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Entrepreneurship education for non-business students: A social learning perspective

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ABSTRACT

This research has two goals. First, map the research on entrepreneurship education for non-business students. Second, propose a synergetic framework for the existing research focusing on the relationship between students, universities, and the entrepreneurial ecosystem. Hence, we conducted a systematic literature review to analyze the *status quo* of the literature and applied a comprehensive bibliometric analysis supported by VOSviewer and Bibliometrix to distinguish the most prominent authors, institutions, countries, seminar articles, journals, and themes. The discussion is grounded on four dimensions of social learning: (i) observational learning in entrepreneurial education, (ii) the role of mentors and peers, (iii) institutional influence on learning, and (iv) the entrepreneurial ecosystem as a social learning environment. Therefore, our research contributes to advancing knowledge in the field of non-business entrepreneurship education through the lens of social learning theory. It sheds light on the entrepreneurial ecosystem surrounding the learning environment and provides a comprehensive overview of the field's current state. From a practical perspective, our study can guide policymakers and educators in designing and implementing changes in entrepreneurial education for non-business curricula. Moreover, it can potentially promote international collaboration and knowledge sharing among stakeholders in the ecosystem.

1. Introduction

Given the increasing importance of entrepreneurship, many efforts have been directed toward educating entrepreneurs (Haase & Lautenschläger, 2011; Ratten & Usmanij, 2021). Thus, entrepreneurship education has been assuming a relevant role in all levels of education, notably at the higher education level (Carpenter & Wilson, 2022; Liu, 2022; Xie et al. 2022) and vocational training (e.g., Rocha et al. 2023; Triyono et al. 2023). Also, it is considered a fostering factor of entrepreneurial intention and could raise the awareness, knowledge, and abilities necessary to start a business (Ahmed et al. 2020; Draksler & Sirec, 2021).

Entrepreneurship education can't elucidate by itself the intention or the business creation, the reason why it is necessary to have in mind the entrepreneurial ecosystem, which includes an intricate network of related elements that all together influence and shape entrepreneurship within a given region or industry. Isenberg (2010) emphasizes the relevance of a supportive entrepreneurial ecosystem, counting on the collaboration of several stakeholders, ranging from entrepreneurs and investors to educational institutions and government bodies. This collaborative synergy creates an environment where entrepreneurs can readily access essential resources,

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mentorship, and funding, fostering a favorable environment conducive to innovation and business development. Additionally, personal factors are relevant in explaining/influencing entrepreneurial intention and the institutional context (Olarewaju et al., 2023), applying his study to emerging economies.

Furthermore, due to this blossom of entrepreneurial education, previous literature reviews approached entrepreneurship education from a few perspectives; for example, John et al. (2023) analyzed entrepreneurial education in programs for hospitality and tourism, Shahid and Alarifi (2021) addressed social entrepreneurship education, Cruz et al. (2021) explored entrepreneurial orientation at HEI, Huang-Saad et al. (2018) examined engineering entrepreneurship education, and Belitski and Heron (2017) looked at the entrepreneurial ecosystems. Nevertheless, entrepreneurship education for non-business students is yet to be wholeheartedly inspected. Thus, this paper analyzes the state of the art of the literature regarding non-business entrepreneurship education through the lenses of the social learning theory. Accordingly, we intend to determine the seminal articles and the best outlets to publish research on entrepreneurial education to non-business students, as well as the most relevant authors in the field. Moreover, we aim to disclose the institutions and countries that most publish and collaborate in researching entrepreneurial education for non-business students. Likewise, we offer an analysis thematic of the research mapped. Furthermore, we propose a framework supported by the social learning theory to support further research in the field.

Our research contributes to advancing knowledge in the field of non-business entrepreneurship education through the lens of social learning theory. It sheds light on the entrepreneurial ecosystem surrounding the learning environment and provides a comprehensive overview of the current state of the field. From a practical perspective, our study can guide policymakers and educators in designing and implementing changes in entrepreneurial education for non-business curricula. It also has the potential to promote international collaboration and knowledge sharing among stakeholders in the ecosystem. In addition, it is worth noting that entrepreneurial education for non-business students is often instructed by educators from business schools who are also responsible for teaching other departments on how to establish a business in their respective fields. Accordingly, our research provides valuable insights that potentially also impact business and management learning and education.

2. Theoretical background

2.1. Social learning theory

According to Bandura (1978), individuals can learn by observing and copying the actions of others, which is known as social learning theory. This learning method allows people to acquire complex patterns of behavior without the need for trial-and-error. The theory also emphasizes the importance of consequences in regulating behavior. In summary, the social learning theory highlights the significance of observation, imitation, and consequences in shaping behavior.

The social learning theory has been used to study entrepreneurship and have found thought-provoking results. For instance, Zapkau et al. (2015) revealed that exposure to entrepreneurial role models, particularly parents, significantly influences people's attitudes towards self-employment and their decision-making about entrepreneurial intention. This supports the Theory of Planned Behavior and underscores the role of observational learning from role models through social learning theory. Similarly, Alonso-Parra et al. (2020) used social learning theory and entrepreneurial action theory to identify different forms of deviance among beekeepers, highlighting the negative aspects of entrepreneurship and contributing to understanding deviance. Türk et al. (2020) found that prior exposure to entrepreneurship can impact the development of entrepreneurial passion. The study used social learning theory to examine how individuals learn through role models or their own experiences and identified two types of prior entrepreneurial exposure: role model experience and direct experience. The findings highlight the significance of learning orientation in utilizing entrepreneurial experiences. Finally, Yang et al. (2023) found that social learning theory is relevant to farmer entrepreneurs who often start their ventures by learning through imitation. The study also emphasizes the importance of environmental factors in enhancing farmers' entrepreneurial performance. Therefore, we chose the social learning theory to underpin our research.

2.2. Entrepreneurial education for non-business students

Entrepreneurs need to acquire and develop a set of competencies and qualifications to pursue, which can be fostered by entrepreneurship education (Carpenter & Wilson, 2022). According to Haase and Lautenschläger (2011), entrepreneurs need genuine knowledge and information about the business creation process and management. It is also crucial to build strong negotiation abilities, leadership, creativity, tolerance to risk, opportunity-seeking, and communication skills. Usually, students from business sciences would be more aware of all these aspects and more prepared to create a business since they have a related educational background. Furthermore, it is common to think that entrepreneurship education is more strongly associated with students' entrepreneurial intentions (Bae et al. 2014). Conversely, Science, Technology, Engineering, and Mathematics (STEM) students usually report substantial obstacles when deciding to implement and commercialize their ideas. Paço et al. (2017) highlight the main problems: the lack of soft and entrepreneurial skills, the shortage of knowledge in financial management, marketing, market research, and human resources management, and the scarcity of financial resources for registering and developing their ideas.

Secundo et al. (2016) refer to the need for a "re-engineering" process of the learning curricula aiming to advance content by mixing knowledge and skills and, in some cases, implementing innovative learning experiences designed to develop technology-intensive ideas into new startups. At this point, Lynch et al. (2021) consider that design thinking is a pedagogy that could be used when presenting entrepreneurship to science and engineering students. In turn, Aadland and Aaboen (2020) advocate that action-based methodologies should be introduced with more traditional approaches in this learning.

Universities ought to educate students to sell science and technology, and it is not just an issue of adjusting existing entrepreneurship courses (Carpenter & Wilson, 2022; Ferreira et al. 2021). According to Martin and Iucu (2014), non-business students are less skilled in issues as sales and marketing, being very “product-oriented”, and forgetting that even if they have a very innovative offer, they need to look first at the market needs. Nevertheless, at the same time, graduates in the technical and engineering field are very well prepared to develop and transform new ideas and inventions into viable products to sell, generating economic and social value through innovative business models (Byers et al., 2011). Thus, developing entrepreneurial mindsets in STEM graduated students should be a priority of higher education institutions (Secundo et al., 2016).

Souitaris et al.’s (2007) delve into entrepreneurship programs for science and engineering students, evidencing that it can raise entrepreneurial inspiration and attitudes. Later in 2020, Ahmed et al. (2020) analyzed how learning, inspiration, and resources could influence intention to become entrepreneurs and concluded that learning and inspiration activities increased students’ perceptions about becoming entrepreneurs. Furthermore, the access to resources, namely incubation assets, had the most significant effect on the intention. In 2023, Rippa et al. (2023, p. 375) found that “‘one size does not fit all’ in entrepreneurship encouragement among engineering students and that different recipes can lead to the same result”. The socioeconomic contexts can make the difference in some cases (e.g., entrepreneurial education fosters entrepreneurial intentions as consequence of the aggregated attitudes toward entrepreneurship plus their parental backgrounds).

