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Entrepreneurship education or entrepreneurship education? A bibliometric analysis

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ABSTRACT

Entrepreneurship education (EE) has attracted much scholarly attention, showing exponential growth in publication and citation numbers. The research field has become broad, complex, and fragmented, making it increasingly difficult to oversee. Our research goal is to organise and integrate the previous literature. To this end, we use bibliometric analyses, differing from prior analyses, which are outdated or have a different focus. Our results show an immense growth in publications and citations over the last decade and an almost equal involvement of business and educational research. We identify the most productive and influential journals and authors. Our co-citation analysis reveals two research clusters, one focusing on psychological constructs relating to EE, and the other on entrepreneurial behaviour and new venture creation. Based on a review of the 25 most-cited articles on an annual basis, we identify and quantify the most relevant research themes and integrate them into a research framework that we propose for future research. A major finding is that extant research centres around the outcomes of entrepreneurship education, whereas its pedagogy is still mainly a black box.

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Bibliometric analysis; co-citation analysis; education; entrepreneurship; entrepreneurship education; performance analysis

1. Introduction

Entrepreneurship is considered highly relevant for economic growth (Acs and Szerb 2007; Galindo and Méndez 2014; McMullen and Long 1987; Wennekers and Thurik 1999), and educating future entrepreneurs is seen as a way to promote entrepreneurial qualities (O'Connor 2013; von Graevenitz, Harhoff, and Weber 2010). Entrepreneurship education (EE) has developed from a niche phenomenon (Hills 1988) to a flourishing field in both practice and research (Katz 2003). The number of course and programme offers has grown rapidly. And with this increasing relevance in teaching and learning naturally come pedagogical questions subject to research. With both education and entrepreneurship scholars contributing to the field, an exponential growth of EE publications and citations can be detected especially in the last decade (Figure 1).

As a consequence of this rapid growth, EE has become a broad, complex, and fragmented research field, which is increasingly difficult to grasp. This proliferation makes it necessary to find orientation. We pursue two research goals: First, we aim to identify the key researchers, key journals, and key research in the EE field. Second, we aim to organise and integrate the highly cited prior research on EE. To achieve this, we use bibliometric analyses, based on publication-specific statistics. The methodology has recently become popular in both entrepreneurship (Baier-Fuentes et al. 2019; Filser et al. 2020; Glinyanova et al. 2021; Hota, Subramanian, and Narayanamurthy 2019; Kraus et al. 2020; Lampe, Kraft,

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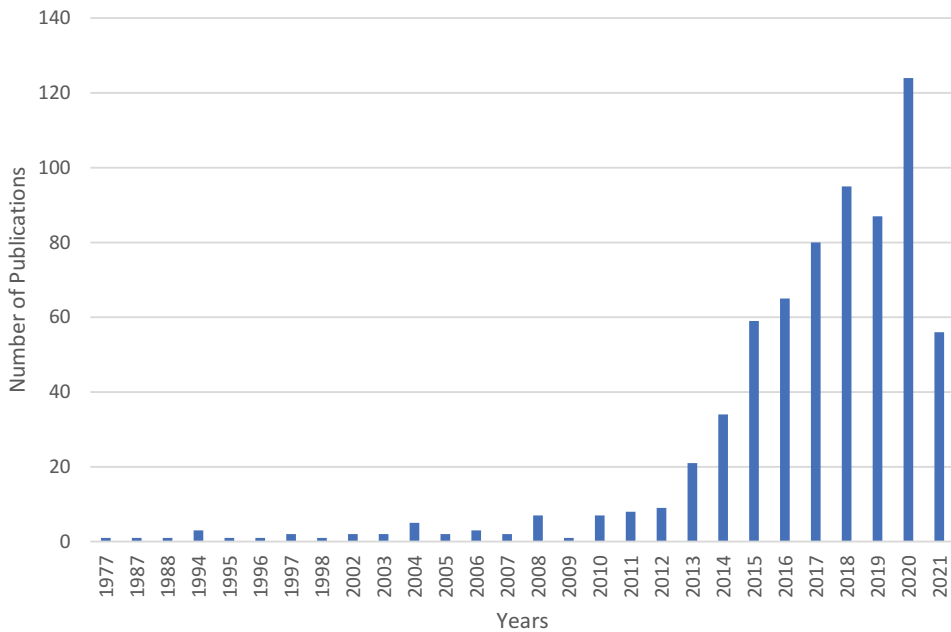


