrastructures.	Qiu, Isusi-Fagoaga, and García-Aracil, 2023; Ronaghi and Forouharfar, 2024; Schlimbach et al., 2024; Yu et al., 2024; Chen & He, 2023; Dai, 2024; Chen et al., 2024; Núñez-Canal, de Obesso, and Pérez-Rivero, 2022; Pritchard, Williams, and Miller, 2024; Zhou & Cen, 2024
Experiential and Project-Based Learning Approaches	Utilizes methods like co-design projects, hackathons, peer coaching, simulations, and industry collaborations to foster entrepreneurial skills, creativity, and adaptability. These methods enhance skills, attitudes, and self-efficacy but may not always increase entrepreneurial intentions, highlighting the need for digital tools, mentoring, and supportive policies.	Laptev & Shaytan, 2022; Pradana & Susanti, 2024; Chen et al., 2023; Patrício, Figueiredo, and Ferreira, 2024; Wu & Wang, 2024; Lafortune et al., 2024; Vecchiarini et al., 2024; Martini, 2024; Oliver & Oliver, 2022; Liu & Ni, 2024
Entrepreneurial Competencies, Mindset, and Social Dimensions	Psychological and social factors like cultural, religious, and sustainability values, gendered learning dynamics, generational traits, and socio-economic contexts shape entrepreneurial learning. Emotional factors such as fear and satisfaction influence intentions. Tailored approaches are needed for specific learner groups like women, Generation Z, seniors, and housewives, considering digital literacy and social support.	Robles, 2022; Pritchard, Williams, and Miller, 2024; Hasan M. et al., 2024; Nano et al., 2024; Al-Housani, Al-Sada, and Koç, 2024; Alzyoud, Harb, and Alakaleek, 2024; Lourenço et al., 2024; Khan et al., 2022; Srebro et al., 2023; Wardana et al., 2024; Atarodi, Ottmann, and Mbaye, 2024
Future-Oriented and Transformative Approaches	Highlights sustainability, humane entrepreneurship, and circular economy models. Preparing learners for uncertain environments (VUCA conditions) requires foresight tools, policy alignment, and agile curricula. Global collaborations, stable infrastructures, and ethical considerations are critical for adapting entrepreneurship education to market and technological changes.	Fülöp and Cifuentes-Faura, 2024; Rosienkiewicz et al., 2024; Li et al., 2023; Abaddi, 2024; Zhang and Rathakrishnan, 2024; Li et al., 2024; Ghannad & Sörensson, 2024; Knaut et al., 2024; Huang R. et al., 2024

The analysis shows that platform-based learning and blended pedagogies are foundational. Digital tools support flexible, interactive, and learner-centered environments. Educators combine traditional methods with online simulations, virtual labs, and AI-driven feedback loops (Wahidmurni et al., 2022; Sofiullah, Gomes Vale, and Darr, 2023). These blended approaches create a strong base for innovation, skill development, and personalized learning experiences.

Cutting-edge research focuses on immersive and AI-driven methods. VR simulations, metaverse platforms, semantic knowledge graphs, and advanced recommendation systems illustrate a move toward more personalized, experiential, and hands-on learning environments (Ronaghi and Forouharfar, 2024; Yu H. et al., 2024). This shift aims to enhance engagement, creativity, adaptability, and problem-solving skills. It also emphasizes cultural alignment, ethical considerations, and responsiveness to diverse learner groups and socio-economic contexts.

3.4.2 Integrative framework development

The findings suggest a holistic conceptual framework that connects advanced technologies, experiential methods, socio-cultural factors, and future-oriented strategies. At the centre of this framework is digital entrepreneurial education as a dynamic and adaptive ecosystem (Figure 7). This ecosystem is shaped by four interrelated elements: technology integration, experiential learning, socio-cultural and psychological dynamics, and future-oriented perspectives.