3. Method

Addressing the purpose of this study, we conducted a systematic literature review (SLR) to collect relevant studies (Liberati et al. 2009; Snyder, 2019) and applied a bibliometric approach to analyze the data (Broadus, 1987; Zupic & Čater, 2015). Moreover, we treated the results following transparency and equality principles. In the following section, we detail both procedures.

3.1. Systematic literature review criteria

We selected the *Clarivate Analytics Web of Science* as our research sample due to its reputation for accuracy, covering over 2000 journals, and the availability of necessary metadata (Aria et al., 2020). Besides, the overall recommendation (e.g., Aria et al., 2020) is to use one database for a bibliometric analysis. Therefore, we searched on the *Web of Science* database core collection on November 1, 2023,¹ employing the following pre-establish search protocol (Denyer & Tranfield, 2009) to conduct the SLR: (a) Including only articles published in Journals; (b) Including only articles in English language (Ankrah and Omar, 2015); (c) Including the entire period (1900–2023) covered by the database (Feng et al. 2015); (d) Topics (title, abstract, author’s keywords, and keywords plus) featuring the terms (“entrepr* train*” OR “entrepr* educat*” OR “entrepr* teach*” OR “entrepr* student*” OR “entrepr* learn*”) AND (“non-business” OR “science” OR “technology” OR “engineering” OR “mathematic*” OR “life science*” OR “arts” OR “humanities” OR “physical science*”).

The search resulted in 1540 documents. We excluded 676 papers based on the publication criteria (a) and 33 articles based on the language criteria (b). The remaining articles are 831. After the objective screening, we read the titles and abstracts to assess whether the results address the topic of interest, entrepreneurial education for non-business students. We removed 281 because their theme was outside of this research scope. For example, the keyword “entrepr* learn*” brought articles about learning with entrepreneurial experience (e.g., Kubberød et al., 2021). Similarly, the keyword “technology” brought information technology articles (Rashidi, 2021; e.g., Aggarwal & Johal, 2021). We maintained all articles that sampled exclusively or included non-business and business students. Likewise, theoretical articles that address all students were also included. Therefore, we analyzed 550 articles for this research.

3.2. Bibliometric analysis

We used a comprehensive bibliometric approach supported by VOSviewer software version 1.6.20 (Van Eck & Waltman, 2010) and Bibliometrix package from *R Studio* (Aria & Cuccurullo, 2017) to understand the scientific activity (Broadus, 1987) concerning entrepreneurship education for non-business students. Using five indicators (articles, authors, journals, institutions, and countries), we performed the software’s citation (Cit), co-citation, and bibliographic coupling analysis (Total Link Strength - TLS). Moreover, we conducted a co-occurrence analysis of authors keywords to cluster the results by theme. Hence, the evaluation combines (i) science mapping: relationship between scientific elements, and (ii) performance: citation, keyword frequency, and publication (Aria & Cuccurullo, 2017).

We analyze the VOSviewer results concerning the units of analysis: articles, authors, journals, and keywords. The initial sections include the top ten citations, co-citations, co-authorship, and bibliographic coupling analysis results. The citation provides the most significant studies in the field, without meaning strengthened network. The co-citation evaluates the documents cited in the results, while the co-authorship indicates the authors’ network regarding institutions and countries. Moreover, the bibliographic coupling indicates the most impacting in the area, their position in the network. Finally, the co-occurrence analysis provides thematic clusters that guides the discussion. This comparative analysis surpasses the bias constraints of using only one of them, offering a comprehensive examination of the scientific domain (Van Eck & Waltman, 2010, 2014; Waltman et al., 2010), augmenting the validity.

¹ For more information: <https://www.webofscience.com/wos/woscc/summary/0b6307ff-568e-4415-8f7e-8afd5c91e1ef-b07c6447/relevance/1>.

4. Analysis of the results

Entrepreneurial education for non-business is increasingly timely and research in this area is expected to expand in the coming years. Likewise, only in the last decade the research boosted, especially since 2015, demonstrating the infancy of the research on entrepreneurship education for non-business students (Fig. 1). Accordingly, the 550 papers are distributed from 1993 to 2023 with 20,107 citations and a 24.2 average per article.

The procedure for each analysis and its criteria is outlined in the following sections. First, the analysis of the results is divided into sections concerning the units of analyses (authors, articles, journals, institutions, and countries) displaying the analyses (citation, bibliographic coupling, co-citation, and co-authorship). Then, we present the co-occurrence of keywords. It is an artificial connection categorized by a word-based information network.

4.1. Most influential authors

There are 1503 authors, and only 5 have at least 4 publications. Then, to analyze the authors, we wrote a *thesaurus file* (Van Eck & Waltman, 2010) to unite authors' names written in diverse formats (e.g., 'Fayolle, Alain' and 'Fayolle, A'). Hence, the key authors in the corpus are Giustina Secundo (7 articles and 71 citations), with five articles Bagus Shandy Narmaditya (11 citations) and Pierluigi Rippa (21 citations) and Agus Wibowo (11 citations), with four articles there are also author with dozen of citations, e.g., Pasquale Del Vecchio (52 citations), Nathalie Duval-Couetil (66 citations), Henry Etzkowitz (47 citations), and Valentina Ndou (31 citations).

Additionally, we conducted the co-citation analyses on VOSviewer using *fractional counting* and default features. Of the 14,424 authors, only 173 had a minimum of 20 citation. Therefore, the fundamental authors in the references are Alain Fayolle (346 citations), Icek Ajzen (271 citations), Norris Krueger (227 citations), Francisco Liñán (220 citations), and Luke Pittaway (170 citations). In the succeeding analysis are the strategic articles of the field, mostly authored by these academics.

4.2. The most relevant articles

Concerning the article's analysis (Appendix 1), in terms of citation and bibliographic coupling, we established 20 citations minimum of the 550 articles; 57 meet the threshold. On the co-citation analysis, with 20 citations minimum, of the 21,149 cited references, 94 meet the threshold. The field's infancy can be seen in the recent years of publication of the main articles present in the references of our corpus (Appendix 1). Accordingly, the fundamental references address the leading theory in entrepreneurship – Theory of Planned Behavior (Ajzen, 1991) and entrepreneurship education (Kuratko, 2005; Souitaris et al., 2007). Furthermore, the most impacting articles are (measured by the total link strength) are Bae et al. (2014), Ahmed et al. (2020) and Kassean et al. (2015).

4.3. Most relevant journals

Our research findings reveal that out of 232 journals, only 17 have published at least 5 papers on entrepreneurship education for non-business students. Among the journals with the highest number of publications are *Education + Training* (36 publications, 264 citations), *Sustainability* (22 articles), *Frontiers in Psychology* (21 articles), *International Journal of Management Education* (19 articles),

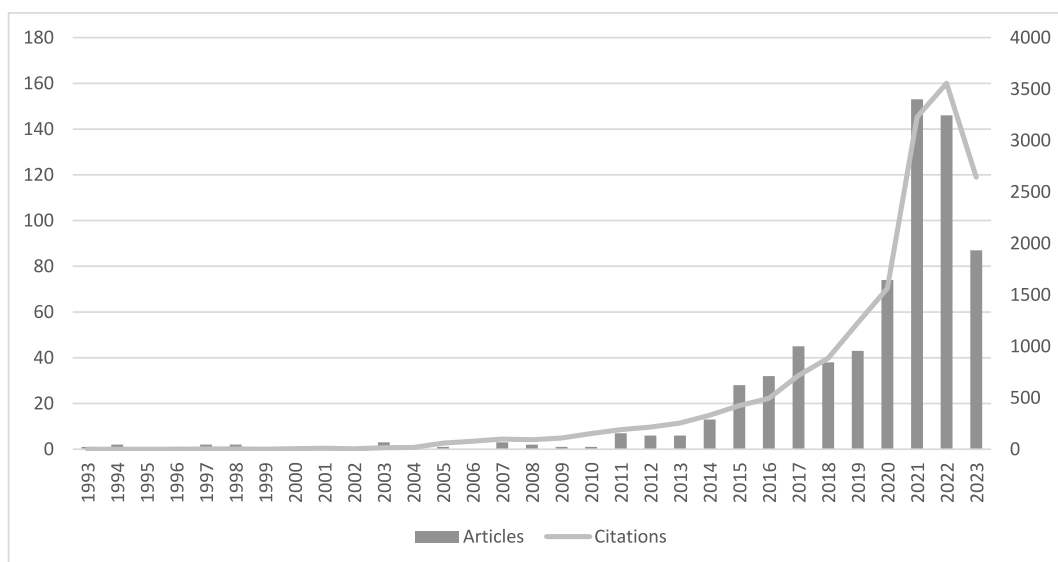


Fig. 1. Publications and citations per year (1993–2023).