Figure 1. Annual development of publications, 1977 to mid-2021.

and Bausch 2019; Martínez-Climent, Zorio-Grima, and Ribeiro-Soriano 2018; Pellegrini et al. 2020; Santos, Marques, and Ferreira 2018; Schröder et al. 2020; Vallaster et al. 2019; Xi et al. 2015) and education (Aparicio, Iturralde, and Maseda 2020; Arici et al. 2019; Chen et al. 2021; Hallinger and Wang 2020; Hao, Chen, and Song 2020; Huang et al. 2020; Ivanović and Ho 2019; Kovačević and Hallinger 2019; Kuzhabekova 2021; Li, Antonenko, and Wang 2019). Whereas diverse bibliometric methods exist, we conduct bibliometric analyses based on high publication and citation numbers. These are considered to reflect scholars' productivity and impact in the field. Therefore, they are also specifically relevant for careers in academia (Jensen, Rouquier, and Croissant 2009; Kelly and Jennions 2006).

Our study complements previous bibliometric analyses on EE. For example, Zheng's (2018) bibliometric analysis focuses on Chinese EE research alone and is, therefore, not comparable.

Recently, Fellnhofner (2019) conducted a bibliometric analysis on EE literature published only until 2014. Bibliometric analyses have to be repeated regularly to track the further development of the state of research. As shown in the analysis of the annual development of publications until mid-2021, a large number of new articles have been published (Figure 1). Also, citations have grown exponentially. As the attention of later research and therefore the distribution of citations might change, all citation-based analyses can show a different picture after several years. Fellnhofner's (2019) bibliometric analysis also differs in regards to the methodology. Her dataset includes literature jointly dealing with both entrepreneurship and education, which goes beyond the mere EE field. With her search strategy, she would also cover research on, for example, non-entrepreneurial education's impact on entrepreneurial intention (e.g. Passaro, Quinto, and Thomas 2018). Unlike our more focused title search, she conducted a topic research, which might lead to fuzzy results (see Methodology). As a result, her dataset is much larger, thus less focused. Additionally, whereas we focus on multiple bibliometric performance analyses and a content analysis of the most cited articles, she conducts a bibliographic coupling, identifying eight research clusters: social and policy-driven EE research, human capital studies related to self-employment, organisational EE, triple helix, (re)design and evaluation of EE initiatives, entrepreneurial learning, impact studies of EE, and EE opportunity-related environment.

Similarly, Aparicio, Iturralde, and Maseda's (2019) bibliometric analysis is not up to date any more, as their dataset ends in 2017. In the following 3 ½ years, many new publications and citations were generated, which now lead to a new research landscape (Figures 1 to 3). Their methodology also differs in some regards. For example, they also conducted a topic rather than title search and also included review articles, which leads to slightly less accurate findings (see Methodology). Apart from some performance analyses, they conducted a keyword co-occurrence analysis. They find that, in the literature after 2007, the broad research clusters are entrepreneurial learning, entrepreneurial intention, higher education, and provocation.

Durán-Sánchez et al.'s (2019) bibliometric approach is purely descriptive and finds that the number of articles as well as the number of citations have increased significantly, as confirmed by our study. However, their dataset, with 164 articles, is much smaller than ours.

Gabrielsson et al. (2020) combine bibliometric analyses with a systematic literature review. Due to their divergent search strategy and database, their larger and less focused dataset ends in 2018, which is more recent than Fellnhöfer (2019) and Aparicio, Iturralde, and Maseda (2019). Their identification of research themes is based on a co-citation analysis and a co-occurrence analysis of common terms in abstracts. They find that the literature since 2013 shows four broad research clusters: the entrepreneurial learning process, enterprising and action, effectiveness and impact, and assessment and frameworks.