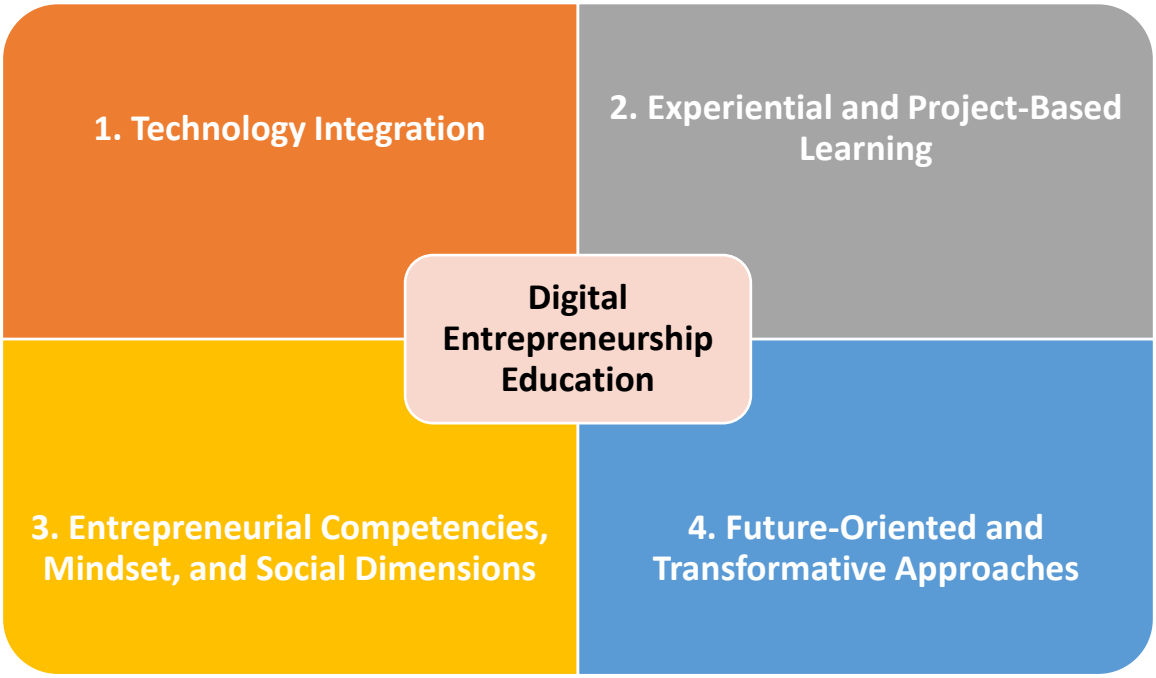

Figure 7: Digital Entrepreneurship Education as a Dynamic Ecosystem

1. **Technology Integration:** Tools such as virtual reality (VR), artificial intelligence (AI)-driven recommendations, semantic knowledge graphs, and metaverse platforms are transforming the delivery of entrepreneurship education. These tools enable personalised content delivery, creative exploration, and real-time feedback (Qiu, Isusi-Fagoaga, and García-Aracil, 2023; Yu H. et al., 2024; Schlimbach et al., 2024). However, as noted by Núñez-Canal, de Obesso, and Pérez-Rivero (2022) and Pritchard, Williams, and Miller (2024), effective deployment requires cultural sensitivity, ethical considerations, and educator competence in digital facilitation. In this light, technology must serve as an enabler, not a determinant, of meaningful entrepreneurial learning.
2. **Experiential and Project-Based Learning:** Learning methods such as gamification, co-design workshops, simulations, and industry collaborations facilitate the development of entrepreneurial skills, resilience, and problem-solving abilities (Wu S. & Wang, 2024; Martini, 2024). These approaches are most effective when embedded in authentic, learner-relevant contexts and supported by social mentoring and inclusive policy frameworks (Laptev & Shaytan, 2022; Patrício, Figueiredo, and Ferreira, 2024). Such methods support deeper engagement and allow learners to construct knowledge through iterative experimentation and reflection.
3. **Entrepreneurial Competencies, Mindset, and Social Dimensions:** Drawing on socio-constructivist and behavioural theories, this element addresses how learner identity, generational characteristics, and emotional factors shape engagement. Self-efficacy, satisfaction, and socio-cultural values critically influence how learners adopt digital tools and embrace entrepreneurial mindsets (Alzyoud, Harb, and Alakaleek, 2024; Lourenço et al., 2024). Building on the insights of Manurung, Purwadi, and Sugiharto (2022), this framework emphasises that creativity in entrepreneurship is not merely a technical skill, but a reflection of critical insight, prudence, and an integrated worldview. This philosophical dimension encourages a form of creativity that transcends digital tool proficiency and is rooted in life understanding, ethical awareness, and social sensitivity.
4. **Future-Oriented and Transformative Approaches:** Preparing learners for uncertain, volatile, and technology-driven futures requires aligning curricula with sustainability, circular economy principles, and global policy shifts (Fülöp and Cifuentes-Faura, 2024; Inada, 2024). This entails foresight-oriented