International Journal of Engineering Education (18 articles). In terms of citations, the most influential are the *Journal of Business Venturing* (3195 citations), *Journal of Small Business Management* (691 citations), *International Entrepreneurship and Management Journal* (530 citations), and *Technological Forecasting and Social Change* (246 citations).

The corpus contains 9296 references. The journals that are cited most frequently in this corpus are highly respected in the research field. They are ranked in the Academic Journal Guide (AJG) published by the UK's Chartered Association of Business Schools and indexed in the Social Sciences Citation Index of the Web of Science. Moreover, these journals are rated in the top quartiles (Q) by the Journal Citations Reports (JCR) based on their Journal Impact Factor. Therefore, the most cited journals in this list are *Entrepreneurship Theory and Practice* (1386 citations, AJG – 4, JCR – Q1), followed by *Journal of Business Venturing* (1307 citations, AJG – 4, JCR – Q1), *Education + Training* (959 citations, AJG – 1, JCR – Q1), *Journal of Small Business Management* (704 citations, AJG – 3, JCR – Q2), and *International Entrepreneurship and Management Journal* (505 citations, AJG – 1, JCR – Q2).

4.4. Institutions with most the publications

We found a total of 835 institutions in the corpus. However, it is apparent that studying entrepreneurship for non-business students is not yet a common practice. This is evident when we look at the productivity per institute; only 14 institutions have four or more publications. Here we detach the most relevant: University of Salento, Italy (most productive, with 12 articles and 86 citations), Stanford University, USA (10 articles and 61 citations), New York University, USA (9 articles and 33 citation), Osaka University (9 articles and 5 citations), and Purdue University, USA (9 articles and 66 citations). These institutions' outputs reflect their productivity and scientific relevance, and this analysis will demonstrate the same for each country.

4.5. Most relevant countries and international collaborations

The articles in the corpus were published in 78 countries. Fig. 2 provides a visual representation of the collaborations between these countries. The countries with darker blue color have published more papers compared to the countries with lighter blue color. The lines on the figure show the collaborations between countries, and the thickness of the line indicates the strength of collaboration between the countries. Based on the number of articles, citations, and international collaborations, the top five countries that publish on entrepreneurship education for non-business students are the USA (177 articles, 3022 citations, and 36 international collaborations), China (157 articles, 145 citations, and 36 international collaborations), the United Kingdom (76 articles, 1268 citations, and 67 international collaborations), Spain (52 articles, 423 citations, and 29 international collaborations), and Italy (51 articles, 319 citations, and 23 international collaborations).

The research on entrepreneurship education for non-business students has traditionally focused on the global North. However, as illustrated on Fig. 2, there is a growing presence of publications and international collaborations coming from Australia (e.g., Maritz, 2017), Brazil (e.g., Cassol et al. 2022; Cavalheiro et al. 2023), Chile (e.g., Lin & Chen, 2023), China (e.g., Bell & Cui, 2023), and South Africa (e.g., Olofinyehun et al. 2022). These countries are establishing themselves as significant contributors to the field.

4.6. Most relevant keywords

The authors keyword co-occurrence analysis is valuable to identify clusters (Fig. 3). We wrote a *thesaurus file* (Van Eck & Waltman, 2010) to unite the synonyms and abbreviations (e.g., competence and competences; technology-transfer and technology transfer). We used all keywords and the *full counting* method, designating at least five occurrences; of 1350 keywords, 20 meet the threshold. Thus,

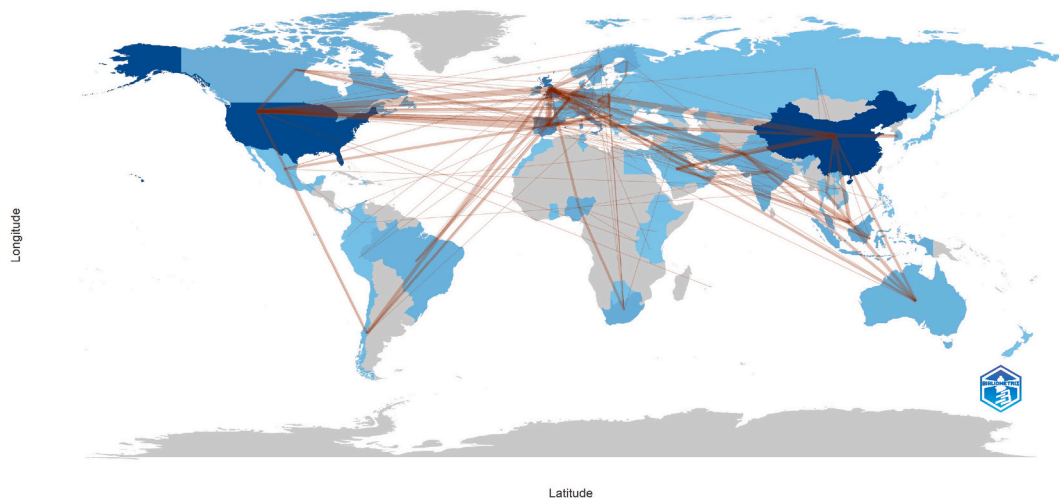


Fig. 2. Country collaboration map by Bibliometrix – R Studio.

the analysis by association using a two-items minimum cluster size provided four clusters with 38 links and 114 of total link strength (TLS).

Moreover, Fig. 3 displays the co-occurrence analysis network with five clusters and their links. The link strength is visible in the size of the frame; the stronger the link, the larger the frame size. Then, *entrepreneurial education* (270 occurrences) is linked to all keywords. Conversely, the keyword *innovation and entrepreneurship education* has five occurrences and is not displayed because it does not link with any other keyword.

In Table 1 we provide details for each cluster in terms of topics and references. As the findings demonstrate, the research on entrepreneurship education for non-business students has spread in various directions. Hence, the bibliometric analysis results support the thematic discussion in the next section. By assessing the indicators' results, biases can be attenuated, increasing the validity of the research and reducing the likelihood of omitting important information about the field (Caputo et al. 2021).

5. Main thematic fields

Considering that the network analysis of the keywords only uses the articles metadata, we decided to go beyond and deeper for the thematic cluster construction. Therefore, we conducted a content analysis looking to the actors and their relationships in the entrepreneurial education ecosystem. First, categorizing articles according to their titles, keywords, and abstracts. Following, we proceeded with the scrutiny of the complete texts to offer an overview of the thematic fields regarding the actors and their interactions, as identified in the previous analysis. Then, in the following sections we briefly approach each thematic group's contributions.

5.1. Non-business entrepreneurial students

5.1.1. Students' entrepreneurial motivations

The motivation for entrepreneurial attitude appears related to other themes. For example, Giacomini et al. (2011) addressed intentions, motivations, and barriers from a cultural lens (American, Asian, and European students) from several fields of study, including art, computer information systems, communication, political science, management, history, foreign languages, engineering, law, and sociology. Mensah et al.'s (2021) findings confirmed college student internship motivation as predicting students' entrepreneurial intention – their sample includes all fields of study. Likewise, Barba-Sánchez and Atienza-Sahuquillo (2018) research the impact of engineering students' motivations on their entrepreneurial intentions and the role of their entrepreneurial education. Also directed to engineering students, Yi and Duval-Couetil (2018) developed and validated an entrepreneurial motivation scale with three factors: motivation for personal interests, motivation for creation and solutions, and managerial motivations.