Johann et al. (2020) have a very narrow focus on the use of design thinking in EE.

Our study shows many methodological differences to the aforementioned previous bibliometric analyses regarding the dataset and data analysis. The dataset is more recent and more focused. Rather than identifying broad research clusters, we searched for distinct research items and discuss their relationships.

2. Methodology

2.1 Bibliometrics

To achieve our research goal, we conducted a bibliometric analysis on the EE literature. Bibliometric analyses aim to measure and review the literature in a specific research field, based on publication statistics. This approach is specifically helpful for literature samples that might be too large for a classic literature review. Besides, the quantitative orientation allows for a more objective assessment of publications (Culnan 1987; Garfield 1979; Zupic and Čater 2015). Among the various possible bibliometric analyses, we chose those relating to our two research goals. Regarding the first research goal, we focus on performance analyses, which centre around high publication and citation numbers (Noyons, Moed, and Luwel 1999). High publication numbers are interpreted as indicators for high productivity, whereas high citation numbers can be seen as indicators for a high impact of research because researchers cite works they consider relevant (Culnan 1987; Noyons, Moed, and Luwel 1999; Ramos-Rodríguez and Ruíz-Navarro 2004; Smith 1981; White and McCain 1998; Yue and Wilson 2004; Zupic and Čater 2015). This way, key researchers, key research, and key journals in the field can be identified (Hota, Subramanian, and Narayanamurthy 2019). In particular, we analysed the annual development of publications and citations, the involved scientific disciplines conducting research on EE, the productivity and impact of publication sources (especially journals) as well as the productivity and impact of authors. Regarding the second research goal, we conduct a co-citation analysis as a science mapping. A co-citation analysis maps the literature by looking for links between publications that are jointly cited in the reference lists of other publications (Osareh 1996; Small 1973). The basic assumption of this mapping method is that citations indicate the relevance of publications (Culnan 1987; Noyons, Moed, and Luwel 1999; Smith 1981; Zupic and Čater 2015) and that publications with strong citation links form distinguishable research clusters (Zupic and Čater 2015). In addition, we review the 25 most cited EE publications on an annual basis to get more detailed insights into the research themes covered by EE scholars.

The bibliometric analyses were conducted with BibExcel, Excel, and VOSViewer.

2.2 Data collection and data set

We conducted a title search on 13 June 2021 with the term 'entrep* education*' on the Web of Science (WoS). We decided to use a title rather than a topic search because the topic search also includes so-called 'Keywords plus', which are generated based on the documents' reference lists. Therefore, publications could become part of the dataset, which do not deal with EE but only cite such literature. In contrast, a title search ensures that only publications are included that are closely related to the inquired field (Kücher and Feldbauer-Durstmüller 2019). The asterisks were used to allow for deviations from the exact term 'entrepreneurship education' (Granados et al. 2011). For example, titles with 'entrepreneurial' or 'educational' would also be included. We used the WoS because it is considered to be exhaustive in social sciences (Norris and Oppenheim 2007) and widely used in bibliometrics (Hota, Subramanian, and Narayanamurthy 2020; Zupic and Čater 2015). The search yielded 799 publications. The use of additional databases usually does not lead to better results (Harzing and Alakangas 2016).

We removed all publications not written in English because English is the predominant scientific language and because we would not understand most other languages. As a result, the dataset was reduced to 773 publications. We further restricted the dataset by the publications' document type, including articles (664 publications), early access articles (37) and book chapters (104). Books (monographs), grey literature, and editorials were excluded because they usually are not peer-reviewed. Due to double-categorisations, the size of the dataset was reduced to 680 articles. To ensure that the dataset is valid, we read the titles and abstracts of all remaining papers (Hill and Georgoulas 2016; Zupic and Čater 2015). No further papers had to be excluded.

3. Results

3.1 Annual development of publications and citations

Figure 1 depicts the development of the numbers of publications per year from the first emergence in 1977 to 2020. After first being mentioned in the title of a publication in 1977, it took another decade until the next article was published. In the following twenty years, 0 to 3 EE articles were published annually, with 2004 as the only exception with five publications. A two-digit number of publications first emerged in 2013. Since then, a clear and quite steady growth is detectable. Apart from a slight decrease in 2019, the numbers were always exceeding the previous year's publication numbers. In the last full year of this analysis, 2020, the number of publications skyrocketed to 124 articles. The smaller number in 2021 stems from the partial year.