pedagogies, agile curriculum design, and international collaborations that cultivate adaptability and long-term thinking. Manurung, Purwadi, and Sugiharto (2022) highlight the need for digital learning processes that foster holistic creativity in response to cultural disorientation and algorithmic standardisation. As such, entrepreneurship education must also address learners' existential and ethical positioning, equipping them to navigate not only economic but also societal complexities.

The integrative framework underscores the importance of aligning educational practices with both technological advancements and deeper human values. It calls for a pedagogy that is responsive to generational preferences, reflective in its philosophical orientation, and inclusive in its structure.

Several gaps persist (Table 5). We need more empirical work in emerging economies to understand how digital entrepreneurship education evolves in different cultural and infrastructural settings. Cross-cultural comparative studies can reveal how regional values and social norms influence entrepreneurial intentions and outcomes. Longitudinal analyses of long-term learning results will help assess the lasting impact of digital tools, experiential methods, and policy changes. Addressing these gaps will inform more targeted strategies for policymakers, educators, and technology developers.

Table 5: Research Methods Used per Theme

Theme	Research Methods	Example Articles
Technology-Enhanced Entrepreneurship Education	Machine learning, VR simulations, big data analytics	Chen & He (2023), Qiu, Isusi-Fagoaga, and García-Aracil (2023)
Experiential & Project-Based Learning	Action research, co-design workshops, industry engagements	Laptev & Shaytan (2022), Oliver & Oliver. (2022)
Competencies, Mindset & Social Dimensions	Qualitative interviews, surveys, cultural comparisons	Pritchard, Williams, and Miller (2024), Hasan M. et al. (2024)
Future-Oriented & Transformative Approaches	Policy analysis, foresight, global collaboration frameworks	Inada (2024), Fülöp and Cifuentes-Faura (2024)

4. Discussion

The findings presented in the previous sections reveal a complex and evolving landscape of digital entrepreneurial education. Building on these results, this section interprets their implications through pedagogical, technological, and socio-cultural lenses. Tools like VR-based simulations (Ronaghi and Forouharfar, 2024), AI-driven ideation platforms (Schlimbach et al., 2024), and semantic knowledge graphs (Yu H. et al., 2024) enhance personalization and engagement in entrepreneurial learning (Qiu, Isusi-Fagoaga, and García-Aracil, 2023; Yu H. et al., 2024). However, technology alone is insufficient without educator digital competence and ethically guided frameworks (Núñez-Canal, de Obesso, and Pérez-Rivero, 2022; Pritchard, Williams, and Miller, 2024). Digitalization democratizes entrepreneurial education, providing access to underserved communities and supporting learners from diverse cultural and socio-economic backgrounds (Sofiullah, Gomes Vale, and Darr, 2023; Wahidmurni et al., 2022; Khan et al., 2022). Policies, cultural adaptation, and inclusive practices are essential to ensure opportunities for women, Generation Z, seniors, and housewives (Hasan M. et al., 2024; Wardana et al., 2024; Atarodi, Ottmann, and Mbaye, 2024).

Global reach expands through MOOCs, virtual labs, and platforms integrating nutritional education, e-commerce, and biotech, necessitating culturally sensitive content and strategies aligned with local needs (Wu & Tien, 2024; Luo X., 2024). This approach creates learner-centered environments fostering creativity, adaptability, and skill development (Oliver & Oliver., 2022; Chen J. et al., 2023). These insights pave the way for new theoretical frameworks that link entrepreneurship, educational technology, and innovation management. Traditional theories may fall short in explaining how digital tools shape entrepreneurial mindsets, but concepts like self-directed learning and autonomy can be expanded through AI-driven recommendations and metaverse platforms (Schlimbach et al., 2024; Qiu, Isusi-Fagoaga, and García-Aracil, 2023). Immersive tools like VR simulations and gamification enhance experiential learning, influencing resilience, risk tolerance, and problem-solving abilities (Wu & Wang, 2024; Lafortune et al., 2024).