5.1.2. Students' entrepreneurial intentions

This is the most robust cluster in terms of total link strength. Its principal theme is entrepreneurial intention. The most cited article, Chen et al. (1998), proposed the entrepreneurial self-efficacy construct to predict the odds of someone's entrepreneurship – comparing entrepreneurship students with organizational psychology and management students. The strength of one's belief in being

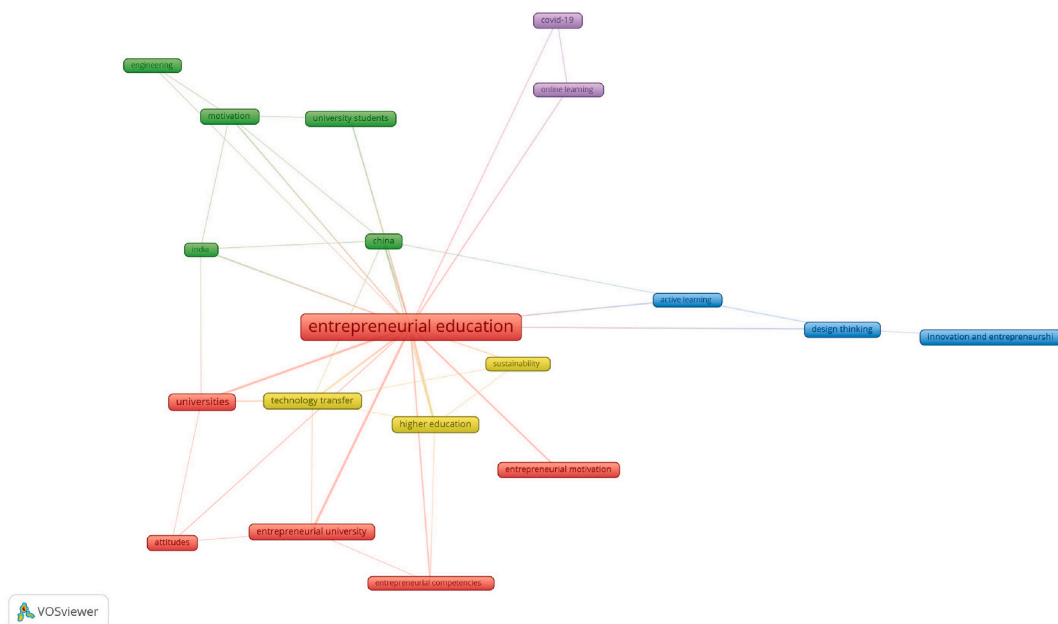


Fig. 3. Network visualization by VOSviewer 1.6.20.

Table 1
Clusters in detail.

Clusters	Keywords	Articles	Topics
#1 (Red)	Entrepreneurial Education	Zhu and Zhang (2022); Yevenes-Jara et al. (2022); Yashin et al. (2018); Thomson and Minhas (2017); Sorensen et al. (2022); Sohu et al. (2022); Sandhu and Hussain (2021); Sánchez (2011); Rakicevic et al. (2022); Pedrini et al. (2017); Padilla-Angulo et al. (2023); Nair et al. (2020); Mueller and Parzych (2018); Morselli (2018); Kusumojanto et al. (2021); Kusumojanto et al. (2020); Kumar et al. (2023); Kim and Park (2023); Kayed et al. (2022); Karyaningsih et al. (2020); Goodwin (2016); Galvao et al. (2018); Gabriellson et al. (2020); Fang and Chen (2019); Divac et al. (2022); Daniel and Almeida (2021); Asimakopoulos et al. (2019); Ahmed et al. (2020); Adelaja et al. (2023); Adelaja (2021)	<ul style="list-style-type: none"> • Entrepreneurial education and firm creation. • Entrepreneurial education and entrepreneurial intention. • The impact of entrepreneurial education on entrepreneurial intention during the COVID-19 pandemic. • Evaluating the impact of entrepreneurship education programs. • Entrepreneurial education for the entrepreneurial university: A stakeholder perspective.
	Entrepreneurial University	Zollo et al. (2017); Ziyae and Tajpour (2016); Yoshioka-Kobayashi (2019); Saeed et al. (2015); Qureshi and Mian (2021); Passavanti et al. (2023); Ouragini et al. (2023); Moreno et al. (2019); Markuerkiaga et al. (2017); Linton and Xu (2021); Guerrero et al. (2020); Etkowitz et al. (2023); Alves et al. (2019); Allahar and Sookram (2019);	<ul style="list-style-type: none"> • Comparative studies between private and public institutions. • Emergence of university-centered entrepreneurial ecosystems in the Caribbean. • Shaping the entrepreneurial university. • Academic institutions and the changing entrepreneurial finance landscape. • Roles of universities in entrepreneurial training. • Determinants of student entrepreneurship. • Entrepreneurial education of university students. • Entrepreneurship education in tourism. • Entrepreneurship education from an ecosystem perspective at MIT. • Junior enterprises and students' entrepreneurial competencies. • Emotional competencies and entrepreneurship. • The role of higher education in development of entrepreneurial competencies. • Role of entrepreneurial education in nurturing entrepreneurial orientation among engineering students. • An entrepreneurship model to increase students' entrepreneurial skills.
	Universities	Wright et al. (2017); Horne et al. (2021); Sterev (2023); Pierrakis et al. (2023); Huezco-Ponce et al. (2021); Huber (2014); Guerrero and Marozau (2023); Gianiodis and Meek (2020); Daneshjoovash and Hosseini (2019); Cavalheiro et al. (2023); Zhang (2023); Breznitz and Zhang, 2022;	<ul style="list-style-type: none"> • Entrepreneurial education and entrepreneurial orientation. • Entrepreneurial intentions, motivations, and barriers. • Role of entrepreneurship education, passion, and motivation in augmenting students' entrepreneurial intention. • The profile of university students, the characteristics of entrepreneurial behavior. • Assessing the role of creativity and motivation to measure entrepreneurial education and entrepreneurial intention. • Social media and entrepreneurial attitudes among students. • Business environment, attitudes, and entrepreneurial intentions. • Music students' attitudes towards entrepreneurship education.
	Entrepreneurial Competencies	Monllor and Soto-Simeone (2020); Magdoiu and Rada (2018); High and Alagic (2023); Dodescu et al. (2021);	
	Entrepreneurial Motivation	Anwar et al. (2023); Haase and Lautenschläger (2011); Kim and Park (2023); Li et al. (2022); Otache et al. (2022); Paliwal et al. (2022);	
	Attitudes	Vargas-Martinez et al. (2023); Schediwy et al. (2018); Barrera-Verdugo and Villarroel-Villarroel. (2022); Ali et al. (2022)	

(continued on next page)

Table 1 (continued)