Figure 2 shows how the number of citations developed over time. The first citation stems from 1979. Again, it took some time – until 1993 – until the second citation was detectable. From then to 2005, only a one-digit number of annual citations could be found.

Figure 3 enlarges the time frame from 2005 to 2020 for better perceptibility. In 2009, the first three-digit number of citations (119) can be found. Since then, an exponential growth is recognisable, peaking in 2020 with 2,511 citations. Again, the full citation data for 2021 was not available when retrieving the dataset.

3.2 Involved scientific disciplines

The 680 articles of the dataset were assigned to 65 different scientific disciplines by the WoS. Table 1 shows the ten scientific disciplines involved in EE with the most publications. As most articles were assigned to more than one discipline, the sum of the publications in the table clearly exceed 680 and

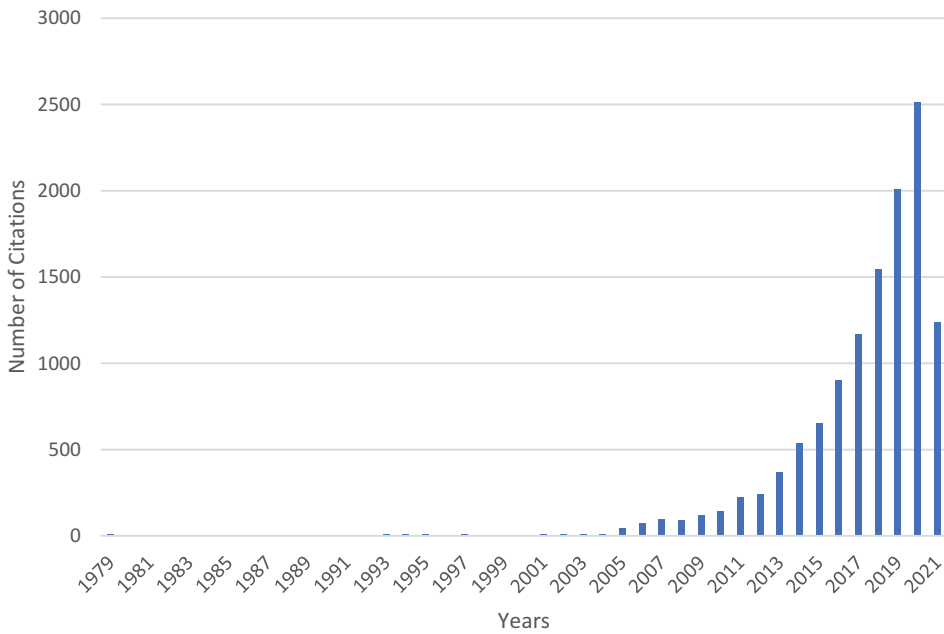


Figure 2. Annual development of citations, 1979 to mid-2021.

