



Conceptual structure and perspectives on entrepreneurship education research: A bibliometric review



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ABSTRACT

This study aims to review the field of Entrepreneurship Education (EE). The review examines 325 scientific articles published in refereed scientific journals from 1987 to 2017. The SciMat software was used to conduct an analysis of performance indicators and science mapping visualizations. The performance analysis results identified some of the field's most active and influential articles, journals, and authors. The science mapping visualization of co-word analysis results revealed EE research evolution. In general, we found that EE research has evolved from EE as part of an economic development strategy to the EE academic perspective. Furthermore, research themes showed that students, rather than teachers, have become the main agents of the educational process. The results of this bibliometric analysis enhance understanding of the evolution of EE research with a global overview of the relevant literature and its authors.

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1. Introduction

The growth of research on entrepreneurship education (EE) and the associated research on the impact of EE has resulted in interesting challenges for institutions delivering EE, as well as supporting organizations. Following the most important research areas in Business and Management, as classified by [Diez-Martín \(2018\)](#), the research about EE is included in the areas of “skills and employability” and “managing complexity”. Management and Business Faculties and Business Schools could have the strongest orientation to entrepreneurship in their educational programs but EE is not only important in Higher Education. Thus, the existing EE research is broad both in levels of education and educational disciplines, accordingly this literature review will not limit the analysis to one specific discipline or level of education.

Although there are no definitive findings regarding the link between EE and entrepreneurial activities, a significant amount of research suggests this association and there is great interest in this research area ([Fernández-Portillo, 2018](#)). Results have shown

that such educational programs improve attitudes and overall entrepreneurial activity and that inspiration (i.e., a construct containing an emotional element) is the most influential EE benefit ([Souitaris, Zerbinati, & Al-Laham, 2007](#)).

EE research has grown rapidly ([Kassean, Vanevenhoven, Liguori, & Winkel, 2015](#)) and has attracted the attention of many renowned researchers. Several authors have helped increase EE knowledge by publishing literature reviews in academic journals. A literature review engages researchers and practitioners not only by providing a transparent auditing trail for legitimizing the order and flow of articles, but also by highlighting and updating the EE landscape. Articles by [Mwasalwiba \(2010\)](#) and [Nabi, Linan, Fayolle, Krueger, and Walmsley \(2017\)](#) are particularly interesting due to their global perspective on EE research and practice.

[Mwasalwiba \(2010\)](#) conducted a semi-systematic literature review of 108 articles, categorizing them according to educational objectives, target audiences, community outreach activities, applied teaching methods, and impact indicators, and then assessing the alignment between each of these aspects. The review showed that at that time, EE was not a developed field. Despite the large number of articles written from the perspective of many different stakeholders, including policymakers, academics, and students, there was no universal agreement as to the important themes that defined EE in practice. However, the review also showed that the field was moving toward a common conceptual approach demonstrated by agreement on educational objectives and

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recommended teaching methods (as opposed to those most frequently applied) and convergence on behavioral impact indicators.

To identify the impact of EE on a range of entrepreneurial outcomes in higher education, [Nabi et al. \(2017\)](#) analyzed 159 articles published between 2004 and 2016. They found that research on EE impact still predominantly focuses on measurements of short-term and subjective outcomes and tends to severely under describe the actual pedagogies currently being tested. The study was broad in scope and constructed an integrated teaching model framework that encompassed EE impact and its underlying pedagogy. In addition, the study underscored the need for future research on critical and underdeveloped themes and provided general recommendations for research in this field and the practical implications.

In addition to these two works that provided a global perspective on EE research, there are other studies that have analyzed the state of the field in specific contexts such as entrepreneurship in engineering education ([Da Silva, Costa, & De Barros, 2015](#)), and the impact of training and EE as facilitators of regional development ([Galvao, Ferreira, & Marqués, 2018](#)).

While each literature review has made important contributions, the present study extends the review of the literature by providing a global EE perspective and going beyond Higher Education. By using bibliometric indicators and mapping the conceptual structure of EE research, this study provides insights not previously identified or evaluated in such detail. Relative to traditional literature review methods, bibliometric analysis provides objective criteria that can assess the research development in a field and act as a valuable tool for measuring scholarship quality and productivity ([Cobo, Martinez, Gutiérrez-Salcedo, Fujita, & Herrera-Viedma, 2015](#)). Additionally, bibliometric methods offer systematization and replication processes that can improve understanding of the dissemination of knowledge in a field and can highlight gaps and opportunities that contribute to the advancement of the discipline. According to [Zupic and Čater \(2015\)](#), bibliometrics introduce a systematic, transparent, and reproducible review process, which permits a better description, evaluation, and monitoring of published research. Therefore, bibliometric analyses bring a new perspective to EE field as a complement of previous research.

Bibliometric reviews have been conducted in many research areas, including management ([Albort-Morant, Leal-Rodriguez, Fernandez-Rodriguez, & Ariza-Montes, 2018](#)), economics ([Bonilla, Merigó, & Torres-Abad, 2015](#)), innovation ([Merigó, Cancino, Coronado, & Urbano, 2016](#)), entrepreneurship ([Baier-Fuentes, Merigo, Amoros, & Gavieri –Martin, 2018](#)), wine tourism ([Duran, Del Rio, & Alvarez, 2017](#)), and international business ([Ferreira, Pinto, & Serra, 2014](#)). In the area of EE, [Galvao, Ferreira, & Marqués, 2018](#), document the paths for future research agendas, but without potential trends for future research.