Clusters	Keywords	Articles	Topics
#2 (Green)	University Students	Shi et al. (2020); Sahoo and Panda (2019); Rios-Rios et al. (2023); Aboobaker and Renjini (2020)	<ul style="list-style-type: none"> • Entrepreneurial intention among female students. • Entrepreneurial intentions and motivations in cross-cultural comparison among students. • Entrepreneurial intentions in emerging economies. • The influence of university entrepreneurship-oriented training in the transformation of intentions into new businesses among university students.
	Engineering	Thongpravati et al. (2016); Svensson et al. (2020); Schuelke-Leech (2021); Loras and Vizcaino (2013); Jung and Lee (2020); Jiang et al. (2017); Idris et al. (2022); Fernandes et al. (2017); Cordero et al. (2023);	<ul style="list-style-type: none"> • Entrepreneurial intention among engineering students. • What drives engineering students to be entrepreneurs. • Role of engineering major in entrepreneurial intentions of engineering students. • The mechanism of entrepreneurial education quality, entrepreneurial self-efficacy and entrepreneurial intention in social sciences, engineering and science education.
	Motivation	Alam et al. (2020); Barba-Sánchez and Atienza-Sahuquillo (2018); Chou et al. (2023); McCartan et al. (2023); Mueller et al. (2015); Omar et al. (2019); Webber et al. (2020); Yi and Duval-Couetil (2018); Zampetakis et al. (2016)	<ul style="list-style-type: none"> • Entrepreneurship education and motivation in students' entrepreneurial intentions. • Entrepreneurial education program motivations in shaping engineering students' entrepreneurial intention. • Exploring students' motivation to participate in entrepreneurial marketing education.
	China	Mensah et al. (2021); Liao et al. (2022); He and Yu (2023); Zhu and Yang (2023)	<ul style="list-style-type: none"> • Entrepreneurial universities in China • Influence of entrepreneurship support programs on nascent entrepreneurial intention among university students in China. • Exploring the predictors of Chinese college students' entrepreneurial intention.
	India	Olarewaju et al. (2023); Anwar et al. (2020); Chhabra et al. (2021); Giacomini et al. (2011); Srivastava and Misra (2017);	<ul style="list-style-type: none"> • Entrepreneurial education and finance for small farmers in India. • Entrepreneurship education and training in Indian higher education institutions.
#3 (Yellow)	Sustainability	Vodā and Florea (2019); O'Rafferty et al. (2014); Lesinski et al. (2023); Hsu and Pivec (2021); Hameed et al. (2016);	<ul style="list-style-type: none"> • The integration of sustainability awareness in entrepreneurship education. • Designing sustainable craft curricula: Balancing academic and practical training. • Mainstreaming sustainability in design education • Integrating entrepreneurial activities in chemical engineering education • A value-creating framework for enhancing entrepreneurial learning in networks.
	Higher Education	Zeng et al. (2022); Yasin and Khansari (2021); Wright et al. (2022); Wasim et al. (2024); Vazquez-Parra et al. (2022); Thom (2017a); Thom (2017b); Salas-Velasco (2023); Saffari et al. (2022); Rusko (2017); Paray and Kumar (2020); Nieminen and Lemmetyinen (2015); Matic et al. (2022); Martins et al. (2023); Lopez and Alvarez. (2019); Lolich and Lynch (2017); Lahn and Erikson (2016); Hoppe et al. (2017); Hall (2021); Ferreira et al. (2021); Fassbender et al. (2022); Etkowitz et al. (2017); Dzisi and Odoo (2017); Cassol et al. (2022); Blesia et al. (2021); Antonaci et al. (2015)	<ul style="list-style-type: none"> • High education on entrepreneurship and innovation ecosystem. • Engineering students' perspectives of entrepreneurial education in higher education. • The impact of higher education on entrepreneurship and the innovation ecosystem. • Addressing academic researcher priorities through science and technology entrepreneurship education. • The impact of higher education student intentions on becoming an entrepreneur. • Assessing engineering students' perspectives of entrepreneurship education within higher education. • Evaluating the impact of social enterprise education on students' enterprising characteristics.
	Technology Transfer	Blankesteijn et al. (2021); Bolzandi et al. (2021); Castro et al. (2019); Diaz-Casero et al. (2012); Duval-Couetil et al. (2021); Guenther and Wagner (2008); Hill and Kuhns (1994); Khelifi (2023); Kretz and Sa (2013); Lackéus and Middleton (2015); Murphy et al. (2021); Novikova et al. (2020); Oehler et al. (2015)	<ul style="list-style-type: none"> • Science-based entrepreneurship education for university-industry technology transfer. • Technology transfer offices and technology entrepreneurship education. • Experiential learning through cross-campus cooperation - Simulating and initiating technology-transfer.

(continued on next page)

Table 1 (continued)

Clusters	Keywords	Articles	Topics
#4 (Blue)	Active Learning	Ramsgaard and Christensen (2018); Pan (2022); Bell and Cui (2023); Arias et al. (2018)	<ul style="list-style-type: none"> • The role of data fusion algorithms in enhancing active learning in higher education. • The impact of big data on the cultivation of innovation and entrepreneurship skills in college students. • The influence of personality psychology education on active learning and cultural diversity in universities.
	Design Thinking	Aranha et al. (2018); DeWaters and Kotla (2023); Fiore et al. (2019); Grau and Rockett (2022); Johann et al. (2020); Lynch et al. (2021)	<ul style="list-style-type: none"> • The use of design thinking in developing new educational services for technology entrepreneurship education at universities. • The application of design thinking in creating student-centered experiences and enhancing student engagement. • The use of virtual reality-interactive learning models in designing smart space services for college entrepreneurship education.
	Innovation and Entrepreneurship	Liu (2022); Abou-Warda (2016); Deng and Wang (2023); Feng et al. (2023); Li (2023); Li (2017); Li et al. (2022); Liu (2023); Liu and Lin (2021); Ma et al. (2020); Pradeep and Satish (2022); Qian et al. (2020); Quan and Zhou (2018); Xue (2017); Yang (2020)	<ul style="list-style-type: none"> • The construction of talent training mechanisms for innovation and entrepreneurship education in colleges and universities based on data fusion algorithms. • The impact of innovation and entrepreneurship education on improving the employability of medical university students. • The role of entrepreneurship incubation process models and gamified educational software in sustainable education.
#5 (Purple)	Online Learning	Zur (2020); Liguori et al. (2020); Lambert and Rennie (2021); Oliver and Oliver (2022)	<ul style="list-style-type: none"> • Online entrepreneurship education at community colleges during the COVID-19 pandemic. • Online university learning of STEM entrepreneurship during the COVID-19 pandemic. • The impact of embedding real-life industry practice in the virtual learning environment for innovative online learning in entrepreneurship education. • The role of digital technologies in assessing entrepreneurial self-efficacy and intention of STEM students in entrepreneurial education. • Entrepreneurial continuous learning through Massive Open Online Courses
	COVID-19	Sawangchai et al. (2020); Britton et al. (2022); Secundo et al. (2022); Primario et al. (2024); Duan (2023)	<ul style="list-style-type: none"> • Entrepreneurship research during COVID-19 and research directions for the post-pandemic era. • Experiences from COVID-19 and emergency remote teaching for entrepreneurship education in engineering programs. • Effects of COVID-19 on the digital learning of entrepreneurs. • Digital-enabled redesign of entrepreneurship education in the COVID-19 pandemic.

entrepreneurial has five factors: marketing, innovation, management, risk-taking, and financial control (Chen et al., 1998, p. 304). Furthermore, Bae et al.'s (2014) meta-analysis review indicates a slight correlation between students' entrepreneurial intentions and education. However, Loi et al. (2016, p. 956) conducted a systematic literature review applying co-citation and factor analyses about entrepreneurship education in all kinds of students. They found six factors, namely "introspection, entrepreneurial intentions, pedagogy, entrepreneurial learning, and evaluation". Also, Ahmed et al.'s (2020) research in Pakistanis universities supports the positive impact of attending an entrepreneurship program on students' entrepreneurial intentions.

Moreover, Souitaris et al. (2007) focus on the effect of entrepreneurship education on science and engineering students' entrepreneurial intention. Their results show an enhancement in students' attitudes and entrepreneurial intention, pointing out inspiration as the major beneficial influence. Likewise, Zhang et al. (2014) approached entrepreneurial education affecting entrepreneurial intention using a Chinese sample, including technological and engineering-oriented universities. Also, their results present gender differences. Fayolle and Gailly (2015) address the effect of entrepreneurial education in students with and without previous entrepreneurial exposure. Their results highlight that "the impact of the program is negatively correlated with the initial level of intention" (Fayolle & Gailly, 2015, p. 88). A more recent study found that social and psychological capital mediate the relationship between entrepreneurial orientation and entrepreneurial intention. Additionally, the study found that digital competence moderates the influence of entrepreneurial orientation on entrepreneurial intention (Triyono et al. 2023). In sum, this topic has sparse research and divergent results, which are avenues for future research to find the causes and correlations for the divergence in entrepreneurial education influencing entrepreneurial intention.

5.1.3. Students' entrepreneurial competences

Students' competences and personality are the main themes of the articles in this cluster. For example, [Sánchez \(2011\)](#), applying a quasi-experimental design, focusing on personality traits, pointed out that entrepreneurial education intensifies students' entrepreneurial competences and intentions. Additionally, [Vodă and Florea \(2019\)](#) addressed the impact of personality traits and entrepreneurial education on entrepreneurial intentions. Using a Romanian sample from civil engineering and economics and business administration faculties, they identified need for achievement, the locus of control, and entrepreneurial education as crucial determinants for students' entrepreneurship. In addition, they highlighted gender's influence; male students were more inclined to engage in entrepreneurship. Furthermore, the gap between entrepreneurial intention and behavior after entrepreneurial education is a concern. Likewise, [Drakslar and Sirec \(2021\)](#) addressed Slovenian college students' entrepreneurial competences, revealing differences between non-business and business students. Their results did not confirm the impact of entrepreneurial education on their competences. However, confirmed that entrepreneurial competences affect entrepreneurial intention. [Huezo-Ponce et al. \(2021\)](#) addressed emotional competences influencing Mexican college students' entrepreneurial intention in two different entrepreneurial ecosystems (i. e., passive and active). Their results only found a direct relationship between emotional competences on entrepreneurial attitude and self-efficacy. However, there was no direct relationship with entrepreneurial intention.