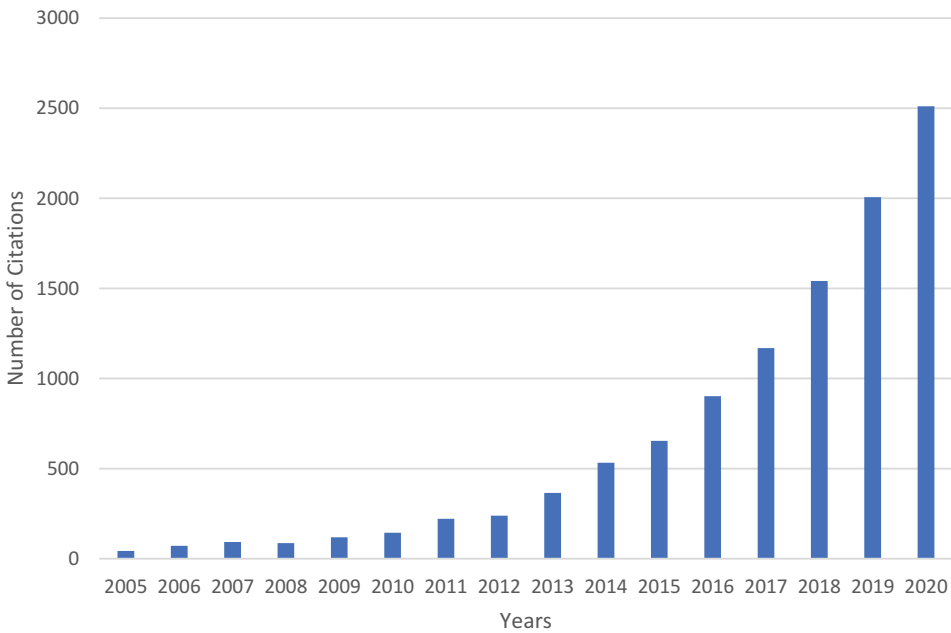


Figure 3. Annual development of citations, 2005 to 2020.

the sum of percentages is greater than 100%. The first two ranks account for the clear majority of articles. Of the 680 publications, 348 were assigned to business and economics and 319 to education

Table 1. Scientific disciplines involved in EE.

Rank	Scientific disciplines	Publications	% of 680
1	Business & Economics	348	51.2
2	Education & Education Research	319	46.9
3	Psychology	32	4.7
4	Engineering	25	3.7
5	Social Sciences (other topics)	20	2.9
6	Environmental Sciences & Ecology	19	2.8
7	Science & Technology (other topics)	16	2.4
8	Area Studies	12	1.8
9	Development Studies	11	1.6
10	Public Administration	10	1.5

and education research. The following ranks after 10 show only one-digit numbers of publications. As every article can be assigned to more than one discipline simultaneously, the sum of publications assigned to the diverse scientific disciplines exceeds 680.

3.3 Productivity and impact of publication sources

The 680 articles in the dataset were published in 258 different source titles. [Table 2](#) shows the 24 most productive journals and books, which have published at least seven EE articles. The three top-ranked sources relate to education; also eight other items are education-based ranks 6, 7, 10, 11, 13, 15, 16, 21, and 25 are education-related publication outlets, with some annual journals or book series specifically even being dedicated to EE alone. Seven journals and books relating to business or economics are specifically dedicated to entrepreneurship. EE is also being published in non-specialised business and entrepreneurship journals. However, the number of articles per journal is lower.

Apart from the productivity, the table also shows the average impact of articles published in these sources, as measured by the average number of citations per article. In sum, all EE articles were cited 11,976 times, which means that, on average, every article was cited 17.6

Table 2. Productivity and impact of publication sources. Note: C/P: Citations per publication.

Rank	Source Title	Publications	Citations	C/P
1	Education + Training	56	531	9.5
2	Industry and Higher Education	26	91	3.5
3	Annals in Entrepreneurship Education	22	48	2.2
4	Journal of Small Business Management	21	1,927	91.8
5	Frontiers in Psychology	19	40	2.1
6	International Journal of Management Education	14	87	6.2
7	Academy of Management Learning and Education	12	1,198	99.8
8	International Journal of Entrepreneurial Behaviour & Research	11	197	17.9
8	Studies in Higher Education	11	168	15.3
8	Sustainability	11	76	6.9
8	Elgar Research Agendas	11	18	1.6
8	Research Agenda for Entrepreneurship Education	11	14	1.3
9	Entrepreneurship Education and Training	10	17	1.7
10	Journal of Business Venturing	8	1,800	225.0
10	Journal of Technology Transfer	8	62	7.8
10	Advances in the Study of Entrepreneurship, Innovation, and Economic Growth	8	35	4.4
10	Journal of Small Business and Enterprise Development	8	29	3.6
10	Annals in Entrepreneurship Education and Pedagogy 2014	8	24	3.0
10	Annals in Entrepreneurship Education and Pedagogy 2018	8	4	0.5
11	Entrepreneurship and Regional Development	7	412	58.9
11	International Entrepreneurship and Management Journal	7	255	36.4
11	Eurasia Journal of Mathematics, Science and Technology Education	7	21	3.0
11	Administrative Sciences	7	38	5.4
11	Educational Sciences: Theory & Practice	7	9	1.3

times. Table 2 shows that the sources clearly differ regarding their average impact, as the average number of citations per publication ranges between 0.5 and 225 citations. The *Journal of Business Venturing* shows the highest average impact (225), followed by the *Academy of Management Learning and Education* (99.8) and the *Journal of Small Business Management* (91.8).