Educators can leverage these findings to create engaging and culturally sensitive curricula, integrating strategies such as co-design projects (Laptev & Shaytan, 2022), industry collaborations (Patrício, Figueiredo, and Ferreira, 2024), and hybrid learning models (Ghannad & Sörensson, 2024). Mentorship, narrative creativity, and social support systems enhance confidence and self-efficacy (Zamkova et al., 2021; Alzyoud, Harb, and Alakaleek,

2024). Policymakers should invest in digital infrastructure, stable internet access, and affordable devices, while encouraging innovative teaching methods and locally adapted content for broader impact (Nano X. et al., 2024; Al-Housani, Al-Sada, and Koç., 2024). International collaborations, using COIL (Collaborative Online International Learning) approaches and triple/quadruple helix models, further facilitate cross-border knowledge exchange and innovation (Inada, 2024; Rosienkiewicz et al., 2024).

5. Future Research Agenda

Future studies should investigate the potential of emerging digital tools, such as blockchain-based training platforms and AI-driven mentoring systems, to assess their effectiveness in enhancing entrepreneurial learning outcomes (Schlimbach et al., 2024). Research could also delve into the use of data analytics and learning analytics for personalising education, improving learner adaptability, and providing real-time feedback (Chen Y. et al., 2024; Li P. et al., 2023). Additionally, integrating VR, the metaverse, and semantic knowledge graphs offers opportunities to foster creativity, engagement, and innovation in entrepreneurial education (Qiu, Isusi-Fagoaga, and García-Aracil, 2023; Yu H. et al., 2024).

Comparative studies across various cultural and institutional contexts would provide insights into how values, norms, and infrastructure shape learner readiness for digital entrepreneurial education (Hasan M. et al., 2024; Al-Housani, Al-Sada, and Koç, 2024; Syed, Alzahmi, and Tariq, 2024). Future research should also address how socio-economic factors influence receptivity to new technologies and pedagogies. Investigations focusing on marginalised communities, emerging economies, and diverse demographic groups can inform the development of culturally responsive and inclusive educational practices (Nano X. et al., 2024).

Long-term studies are needed to evaluate how digital tools and experiential learning approaches impact entrepreneurial skills over time and how learners apply these competencies in real-world scenarios, such as launching ventures or driving innovation within organisations (Chen J. et al., 2023; Munawar et al., 2023). These evaluations should consider the stability of support systems, the role of mentorship, and the evolving technological landscape. Such longitudinal research will equip policymakers and educators with the insights needed to sustain growth, update curricula, and ensure enduring entrepreneurial success (Oliver & Oliver, 2022; Inada, 2024).

6. Conclusion

This study explored the landscape of digital entrepreneurial education by identifying key themes related to technological integration, experiential pedagogies, socio-cultural dynamics, and forward-oriented strategies. Through a Bibliometric-Systematic Literature Review (B-SLR) of 261 articles, the research developed a conceptual framework that synthesises these dimensions into a coherent model of digital entrepreneurship education. The findings demonstrate that effective implementation depends not only on digital tools, but also on cultural relevance, educator competencies, inclusive practices, and supportive policy environments. This framework offers actionable insights for scholars, educators, and policymakers seeking to cultivate innovative, adaptable, and equitable learning ecosystems.

While the study provides a comprehensive overview, its scope was limited to English-language sources and selected databases, which may exclude other valuable perspectives. Future research should expand this scope to encompass diverse linguistic and cultural contexts, applying interdisciplinary and comparative approaches. Furthermore, future reviews may benefit from integrating non-English sources and grey literature to expand the representativeness of findings across global contexts. Continued development of theoretical models and longitudinal empirical studies is crucial for capturing the evolving interplay between digital innovation and entrepreneurship education. These efforts will help ensure that digital entrepreneurial learning remains inclusive, impactful, and responsive to global educational and economic challenges.

AI statement: No AI tools were used in the research, writing, or preparation of this manuscript.

Ethics statement: This study did not require ethics approval as it involved only the analysis of published literature.

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