5.1.4. Entrepreneurial students gender

As seen in the previous topics, the differences in outcomes for genders must be considered. Therefore, this section features the studies focusing on female and gender-neutral entrepreneurship. For example, [Kourilsky and Walstad \(1998\)](#) have identified differences between female and male students in several areas. For example, females are more aware of their entrepreneurial knowledge shortcomings. Additionally, [Bullough et al. \(2015\)](#) developed a comprehensive framework for designing and executing effective educational programs for women concerning leadership and entrepreneurship. Likewise, [Westhead and Solesvik \(2016\)](#) addressed Ukrainian female students' entrepreneurial intentions using a sample of engineering and business students. [Srivastava and Misra's \(2017\)](#) results established the crucial role of social evaluation on the entrepreneurial intentions of Indian female students. More recently, [Epstein et al. \(2021\)](#) identified motives that lead women to undervalue their projects potential, such as lower entrepreneurial intention than male students. With a focus on primary and secondary school, [Berglund et al. \(2017\)](#) analyze the subjectivities nurtured among students in a gender-neutral and inclusive introduction to entrepreneurship. Even with the inclusive pedagogy, the results show the promotion of a 'neo-masculine'.

5.2. Universities and entrepreneurship education for non-business students

5.2.1. Entrepreneurial teaching programs and models

In the early days of entrepreneurial education, the importance of measuring the progress of education, i. e., successes and failures in entrepreneurial education at business and engineering schools ([Gartner & Vesper, 1994](#)), which courses would be part of the programs, and the impact of the program's quality was highlighted ([Vesper & Gartner, 1997](#)). Furthermore, [Fiet \(2001\)](#) discussed an overall teaching strategy for theoretical entrepreneurial education to develop students' cognitive skills to enhance their entrepreneurial decisions. Concerning theoretical lenses, [Kassean et al. \(2015\)](#) advise using social cognitive career theory and social cognitive theory in entrepreneurship as an alternative to the planned behavior theory. Their sample included both business-related and non-business-related students. Moreover, [Haase and Lautenschläger \(2011\)](#) discuss entrepreneurship education's 'Teachability Dilemma', claiming it should focus on experiencing entrepreneurship. On the other hand, [Boldureanu et al. \(2020\)](#) emphasizes that entrepreneurship programs focused on role models should be planned differently for non-business students.

E-learning and virtual teaching are current themes. For example, [Secundo et al. \(2021\)](#) present a framework redesigning entrepreneurial education using digital technologies. Their study was conducted in an Italian laboratory "where students with different background can be involved in entrepreneurial learning activities to promote their entrepreneurial awareness and innovative ability, and work on the incubation of their business ideas" ([Secundo et al. 2021](#), p. 4). With an approach focused on university brand image, [Sawangchai et al. \(2020\)](#) point out that students' satisfaction with e-learning education strengthens the brand image. Their sample included Thai university students from several courses. On the other hand, [Liguori et al. \(2021\)](#) explored how educators of community colleges responded to the change towards online teaching. Their findings identified the opportunity for professional development concerning educational technology tools. In their turn, [Lambert and Rennie \(2021\)](#) report a case study focusing on the learning outcomes of remote teaching to engineering students focused on entrepreneurship. Their outcomes identified no differences in learning quality, regardless of the learning environment. Furthermore, the pandemic changed college programs in several countries, [Liguori et al. \(2021\)](#) analyzed how educators in the US community colleges transformed their programs for the online environment.

In a recent study conducted by [Kaewsang-On et al. \(2022\)](#), they were able to establish a connection between knowledge management and innovation theories and its application in entrepreneurship education, providing relevant implications for school leaders and practitioners. [Liu \(2022\)](#) researched how to cultivate innovative and entrepreneurial talents in higher education institutions and highlights the role of data fusion algorithms in promoting the society's progress in the era of intelligence and information. In addition, according to the study by [Xie et al. \(2022\)](#), it is essential to comprehend the shifts in entrepreneurial mindset and the way entrepreneurial setbacks are perceived to ensure the triumph of entrepreneurship training and the effective administration of start-ups. Moreover, [Naqvi et al. \(2023\)](#) explored the beliefs and perceptions from learners and the faculty about the entrepreneurial courses.

5.2.2. Entrepreneurial teaching methods

In recent years there has also been an emergence of research related to entrepreneurship teaching methods. For example, [Rossano](#)

et al. (2016) addressed the importance of problem-based learning on enhancing the entrepreneurial ecosystem, focusing on university-business cooperation from a pedagogical lens. Their sample included a German university of applied sciences. Likewise, Clarke et al. (2020) undertook a case study in a UK university with students from the module Bioscience with Enterprise, applying problem-based learning and self-reflective methods. Their results show non-business students' high level of satisfaction and enhanced coaction between entrepreneurship education and their course. Additionally, Sansone et al. (2021) analyzed Junior Enterprises Europe, exploring student-led entrepreneurial organizations' effect. Their sample includes students enrolled in various courses, e.g., students are enrolled in Languages and Communication, Arts, Sport, Science and Technology, Business, Human Science, and Biological Science. Their findings point out a fostering role of this extra-curricular entrepreneurial activity in students' entrepreneurship intention. In a recent research, Huang (2022) examined the connection between e-learning satisfaction, psychological capital, digital readiness, and the potential moderating role of mindfulness in entrepreneurial education for musicians.

5.2.3. University's support

Universities can offer various forms of support. For example, besides the educational and institutional, there is the support to develop ideas and business (Saeed et al. 2015). Furthermore, Saeed et al. (2015) identified that the crucial elements of students' entrepreneurial intentions are individual motivations and entrepreneurial self-efficacy. Their sample included Pakistani college students from several courses attending entrepreneurial education, elucidating that their entrepreneurial self-efficacy (individual's belief in their capacity to be an entrepreneur) is formed by institutional support and business and concept development support. Weilerstein and Couetil (2016) presented solutions to solve the needs of students inventors, for example, in terms of technology commercialization. They suggest combining formal policies with practical support, educational resources, and a recognition system to foster students' participation in the ecosystem. Recent research from Olarewaju et al. (2023) emphasize the relevance on institutional support along with the availability of information and technologies for communication to fosters entrepreneurial intentions in emerging economies.

5.3. Ecosystem of the entrepreneurship education for non-business students

5.3.1. Collaborations among the actors

Collaborations are a significant part of teaching entrepreneurship to non-business students. Through a conceptual approach, Wright et al. (2017) present a comprehensive framework on the entrepreneurial ecosystem for student startups, pointing out the actors (i.e., university, entrepreneurs, investors, accelerator, and incubator) and context (i.e., policy, institutions, and industry) over time. Additionally, Levie (2014), analyzing two case studies of UK-based technological universities, condenses the entrepreneurial ecosystem's barriers and opportunities, focusing on education's role in technology commercialization. Moreover, Belitski and Heron (2017) carried out a systematic literature review on the entrepreneurship ecosystem in education, highlighting the urge for a theory. They recommended entrepreneurship education ecosystem – considering university-industry-government collaboration for start-up

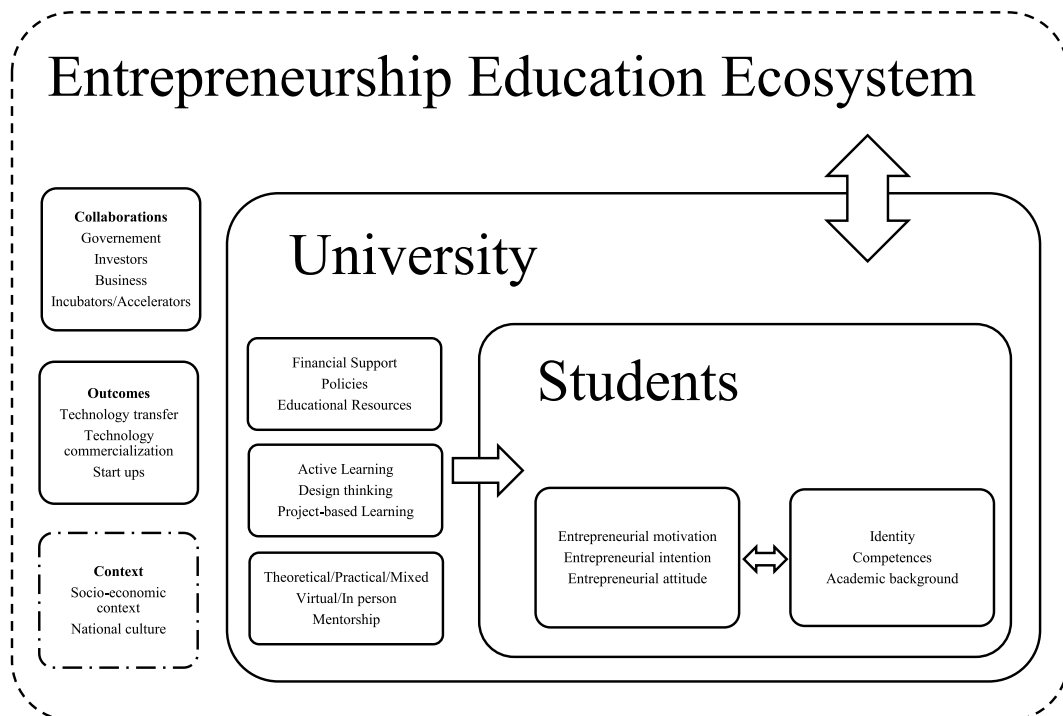


Fig. 4. Framework on entrepreneurship education for non-business students.