3.4 Productivity and impact of authors

The articles of the data set were (co-)authored by 1,505 authors. Table 3 shows the 24 authors with at least four publications regarding EE. The ranking is led by Fayolle as both the most productive and most impactful EE scholar on total. Several authors not included in the table show even higher citation numbers. In particular, the article by Wilson, Kickul, and Marlino (2007) on 'Gender, entrepreneurial self-efficacy, and entrepreneurial career intentions: Implications for entrepreneurship education reached' even reached 725 citations. However, all three co-authors appeared only once in the data set. Whereas this impact with only one publication is impressive, researchers with only one article cannot specifically be called EE researchers. Considering the average citations per publication, Honig is the most impactful researcher on our list, with 109.3 citations per publication.

3.5 Most cited articles

Figure 4 depicts the co-citation map of our literature sample for the 25 articles that were cited at least 50 times. The nodes represent articles and the lines indicate the citation links between them. The cluster analysis shows two distinguishable research clusters. The red cluster on the left contains 14 and the green cluster on the right consists of 11 articles.

Table 4 lists the 25 most cited articles from our dataset, sorted descendingly by total citations. As mentioned before, Wilson, Kickul, and Marlino (2007) received the highest total number of citations (725), which is more than six times as much as the 25th most cited paper. It has to be mentioned again, that reviews were excluded from the dataset, as they organise, summarise, consolidate, or integrate research on a topic, but are not considered original research themselves. As a consequence

Table 3. Productivity and impact of publication sources. Note: C/P: Citations per publication.

Rank	Author	Publications	Citations	C/P
1	Fayolle, A.	7	577	82.4
2	Morris, M. H.	6	217	36.2
2	Lans, T.	6	149	24.8
2	Pihkala, T.	6	50	8.3
2	Ratten, V.	6	37	6.2
3	Duval-Couetil, N.	5	156	31.2
3	Maritz, A.	5	53	10.6
3	Jones, P.	5	40	8.0
3	Penaluna, A.	5	38	7.6
3	Bell, R.	5	24	4.8
4	Honig, B.	4	437	109.3
4	Ruskovaara, E.	4	66	16.5
4	Komulainen, K.	4	63	15.8
4	Korhonen, M.	4	63	15.8
4	Raty, H.	4	63	15.8
4	Johansen, V.	4	46	11.5
4	Jones, C.	4	44	11.0
4	Hägg, G.	4	29	7.3
4	Ferreira, J. J.	4	25	6.3
4	Secundo G.	4	18	4.5
4	Anwar, I.	4	6	1.5
4	Saleem, I.	4	6	1.5
4	Narmaditya, B. S.	4	2	0.5
4	Wibowo, A.	4	2	0.5