Thus, the aim of this study is to conduct a literature review of EE research using bibliometric methods. First, using performance analysis, including selected productivity and impact indicators, this study attempts to highlight and provide an updated overview of EE research by revealing patterns in journals, articles, and authors. Second, by mapping a co-word analysis, a strategic diagram is developed to graphically illustrate the themes of current research, emerging themes, and potential trends for future research. Thus, the findings provide a roadmap for further investigation in this field.

The rest of this paper is structured as follows. The next section describes the methodology applied in this study's analysis, followed by the discussion of the results for the activity indicators and the science mapping analysis. The final section discusses the study's conclusions, limitations, and proposals for future research.

2. Methodology

The methodological design for this study's bibliometric analysis involves two phases, document source selection and bibliometric analysis. The steps for each are detailed in the following sections.

2.1. Document source selection

The journals were selected in order to analyze bibliographic information. For the purpose of this study, data were collected from the Social Science Citation Index compiled by the online Web of Science (WoS) database, which contain thousands of scholarly publications and bibliographic information with regard to authors, affiliations, and quotations. Previous research has shown that the simultaneous use of other relevant databases does not increase the amount of relevant documents captured due to the duplications that occur among the databases ([Harzing & Alakangas, 2016](#)). Thus, this study's literature survey was conducted using only the WoS Core Collection database.

To undertake the literature survey were carried out different search steps following [Riera and Iborra \(2017\)](#). First the documents were retrieved using some related terms. In this case, documents with the generic term "entrepren* education", appeared as a social science topic (i.e., as keywords in document titles, keywords, and abstracts). Second the "type of document" was specified as the "article" and "review" categories. And finally, the documents were selected from the discipline categories most commonly used to classify journals that cover EE research including the WoS sub-categories of "business," "management," "economics," "education educational research," "psychology educational," or "education scientific disciplines." Using these search criteria, the study obtained 325 articles that formed the basis of the bibliometric analysis, and searched for and counted the articles in the database on January 15, 2018. The oldest article in the dataset is the starting point of the analysis. It was an article published in the *Journal of Business Venturing*, titled "Entrepreneurship education in the nineties" ([McMullan & Long, 1987](#)). This article traces the history of EE in the nineties by reviewing propositions from individuals who had begun to use EE as a part of an economic development strategy.

2.2. Bibliometric analysis

Bibliometric analysis is defined as a part of scientometrics, which utilizes mathematical and statistical methods to analyze scientific activities in a research field ([Callon, Courtial, & Laville, 1991](#); [López-Fernández et al., 2016](#)). Bibliometrics provides a general picture of a research field that can be classified by papers, authors, and journals ([Merigo & Yang, 2017](#)). Bibliometric methods involve two main approaches: a performance analysis and a graphic mapping of science or bibliometric mapping ([Noyons, Moed, & Luwel, 1999](#)). On the one hand, the performance analysis evaluates the impact of citations of the scientific production made by the different actors that interact in a research field. These actors can be countries, universities, departments and, of course, researchers. The most popular indicators are those that consider the number of publications and the number of citations ([Yu & Shi, 2015](#)). The number of publications is correlated to the productivity of the author, while the number of citations is correlated to its influence on the scientific community ([Merigo & Yang, 2017](#)). On the other hand, science mapping aims to illustrate the structure and dynamics of scientific fields ([Zupic & Čater, 2015](#)). It is a spatial representation of how disciplines, fields, specialties, and documents or authors are related to one another ([Moral-Muñoz, Cobo, Peis, Arroyo-Morales, & Herrera-Viedma, 2014](#)).

For conducting this study, the Science Mapping Analysis Tool (SciMAT) ([Cobo, López-Herrera, Herrera-Viedma, & Herrera, 2012](#))

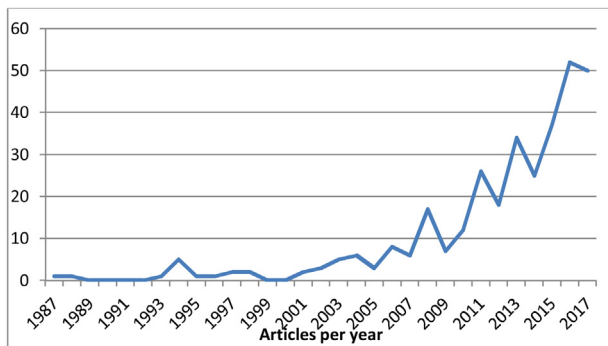


Fig. 1. Evolution of scientific research on EE
Source: Authors' own research.

was used. The software reports performance indicators and a co-word analysis, which is based on the assumption that an article's keywords constitute an appropriate description of its contents. The co-occurrence of two keywords in the same article is an indication of a link between the issues referred to in the article, and reveals the patterns and trends of a specific discipline by measuring the strength of association between the representative terms of relevant publications produced in the same area (Zupic & Čater, 2015).

The thematic networks or clusters generated during the co-word analysis have allowed the synthesis and organization of existing knowledge in this field and the identification of potential avenues for future research. The identification of future research streams or key research topics is systematically carried out using SciMAT; that is the main differential characteristic of this bibliometric software compared to others (i.e. Vosviewer, Biexcel).