creation using knowledge – as a unity of analysis. Furthermore, Yoshioka-Kobayashi (2019) examined the evolution of the University of Tokyo from an anti-industry culture to a prominent entrepreneurial university in the last decade. The progress occurred through the development of an entrepreneurial ecosystem in the university. Some research focuses on the actors' specific roles in the ecosystem. For example, Bolzani et al. (2021) scrutinized the role of the technology transfer offices in the entrepreneurial education ecosystem regarding science and technology entrepreneurship education. On the other hand, current research highlights entrepreneurial education in hospitality and tourism areas that can gain from overseas partnerships to increase quality and staff development in post-Soviet countries (John et al., 2023).

5.3.2. Entrepreneurial education outcomes

Finally, we have articles engaged on entrepreneurship education outcomes in this cluster, such as technology commercialization. Currently, the research on technology commercialization focuses on changing entrepreneurial education for non-business. For example, Duval-Couetil et al. (2012) approached entrepreneurial education's career outcomes to engineering students. Additionally, Lackeus and Middleton (2015) addressed the gap between entrepreneurial education and technology transfer proposing a bridge using the capabilities of venture creation programs. Moreover, Gianiodis and Meek (2020) approached the process (in business and engineering schools) until the technology commercialization through the stakeholder theory lens, including assessment metrics addressing stakeholders' needs. Likewise, Blankesteijn et al. (2021) addressed the technology transfer via science-based (natural sciences, social sciences, and business and economic perspectives) entrepreneurship education; they identified four pillars: inserting entrepreneurship education in universities, balancing theory and practice, building an entrepreneurial mindset, and creating spin-offs through entrepreneurial education. Furthermore, Duval-Couetil et al. (2021) proposed a doctoral technology and science entrepreneurship education program to commercialize their research. Their results revealed a positive impact on motivation.

6. Discussion

We synthesized the findings and the thematic analysis above in Fig. 4, illustrating it in a synergetic framework presenting the thematic areas and further discuss it under the lenses of social learning theory. Hence, we highlighted entrepreneurship education for non-business students on three dimensions: students, universities, and the entrepreneurial ecosystems. Accordingly, the achievement of an efficient integration between the actors and the construction of a sustainable entrepreneurial ecosystem is indispensable for successful entrepreneurial education.

The research focusing on entrepreneurship education for non-business is driven by these three perspectives, students, university, and the entrepreneurial ecosystem (Fig. 4). It grew after the first decade and a half of research, and the themes spread (Fig. 1). The driving keywords from 2019 are closely linked to promising subjects, i.e., teaching methods and e-learning for entrepreneurial education. Likewise, each dimension of the framework (Fig. 4) has main topics that are related to them. For example, the university's support and collaborations in the entrepreneurial ecosystem are addressed simultaneously, and students' entrepreneurial attitudes and entrepreneurial teaching methods (education). The combined dimensions of the framework are represented in the links across clusters in the keyword co-occurrence analysis (Fig. 3). The evolution of the combinations reveals a recent emphasis on entrepreneurial teaching methods and the entrepreneurial ecosystem. Although India and China are the most mentioned countries in the keywords, the field has more papers on students and institutions from the USA and England. The cultural idiosyncrasy and countries' socio-economic context should be acknowledged and addressed in further research. Thereby, the frame line around this variable is different from the others.

Our results bring some discussion points considering the social learning theory and the framework on Fig. 4, such as: (i) observational learning in entrepreneurial education; (ii) role of mentors and peers; (iii) institutional influence on learning; and (iv) the entrepreneurial ecosystem as a social learning environment.

- (i) Observational learning, shadowing and experiential learning from successful entrepreneurs allow students to be in touch with entrepreneurial role models which in turn would influence their perceptions and behaviors. Bandura's social learning theory (1977) is particularly relevant emphasizing the importance of observational learning in acquiring new behaviors and skills. Further, by observing successful entrepreneurs, students will be able to witness the application of theoretical knowledge in a practical setting, enhancing their ability to identify opportunities and make informed decisions. On the other side, by also observing the failures, potential entrepreneurs will develop more realistic understanding of the challenges associated with entrepreneurship (Shane & Venkataraman, 2000). In the entrepreneurship education ecosystem, the possibility of having an observational learning would come from the interactions and collaborations with the actors like the entrepreneurs, government, investors, and incubators/accelerators and being sponsored by the university and the educators. Moreover, the students will be able to experience the business context developing a critical perspective of their educational background.
- (ii) Mentorship programs and peer interactions through collaborative learning environments offer students the opportunity to engage with experienced professionals, providing valuable insights, guidance, and practical advice. Peer interactions within collaborative learning environments stimulate discussions and knowledge sharing. In educational settings, collaborative learning has been associated with enhanced critical thinking, problem-solving skills, and a deeper comprehension of subject matter (Johnson & Johnson, 1989). Besides the possibility of observing, having the opportunity to be set in mentorships programs with entrepreneurs combined with peer learning from people from diverse backgrounds will increase the strength in the ecosystem and the learning experience outcomes.

- (iii) The role of universities and educational institutions as social environments supporting the acquisition of entrepreneurial mindset and competences. These institutions provide a unique environment where students can engage in experiential learning, networking, and exposure to entrepreneurial role models. The concept of the university as a social environment aligns with the social learning theory, as proposed by Bandura (1977), and impacts on the embodiment of new behaviors. In this environment, the student is not passive in the learning experience, they have an active role in their development and their identity is embraced as the cornerstone for their unique perspectives and business ideas.
- (iv) The entrepreneurial ecosystem serves as a social learning environment for non-business students where they can engage in experiential learning, using conceptual understanding in real-world scenarios (Autio et al., 2014). Within this context, individuals engage with various stakeholders such as mentors, investors, and fellow entrepreneurs, observing and learning from their experiences, strategies, and decision-making processes. These interactions contribute to their entrepreneurial development and maturity. Therefore, a change in the pedagogical approaches is urgent as stated by Klapper and Fayolle (2023) in suggestion Paulo Freire's critical pedagogical approach for sustainable entrepreneurship education.

6.1. Implications

This investigation contributes to the progression of knowledge within the field of non-business entrepreneurship education, utilizing the framework of social learning theory. It brings to light the entrepreneurial surroundings encompassing the learning environment and presents a thorough overview of the current state of the field. From a practical perspective, our research can serve as guidance for policymakers and educators when creating and implementing changes in entrepreneurial education for non-business curricula.

To the authors' knowledge, this article is pioneering in systematically addressing entrepreneurship education for non-business students by using the support of the social learning theory. It goes further previous reviews limited to entrepreneurial intentions (e.g., Bae et al. 2014) or entrepreneurial ecosystems (e.g., Belitski & Heron, 2017). Likewise, our outcomes exceed previous research that comprised only one decade of the literature (e.g., Baptista & Naia, 2015, using papers selected from 2000 to 2011). Therefore, the framework (Fig. 4) is a sound foundation for discussion, critique, and supporting further research. In view of these considerations, we recommend future empirical research addressing the interactions outlined in the framework. For example, by indicating success and failure cases, especially in the post-pandemic changes.

Our outcomes provide valuable information to the actors involved in entrepreneurial education for non-business students (e.g., deans, heads of faculty, teachers, managers, and policymakers) to grasp opportunities and challenges concerning the dynamics and dimensions of entrepreneurial education for non-business students. This enhanced knowledge is also essential concerning their relationship in the entrepreneurship education ecosystem. For example, supporting collaborations between universities and businesses interested in fostering students' entrepreneurial attitudes. Moreover, our findings are useful in assisting the revision and adaptation of teaching methods and courses programs since the dimension about the students' uniqueness and contexts provide information to teachers and coordinators regarding their pedagogical needs concerning entrepreneurial education. Accordingly, practitioners can use our results to enhance all dimensions of the entrepreneurship education ecosystem, i.e., the collaborations with the universities and the government.