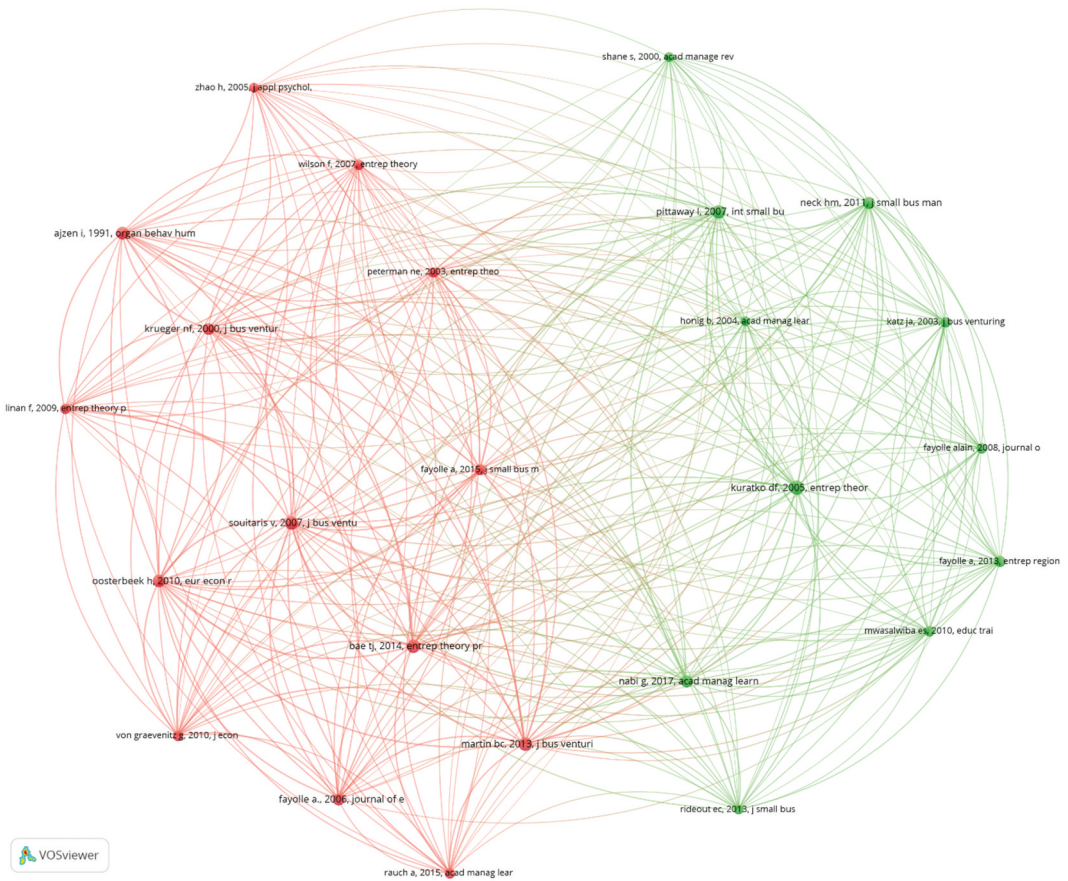


Figure 4. Co-citation map (VOSViewer).

of their helpful overview providing character, reviews have a general tendency to attract above average citation numbers. This is also the case for EE research. If reviews were included in this bibliometric analysis, Kuratko (2005) would be ranked first with 860 citations. We do not consider Katz (2003) a classical literature review but also a historical review of both EE research and practice, which is why we kept it in the list.

A sole look at the total citation numbers privileges older over younger publications, as older articles had more time to collect citations. As a consequence, the average citations per year, which are also provided in Table 4, equalise the temporal effect. Considering this, the ranking would look quite different, as shown in the right column. The highest annual citations, 65.1, were received by Bae et al. (2014), who conduct a meta-analysis on the highly relevant question if EE raises the intention to become an entrepreneur.

The majority of the 25 most cited papers were published in entrepreneurship journals. The most frequently appearing journal is the *Journal of Business Venturing* with seven articles, followed by the *Journal of Small Business Management* with six papers. One journal, the *Academy of Management Learning & Education*, equally belongs to the fields of business/management as well as education and accounts for four articles. *Entrepreneurship Theory & Practice* has published two of the most cited papers, the already mentioned works by Bae et al. (2014) and Wilson, Kickul, and Marlino (2007).

Table 4. Most cited articles. Note: C/Y: Citations per year.