3. Results

The following sections describe some interrelated and complementary steps of the performance analysis

3.1. Evolution of scientific production

Research activity was measured by the number of publications during a particular period. Fig. 1 shows the distribution of EE publications from 1987 to 2017 that were used in the study. The changes in productivity over time allowed the identification of three research stages. The *initial stage*, which spans 1987-2000, in which 14 articles were published, at the rate of fewer than two articles a year (with the exception of 1995, during which five articles were published). The *development stage*, which spanned 2001-2007, with 33 articles published at the rate of almost five

articles a year. The *expansive stage*, which spanned 2008-2017, with 198 articles published. The rate of publication of the articles during this last stage increased significantly, and thus, this stage accounted for more than 60% of the total publications over the last 10 years.

Based on this evidence of productivity, for the rest of the study, the first two periods were combined to form the *pre-expansion stage*. Thus, this study distinguished between two principal periods: *pre-expansion*, T1, (1987-2007) and *expansion*, T2, (2008-2017).

3.2. Most influential journals

Table 1 shows the 10 most productive and influential journals in the field of EE. Specifically, Table 2 shows the journals with five or more articles and the journals with more than 100 cites. In addition, some bibliometric indicators such as the total number of EE papers (TP) and total number of citations (TC) are presented. Further, an indicator has been included for the articles' citation frequency from more than 150, 100, 50, 10 citations, to a single citation. Finally, Table 1 shows the number of articles in each period, that is, T1 and T2.

According to Table 1, the journals with the highest number of published articles on the topic of EE were the Journal of Small Business Management (22), International Journal of Entrepreneurial Behavior & Research (21), Academy of Management Learning & Education (19), Journal of Business Venturing (16), Entrepreneurship and Regional Development (15), and International Entrepreneurship and Management Journal (14).

The two most productive journals have published special issues on EE: *Journal of Small Business Management* (Vol. 51, Issue 3, 2013) and *International Journal of Entrepreneurial Behavior & Research* (Vol. 24, Issue 3, 2017). This result confirms that EE has increased interest among academics in the *expansion stage*.

It is necessary to note the importance of the *Journal Business Venturing*, with twelve of the articles published in the *pre-expansion period* (T1), and a total of sixteen articles and 1787 cites. In addition, *Entrepreneurship Theory and Practice* had 1193 cites from three published articles, and *Academy of Management Learning & Education* had six articles and 575 cites in this period. Table 1 also highlights the *Journal of Small Business Management*, with twenty articles and 771 cites during the *expansion period* (T2). The *International Journal of Entrepreneurial Behaviour & Research* has published twenty one articles in T2 but has only 82 cites.

Finally, from an overall perspective, the results show that research on EE has been progressively published in more journals. Specifically, in T1, forty seven articles were published in twenty journals, whereas in T2, 278 articles were published in eighty nine journals.

Table 1
Rankings of the most productive and cited journals in the field.

R	JOURNAL	TP	TC	>= 150	>= 100	>= 50	>= 20	>= 10	>= 1	TP1	TC1	T2P	T2C
1	JSBM	22	874	1	1	7	16	20	22	2	103	20	771
2	IJEER	21	82	0	0	0	1	3	12	0	0	21	82
3	AMLE	19	854	2	2	4	13	15	19	6	575	13	279
4	JBV	16	1787	2	7	12	14	14	15	12	1598	4	189
5	ERD	15	147	0	0	1	2	4	13	0	0	15	147
6	IEMJ	14	297	0	0	1	6	10	13	0	0	14	297
7	EJMSTE	12	15	0	0	0	0	1	4	0	0	12	15
8	ISBJ	11	341	1	1	1	2	5	10	1	264	10	77
9	ETP	8	1518	4	4	5	6	7	8	3	1193	5	325
10	ML	7	142	0	1	1	2	2	6	2	136	5	6

Abbreviations: R = Rank; TC1 and TP1 indicates Total citations and papers in *pre-expansion period*, period before 2007, and TC2 in the expansion period after that year; >= 150, 100, 50, 20, 10 and 1 indicates number of papers with equal or more than 150, 100, 50, 20, 10 and 1 citations; JSBM, Journal of Small Business Management; IJEER, International Journal of Entrepreneurial Behaviour & Research; AMLE, Academy of Management Learning & Education; JBV, Journal of Business Venturing; ERD, Entrepreneurship and Regional Development; IEMJ, International Entrepreneurship and Management Journal; EJMSTE, Eurasia Journal of Mathematics Science and Technology Education; ISBJ, International Small Business Journal; ETP, Entrepreneurship Theory and Practice; ML, Management Learning.

Table 2
List of the most cited papers.