7. Further research avenues

Grounded on the thematic analysis, this section provides suggestions for future research on entrepreneurship education to non-business students.

7.1. Non-business entrepreneurial students

A pivotal facet that warrants scholarly attention is the correlation between mental health, including attention deficit hyperactivity disorder, depression, and anxiety, and its influence on students' competences. A nuanced exploration of how disparities in personalities and competences align with distinct teaching programs and pedagogical approaches is recommended. Additionally, research should extend to encompass cultural disparities, linguistic variations, and the formulation of teaching models tailored for individuals with disabilities and psychological disorders. Subsequently, an imperative undertaking involves the analysis of outcomes within this demographic, particularly regarding the commercialization of technologies.

Furthermore, diversifying the scope of inquiry, future research endeavors should incorporate alternative measures of gender identification, encompassing non-binary and transgender categories. An examination of the efficacy of female entrepreneurship within non-business-focused entrepreneurship courses is advocated, alongside an exploration of the interplay between gender and national cultural influences on entrepreneurship education for non-business students.

The exploration of teaching methods remains a nascent area requiring comprehensive investigation. Recommendations for future research include novel perspectives on successful instances of innovative teaching methodologies and entrepreneurial education, with a specific emphasis on global south countries. Experimental and case study approaches are advocated to unravel the intricate relationship between teaching methods and entrepreneurial attitudes among students. Moreover, the application and adaptation of models from the global north to the global south, particularly in extracurricular entrepreneurial activities, warrant scholarly attention.

In terms of prospective research, a comparative analysis of entrepreneurial success following online versus on-site courses is

proposed, stratifying the outcomes by demographic factors such as age, gender, and educational background. Distinct attention is warranted for students diagnosed with Covid-19, differentiating their experiences from those unaffected. Additionally, a critical evaluation of pedagogical enhancements for virtual entrepreneurship instruction is imperative, with a focus on longitudinal studies to discern enduring effects on both educators and learners. A meticulous examination of the distinctive attributes characterizing teaching methods for non-business students remains a lacuna in current scholarship and necessitates dedicated exploration.

Efforts to comprehend the repercussions of the pandemic encompass a multifaceted exploration of its impact on entrepreneurial motivation and attitudes. This investigation necessitates an examination of diverse facets, such as the surge in e-learning, stringent lockdown measures, and economic crises. Employing various theoretical frameworks on motivation is imperative to garner a nuanced understanding of the shifts occurring in entrepreneurial dynamics. Furthermore, a fruitful avenue for prospective research lies in scrutinizing students' entrepreneurial motivations concerning values, climate change, sustainability, religion, and cultural influences.

7.2. Universities and entrepreneurship education for non-business students

Universities supporting student's entrepreneurship, a recurrent subject in extant literature, demands focused inquiry in forthcoming research. An in-depth examination should elucidate how distinct courses necessitate varied forms of university support, addressing the financial requisites and potential collaborative ventures with businesses and government entities. Likewise, the university's support on more active learning experiences and their sponsorship in the collaborations required to the development of mentorships and observational learning.

7.3. Ecosystem of the entrepreneurship education for non-business students

Proposing an abductive approach for future investigations, scholars are encouraged to scrutinize the roles played by different actors within the entrepreneurial landscape, particularly considering transformative changes post-Covid-19. This involves delving into processes such as digitalization, the advent of home office systems, social distancing measures, and the integration of Artificial Intelligence, Big Data, and the Internet of Things. An exploration of how intuition and tacit knowledge permeate the entrepreneurial ecosystem through shared value creation is essential. Furthermore, a forward-looking perspective on the entrepreneurial ecosystem should entail an examination of partnership models between students/ex-students and universities, with a particular focus on global south countries.

A comprehensive assessment of the impact of teaching on students' career trajectories is warranted. Concurrently, a dedicated inquiry into the economic outcomes of entrepreneurship post-education is imperative. Longitudinal studies should scrutinize the survival rates of startups in their initial years, delineating the contributing factors to their success or failure. Crucially, an analysis of these outcomes in relation to the principles of circular economy, sustainability, and the United Nations Sustainable Development Goals is indispensable.

8. Conclusion

Regardless of recent development, research in entrepreneurial education for non-business students is still in its infancy. This research is the first to present a comprehensive examination of the results of studies on entrepreneurial education for non-business through the lens of the social learning theory. Therefore, it mapped the literature by systematically scrutinizing the scientific domain through a comparative analysis (i.e., keywords, authors, papers, journals, institutions, and countries). The outcomes identified the most relevant research along with the thematic clusters: (i) students, (ii) universities, and (iii) the entrepreneurial ecosystems. Furthermore, supported by these outcomes, we propose a synergetic framework on the existing research focusing on the relationship between the thematic clusters, along with a discussion on entrepreneurial education to non-business students grounded on four dimensions of social learning (i) observational learning in entrepreneurial education; (ii) role of mentors and peers; (iii) institutional influence on learning; and (iv) the entrepreneurial ecosystem as a social learning environment. It is a thorough foundation for continued debate and upcoming research in this evolving area.

Additionally, this research on entrepreneurship education for non-business students, analyzed through the lens of social learning theory, has numerous applications in management teaching and education. For instance, the focus on observational learning, mentorship, and the significance of the entrepreneurial ecosystem can aid management educators in teaching entrepreneurship across various disciplines by promoting interactive and experiential learning methods. Similarly, the findings of this research can support management educators in creating curriculum modifications that facilitate innovation and entrepreneurship across courses and programs, thereby equipping students for varied business environments and encouraging cross-disciplinary teamwork.

Notwithstanding its contributions, this research also has limitations, which can be used as a basis for future research. For example, using other databases, other bibliometric analysis software, adding other search topics, and in-depth discussion of the clusters identified. Likewise, the chosen research method does not capture all research available on entrepreneurial education for non-business students. Additionally, the results do not assess the context of the citation, meaning there is no information on the positive or negative intentions in quoting the studies. Moreover, the results display the research *status quo* at an exact moment.

In sum, developing entrepreneurial education for non-business has undergone transformations over the years (even before the COVID-19 pandemic). Accompanying a brittle, anxious, nonlinear, and incomprehensible world is a tough endeavor for educators, educational institutions, and, especially, for students. Therefore, future studies ought to address means of adapting effectively and promptly so that courses and educators can keep up updated and provide suitable education to future entrepreneurs. Hereby, we

suggest future research to address the gaps presented in the previous sections.

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CRedit authorship contribution statement

Raysa Geaquinto Rocha: Data curation, Conceptualization, Writing – review & editing, Formal analysis, Investigation, Methodology, Project administration, Software, Writing – original draft. **Arminda do Paço:** Funding acquisition, Project administration, Supervision, Writing – review & editing. **Helena Alves:** Writing – original draft, Project administration, Funding acquisition.

Data availability

Data will be made available on request.

Appendix 1. Comparison of articles' citation, co-citation, and bibliographic coupling by VOSviewer

Citation			Co-citation			Bibliographic coupling	
Article	Cit	Links	Cited reference	Cit	TLS	Article	TLS
Chen et al. (1998)	1132	16	Souitaris et al. (2007)	169	167	Bae et al. (2014)	84
Souitaris et al. (2007)	859	28	Ajzen (1991)	158	157	Ahmed et al. (2020)	64
Katz (2003)	521	12	Krueger et al. (2000)	112	112	Kassean et al. (2015)	59
Bae et al. (2014)	490	12	Bae et al. (2014)	105	102	Haase and Lautenschläger (2011)	59
Fayolle and Gailly (2015)	319	6	Kuratko (2005)	98	96	Vodá and Florea (2019)	53
Vesper and Gartner (1997)	216	5	Oosterbeek et al. (2010)	95	94	Srivastava and Misra (2017)	49
Fiet (2001)	207	6	Fayolle et al. (2006)	87	87	Saeed et al. (2015)	47
Kourilsky and Walstad (1998)	199	2	Martin et al. (2013)	84	83	Fiore et al. (2019)	47
Piperopoulos and Dimov (2015)	194	4	Pittaway and Cope (2007)	82	79	Fretschner and Weber (2013)	44
Sánchez (2011)	168	4	Peterman and Kennedy (2003)	78	78	Loi et al. (2016)	44

Note: Doc – documents; Cit – citation; TLS – total link strength.

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