R	TITLE OF THE PAPER	AUTHOR	JOUR.	YEAr	TC	TCY	T1	T2
1	The emergence of entrepreneurship education: Development, trends, and challenges	Kuratko (2005)	ETP	2005	468	33,43	X	
2	Do entrepreneurship programmes raise entrepreneurial intention of science and engineering students? The effect of learning, inspiration and resources	Souitaris et al. (2007)	JBV	2007	418	34,83	X	
3	Enterprise education: Influencing students' perceptions of entrepreneurship	Peterman & Kennedy (2003)	ETP	2003	381	23,81	X	
4	Gender, entrepreneurial self-efficacy, and entrepreneurial career intentions: Implications for entrepreneurship education	Wilson et al. (2007)	ETP	2007	344	28,67	X	
5	The chronology and intellectual trajectory of American entrepreneurship education 1876-1999	Katz (2003)	JBV	2003	323	20,19	X	
6	Opportunity recognition as pattern recognition: How entrepreneurs connect the dots to identify new business opportunities	Baron (2006)	AMP	2006	296	22,77	X	
7	Entrepreneurship education - A systematic review of the evidence	Pittaway & Cope (2007a)	ISBJ	2007	264	22	X	
8	Entrepreneurship Education: Toward a Model of Contingency-Based Business Planning	Honig (2004)	AMLE	2004	235	15,67	X	

Source: Authors' own research.

3.3. Most cited articles

Table 2 shows the articles with more than 200 citations in the WoS (TC) and the number of cites per article by year (TCY). The nine most influential articles were published in the *pre-expansion* period and have a significant number of citations (between 468 and 195). Among them, it is necessary to highlight the articles by Kuratko (2005) and Peterman & Kennedy (2003) in *Entrepreneurship Theory and Practice*, and an article by Souitaris et al. (2007) in the *Journal of Business Venturing*, that were the most cited articles and had the highest annual citation averages in WoS. Therefore, they could be considered as reference articles in the EE literature. The study by Kuratko (2005) is the most relevant, not only by the number of cites but also for its focus. This study analyzed growth and development in curricula and programs devoted to entrepreneurship and new venture creation. Having been published near the *expansion period*, this article advanced the change in the EE research focus, from EE as part of an economic development strategy (mcmullan & Long, 1987) to the EE academic perspective (Kuratko, 2005).

3.4. Most influential authors

Many authors have made fundamental contributions to the development of EE. This section presents and ranks some of these authors, based on the information found in WoS. The measurement includes the number of papers published and the number of citations received, which have been used as measures in previous studies relevant to the field. Following Merigo and Yang (2017), this study implemented a combined method using both number of papers published and number of citations received.

The field of EE is characterized by continuous growth and the participation of a large number of authors. The results indicate that 698 authors contributed to the publication of 325 documents on EE research, which is an average of 2.15 authors per article. The fact that only authors have published more than four articles signifies low concentration in the field. Table 3 shows the list of authors with more than 200 citations. Note that the authors are ordered according to their productivity in the field (TP). In the case of a tie, we considered the total number of citations in the field (TC). Table 3 lists the TC and TP of each author for each period, that is, *pre-expansion period* (T1) and *expansion period* (T2).

Kartz is one of the most productive authors with six articles and is the second most cited author with 462 cites. Based on the analysis

Kartz could be considered as a reference author in the EE literature. Nevertheless, it is necessary to note the number of cites obtained by Kuratko, Al-Laham, Souitaris, Zerbini, Peterman and Kennedy with only one article published on this topic.

On the other hand, Fayolle and Kartz were among the most productive authors, each contributing six articles, followed by Linan and Pittaway, who each contributed five articles. In regard to time period, Kartz, Pittaway, Cope, Vesper and Gartner are the most productive in T1, and in T2 Kartz, Fayolle, Pittaway, Linan and Van Praag are the most productive.

3.5. Mapping the conceptual structure of the EE field

The topic of EE has attracted significant academic interest and the research focus has evolved over the years. Therefore, this study conducted an analysis of EE's thematic evolution and created a strategic diagram of EE research using article keywords to determine the most notable EE research themes. As we have indicated previously, SciMAT was used to develop the Science Mapping Analysis.

SciMAT is based on the bibliometric analysis methodology defined by Cobo, López-Herrera, Herrera-Viedma, & Herrera (2011) to analyze a research field and detect and visualize its conceptual subdomains (i.e., particular topics/themes or general thematic areas) and its thematic evolution.

Cobo et al. (2011) established stages to analyze a research field in a longitudinal framework. First, for each period of T1 and T2, the corresponding research themes were detected by applying a co-word analysis to the raw data. This was followed by clustering keywords to themes using the simple centers algorithm (Cobo et al., 2011), which locates keyword networks that are strongly linked to each other and that correspond to centers of interest. These themes can be understood as conglomerates of textual information or semantic/conceptual groups of different themes addressed by the research field. The similarity between the keywords is assessed using the equivalence index (Callon et al., 1991) and a theme is labeled using the name of the most significant keyword in the associated thematic network. The graphic representation of a theme is a sphere whose size is proportional to the number of associated documents (Cobo et al., 2011). To obtain a spatial representation of the thematic clusters of EE, the original keywords assigned by authors were used. A de-duplicating process was applied to improve data

Table 3
The most productive and cited authors.

R	AUTHOR	TC	TP	TC/TP	TP1	TC1	TC1/TP1	T2P	T2C	TC2/TP2
1	Katz, Jerome A.	462	6	77,0	2	404	202,0	4	58	14,5
2	Fayolle, Alain	151	6	25,2	0	0	0,0	6	151	25,2
3	Pittaway, Luke	434	5	86,8	2	376	188,0	3	58	19,3
4	Linan, Francisco	108	5	21,6	1	0	0,0	4	108	27,0
5	Gartner, William	316	4	79,0	3	314	104,7	1	2	2,0
6	Van Praag, Mirjam	246	4	61,5	0	0	0,0	4	246	61,5
7	Cope, Jason	376	2	188,0	2	376	188,0	0	0	0,0
8	Kickul, Jill	350	2	175,0	1	344	344,0	1	6	6,0
9	Honig, Benson	236	2	118,0	1	235	235,0	1	1	1,0
10	Vesper, Karl H	233	2	116,5	2	233	116,5	0	0	0,0
11	Oosterbeek, Hessel	230	2	115,0	0	0	0,0	2	230	115,0
12	Mueller, Stephen L.	204	2	102,0	0	0	0,0	2	204	102,0
13	Neck, Heidi	194	2	97,0	0	0	0,0	2	194	97,0
14	Fiet, James O.	188	2	94,0	1	91	91,0	1	97	97,0
15	Brush, Candida G.	154	2	77,0	1	81	81,0	1	73	73,0
16	Rasmussen, Einar	141	2	70,5	1	122	122,0	1	19	19,0
17	Sorheim, Roger	141	2	70,5	1	122	122,0	1	19	19,0
19	Martin, Bruce C.	135	2	67,5	0	0	0,0	2	135	67,5
20	McNally, Jeffrey J.	135	2	67,5	0	0	0,0	2	135	67,5
21	Kuratko, Donald F	468	1	468,0	1	468	468,0	0	0	0,0
22	Al-Laham, Andreas	418	1	418,0	1	418	418,0	0	0	0,0
23	Souitaris, Vangelis	418	1	418,0	1	418	418,0	0	0	0,0
24	Zerbinati, Stefania	418	1	418,0	1	418	418,0	0	0	0,0
25	Kennedy, Jessica	381	1	381,0	1	381	381,0	0	0	0,0
26	Peterman, Nicole E	381	1	381,0	1	381	381,0	0	0	0,0
27	Marlino, Deborah	344	1	344,0	1	344	344,0	0	0	0,0
28	Wilson, Fiona	344	1	344,0	1	344	344,0	0	0	0,0
29	Baron, Robert A	296	1	296,0	1	296	296,0	0	0	0,0

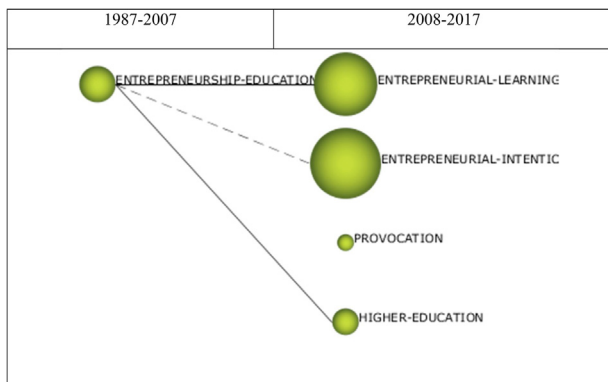


Fig. 2. Thematic evolution in the EE research field (1987–2017)
Source: Authors' own research.

quality by grouping words representing the same concept (consulting with peer of the authors of this article).

After that step, this study analyzed the evolution of the research themes (Cobo et al., 2012). Their evolution over the whole time period is then measured as the overlapping of clusters from two consecutive periods. For this purpose, the inclusion index is used to detect conceptual nexuses between research themes in different periods and to identify the thematic areas in a research field (Cobo et al., 2015). Fig. 2 shows the bibliometric map of the thematic evolution over the two time periods. Each theme is represented in the chart by a circle and the lines between circles represent thematic networks.

As Fig. 2 shows, EE was a unique research theme during 1987–2007 (T1). However, related topics, including *entrepreneurship learning*, *entrepreneurship intention*, *higher education*, and *provocation* appeared during 2008–2017 (T2). The solid lines characterize the connection between periods when the linked themes shared the same keywords or the label of one theme was a part of another. A dotted line indicates that the themes shared keywords that did not indicate the main research topic of the previous

theme (Moral-Muñoz et al., 2014). *Entrepreneurship education* had solid connections to *higher education* and *entrepreneurship learning*. However, *entrepreneurship intention* only shared keywords with *entrepreneurship education*. *Provocation* was a new theme that emerged during the second period (T2).

The next step is visualizing the research themes. In this phase, the themes are visualized by means of two different visualization instruments: strategic diagram and thematic network (Cobo et al., 2015). The diagram shows each theme as characterized by two measures: centrality and density. Centrality measures the degree of interaction between a network and other networks; in other words, the strength of external ties to other themes. Density measures the strength of internal ties among all keywords describing a research theme and it can be understood as a measure of the theme's development (Murgado-Armenteros, Gutiérrez-Salcedo, Torres-Ruiz, & Cobo, 2015)

There are four kinds of themes (Callon et al., 1991; Courtial & Michelet, 1994; Cahlik, 2000) classified by the quadrant in which they appear in the strategic diagram (Cobo et al., 2011). Themes in the upper-right quadrant are known as **motor themes**, because they exhibit strong centrality and high density. These themes are well developed and important for the structure of a research field. Themes in the upper-left quadrant are very specialized and possess a **peripheral** character. These themes are considered to have marginal importance to the field since they have well-developed internal ties but unimportant external ties. Themes in the lower-left quadrant may represent **emerging or disappearing** themes, because they are weakly developed and marginal. These themes possess low density and low centrality. Accordingly, they have not demonstrated significant research interest. Themes in the lower-right quadrant represent **transversal, general, and basic** topics. These themes are important to the research field but are not well developed.

3.5.1. Pre-expansive period (1987–2007) (T1)

According to the thematic evolution presented in Fig. 2, it was a unique research theme in this period, so the strategic diagram only

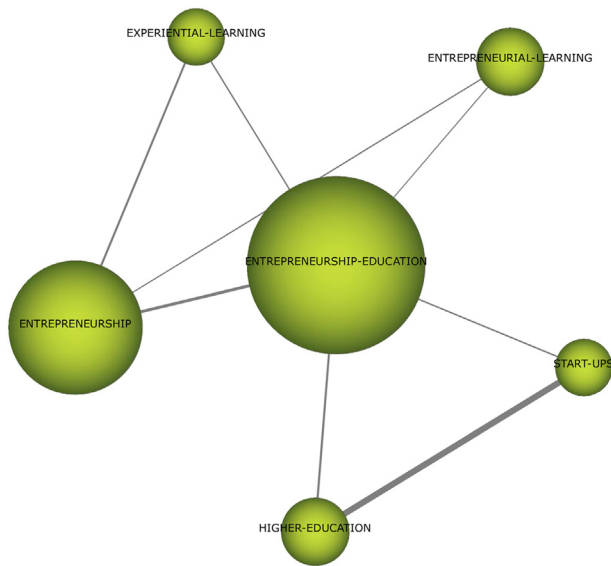


Fig. 3. Cluster network of EE themes (1987–2007)
Source: Authors' own research.

could have this theme represented. Thus, the research during this period pivoted on the EE theme.

Based on the analysis of the thematic network of the EE theme, the keyword network associated with this theme indicates that EE was the most studied theme according to the number of documents (Fig. 3). The topics of this theme involved two principal interrelated facts. The first fact involved the teaching-learning process (i.e., *entrepreneurial learning* and *Higher Education*) and its methodology (i.e., *experiential learning*) (Pittaway & Cope, 2007a; Pittaway & Cope, 2007b). The second fact involved the importance of studying the economic effects of the educational process (i.e., *entrepreneurship*) and new business innovators (i.e., *start-ups*) emerging from universities (Parker, 2006; Rasmussen & Sorheim, 2006).

Nevertheless, at the end of the first period, Pittaway and Cope (2007a) conducted a systematic review of EE evidence and detected a need for the reorientation of EE research to include the demand for enterprise skills. They also noted the need to understand how different models of entrepreneurship achieve different objectives.

3.5.2. Expansive period (2008–2017) (T2)

The four themes identified in the second period of thematic evolution (Fig. 2) are presented in a strategic diagram in Fig. 4, and each theme in the strategic diagram has an associated keyword network (Fig. 5A–D).

The strategic diagram presents four themes (Fig. 4). Analysis of the position of the themes in the strategic diagram and their associated keyword networks reveals that *entrepreneurial learning* has been the field's motor theme. It is related to EE in its keyword network (Fig. 5A). Although it remains the most studied subject based on the number of relevant documents, it lost its position of network centrality due to new research perspectives related to the teaching-learning process. That is, students rather than teachers became the main agents in the educational process. The rest of the topics that use the same network keywords (i.e., *experience*, *small firms*, *guess*, and *growth*) consider the same perspective when studying the influence of "learning by doing" in the learning process, including concepts such as experience, social knowledge networks, and the different contexts of entrepreneurship action (Fig. 5A), that are motivations to obtain the necessary student engagement in EE. Representative papers

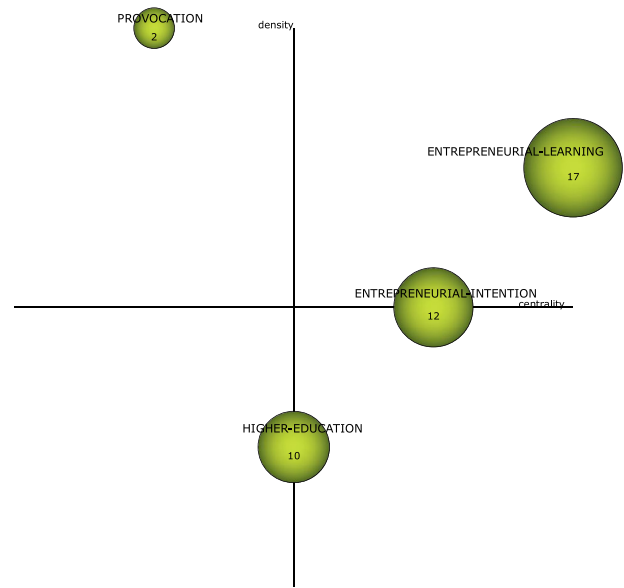


Fig. 4. EE research 2007–2018
Source: Authors' own research.

in this thematic network were those by Von Graevenitz, Harhoff, and Weber (2010), Pittaway, Rodriguez-Falcon, Aiyegbayo, and King (2011), Lourenço and Jayawarna (2011), and Middleton and Donnellon (2014).

As Fig. 2 indicates, although some related keywords had previously been addressed *entrepreneurial intention* is a theme that more fully emerged during this period. It is not sufficiently developed for consideration as a motor theme in the field (Fig. 4), but it is related to other relevant topics (Fig. 5B) in economic development strategy (e.g., *entrepreneurship* and *entrepreneurial skills*). Other important pathways of research such as *national culture* or *personal traits* are linked to the *theory of planned behavior* (TBP). The TBP, proposed by Azjen (1985), has been applied to studies on the relationships among beliefs, attitudes or behavioral intentions, and behaviors (Sanchez, 2010; Zhang, Duysters, & Cloodt, 2014). Moreover, it clearly represents an opportunity for further research, based on each of these perspectives (Miranda, Chamorro-Mera, & Rubio, 2017).

Provocation is a theme that emerges during this period without any relationships with other thematic networks (Fig. 2). Its position in the strategic diagram indicates that it does not contain any external links to other subjects in the field (Fig. 4). However, Fig. 5C indicates that the keyword network related to this new theme is consistent with the new trends in educational innovation methodologies, which focus on the development of transversal competencies such as *provocation*, *affect*, and *imagination*. This is not confined to the transmission of knowledge. These new trends have developed new practices of scholarship in entrepreneurship studies (Hjorth, 2011; Steyaert, Hjorth, & Gartner, 2011).

Finally, *higher education* and its thematic network demonstrated the position of the university in the formation of EE knowledge (i.e., *entrepreneurial knowledge*) and EE action (i.e., *technology transfer*) (Fig. 5D). This is because universities are entities related to these interrelated and mutually complementary functions (Bramwell & Wolfe, 2008; Guenther & Wagner, 2008). It is worth highlighting that the article by Kartz, Roberts, Strom, and Freilich (2014) provided a history of the development of cross-campus entrepreneurship education (CEEE) in the United States and the European Union. It identified different approaches to EE in the context of higher education.

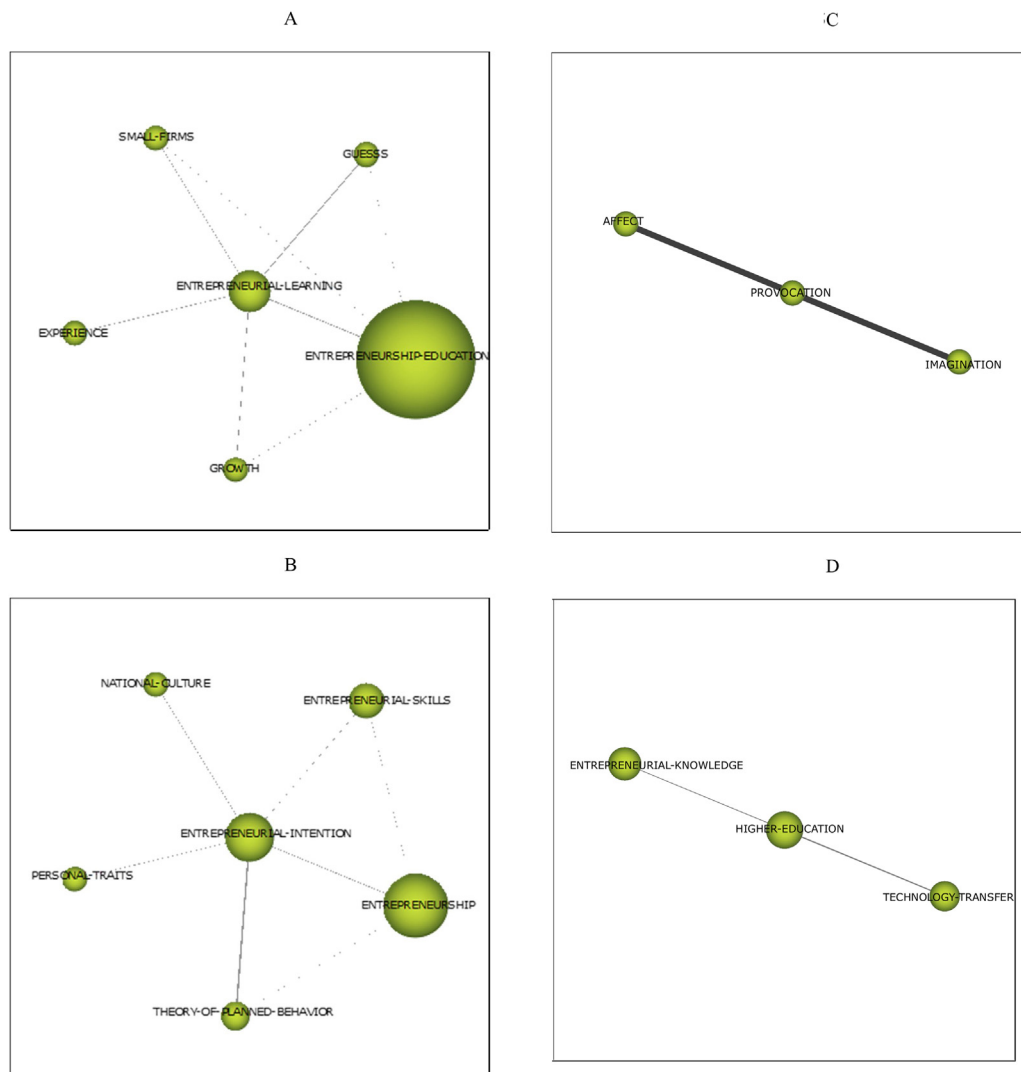


Fig. 5. Keyword Networks in EE research (2008-2017)
Source: Authors' own research.

4. Conclusions, limitations, and proposals for future research

This study examined the evolution of scientific research in EE between 1987 and 2017, based on publications in the WoS database. Although this study is not the first attempt to conduct a comprehensive and systematic review of academic EE research, it is the first attempt to map an orderly conceptual structure by applying bibliometric techniques. This offers researchers an opportunity to position their research within this evolving field and allows for the identification of new avenues of research. It is hoped that the results presented in this paper will encourage and facilitate new EE research. The results also have important practical implications since EE has been a priority across educational policies and across all the academic levels and disciplines.

The bibliometric review demonstrated objective indicators that revealed interesting research characteristics. First, the most productive journals (i.e., *Journal of Small Business Management* (22), *International Journal of Entrepreneurial Behavior & Research* (21) and *Journal of Business Venturing* (16) are business-specific journals that do not involve research on the learning and education process.

Based on the small number of articles per author (at most six) the analysis indicates that the research area is not highly concentrated. The most productive authors, Fayolle and Kartz, had six articles

each, while Linan and Pittaway followed closely behind with five articles each. In addition, although not the most productive in terms of article numbers, Kuratko is the most cited author. Kuratko (2005) conducted a remarkable analysis of the growth and development in the curricula and programs devoted to entrepreneurship and new venture creation. The evolution in productivity suggests significant growth in the number of published articles since 2008. Thus, the entire period of study was divided into two consecutive periods: *pre-expansive*, T1 (1987-2007; 21 years; 47 articles) and *expansive*, T2 (2008-2017; 10 years; 278 articles).

The examination of the field's conceptual structure through a co-word analysis revealed several thematic networks. EE was the unique theme during the first period (T1). However, different related topics appeared during the second period (T2), including *entrepreneurship learning*, *entrepreneurship intention*, *higher education*, and *provocation*. In essence, these results are similar to the findings of Galvao et al. (2018) whose literature review revealed three interrelated clusters: *entrepreneurial universities*, *entrepreneurial spirit*, and *process of business creation*; but this study doesn't support the dynamic perspective demonstrated with SciMat results.

Finally, the examination of the evolution of EE research in the literature showed that there is a clear interest in determining the academic perspective of EE by analyzing both the teaching

process and context of EE. Similarly, researchers have been interested in proposing indicators of success to assess the impact of EE in business creation. Nonetheless, EE research in the second period (T2) has been more focused on the academic perspective, and entrepreneurial learning appears as a motor theme in this period (T2). These findings indicate a change in the focus of the research to emphasize the teaching process and EE context. Specifically, emphasis is increasing on new methodologies that situate the student as the main agent and stress the acquisition of competencies rather than just the transmission of knowledge, an essential part of the education model. Furthermore, the examination of Fig. 5C shows that the isolated theme, *provocation*, is related with aspects of students' sentiments in the training process (*provocation-affect-imagination*). This result is consistent with the call for new research made by Nabi et al. (2018), who noted that future researchers must provide detailed information on pedagogical methods in order to understand the impact of EE on their outcomes.

The theme *entrepreneurial intention* emerged in the second period but was not developed enough to be considered a motor theme in the field. In other words, from a bibliometric perspective, it appears to be related to other subjects, but it is not dense enough to be considered as a motor theme. In their literature review, Nabi et al. (2017) highlighted that research on EE has focused on short-term, subjective impact measures such as entrepreneurial attitudes and intentions, rather than longer-term ones such as venture creation behavior and business performance, and they called for future research to address this gap. Even so, these authors emphasize the need to examine the moderating effect on the relationship between entrepreneurial spirit and its outcomes through other themes such as national culture and gender. The present bibliometric study's results are consistent with the demanded future research called for by Nabi et al. (2017), as demonstrated by the themes related to *entrepreneurial intentions*, *national culture*, *entrepreneurial skills*, and *personal traits*, with TBP as the predominant theory used to justify many of these studies.

It is important to realize that while our study is not specifically limited to Higher Education, but the results reveal little EE research in this context. In this sense, Nabi et al. (2017), who focused exclusively on EE research in this specific field, indicated the need for a current review that focuses on EE pedagogy and outcomes in higher education.

Finally, some study's limitations should be pointed out. However, it must be recognized that all the limitations are due to the compulsory decisions for applying a bibliometric technique like SciMAT. First, a methodological bias was introduced during the co-word analysis because it was necessary to group some of the keywords such as those representing the same concept as the authors' criteria. Second, the maps generated depended on the selected parameters. In this sense, different similarity measures and different clustering algorithms may have been implemented. Expertise in appropriately configuring the SciMat program was very important in setting the best parameters to avoid the appearance of strategic diagrams that are too complex to analyze.

The next step in this research might be to conduct a deeper content analysis (using textual analysis software such as NVivo) of the articles in each thematic cluster to show a more in-depth discussion of each identified theme. In a content analysis there are no restrictions on the format of the archives, as is required for the bibliometric software treatment.

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