Rank	Author(s)	Title	Citations	C/Y (Rank)
1	Wilson, Kickul, and Marlino (2007)	Gender, entrepreneurial self-efficacy, and entrepreneurial career intentions: implications for entrepreneurship education	725	51,8(3)
2	Katz (2003)	The chronology and intellectual trajectory of American entrepreneurship education 1876–1999	513	28,5(9)
3	Oosterbeek, van Praag, and Ijsselstein (2010)	The impact of entrepreneurship education on entrepreneurship skills and motivation	497	45,2(5)
4	Bae et al. (2014)	The relationship between entrepreneurship education and entrepreneurial intentions: a meta-analytic review	456	65,1(1)
5	Martin, McNally, and Kay (2013)	Examining the formation of human capital in entrepreneurship: a meta-analysis of entrepreneurship education outcomes	445	55,6(2)
6	Neck and Greene (2011)	Entrepreneurship education: known worlds and new frontiers	435	43,5(6)
7	Honig (2004)	Entrepreneurship education: towards a model of contingency-based business planning	422	24,8(13)
8	von Graevenitz, Harhoff, and Weber (2010)	The effects of entrepreneurship education	312	28,4(10)
9	Fayolle and Gailly (2015)	The impact of entrepreneurship education on entrepreneurial attitudes and intention: hysteresis and persistence	284	47,3(4)
10	Rasmussen and Sorheim (2006)	Action-based entrepreneurship education	258	17,2(18)
11	Fayolle (2013)	Personal views on the future of entrepreneurship education	236	29,5(7)
12	Vesper and Gartner (1997)	Measuring progress in entrepreneurship education	212	8,8(22)
13	Morris et al. (2013)	A competency-based perspective on entrepreneurship education: conceptual and empirical insights	194	24,3(14)
14	Bechard and Gregoire (2005)	Entrepreneurship education research revisited: the case of higher education	183	11,4(20)
15	Rideout and Gray (2013)	Does entrepreneurship education really work? A review and methodological critique of the empirical literature on the effects of university-based entrepreneurship education	178	22,3 (16)
16	Piperopoulos and Dimov (2015)	Burst bubbles or build steam? entrepreneurship education, entrepreneurial self-efficacy, and entrepreneurial intentions	174	29,0(8)
17	Rauch and Hulsink (2015)	Putting entrepreneurship education where the intention to act lies: an investigation into the impact of entrepreneurship education on entrepreneurial behaviour	167	27,8(11)
18	McMullen and Long (1987)	Entrepreneurship education in the nineties	154	4,5(24)
19	Zhang, Duysters, and Cloodt (1987)	The role of entrepreneurship education as a predictor of university students' entrepreneurial intention	143	20,4(17)
20	O'Connor (2013)	A conceptual framework for entrepreneurship education policy: meeting government and economic purposes	133	16,6(19)
21	Gartner and Vesper (1994)	Experiments in entrepreneurship education – successes and failures	133	4,9(23)
22	Maresch et al. (2016)	The impact of entrepreneurship education on the entrepreneurial intention of students in science and engineering versus business studies university programs	132	26,4(12)
23	Hills (1988)	Variations in university entrepreneurship education – an empirical study of an evolving field	132	4,0(25)
24	Edelman, Manolova, and Brush (2008)	Entrepreneurship education: correspondence between practices of nascent entrepreneurs and textbook prescriptions for success	125	9,6(21)
25	Karimi et al. (2016)	The impact of entrepreneurship education: a study of Iranian students' entrepreneurial intentions and opportunity identification	119	23,8(15)

4. Discussion

Considering the age of both the practice of entrepreneurship in the economy and entrepreneurship research, the late emergence of EE is surprising. Entrepreneurship, as the creation of new ventures, goes back to ancient human history and is as old as the economy itself. Economic theory started to address entrepreneurship some 300 years ago. An important bust to economic entrepreneurship research was

initiated by scholars such as Schumpeter and Kirzner in the 20th century. The *Journal of Small Business Management* was founded in 1963, *Entrepreneurship Theory and Practice* in 1976, the *Journal of Business Venturing* in 1985, and *Small Business Economics* in 1989.

The first entrepreneurship class was held in 1947 (Katz 2003). In his 1988 paper, Hills (1988) finds that EE was still in an embryonic state and that many academics found it somewhat suspect. Fifteen years later, Katz (2003) attested that EE was already a matured field. According to the annual publication and citation numbers, the field gained even much stronger momentum a decade later. Since then, it has been growing exponentially. A reason for this late emergence could be found in the formerly predominant collective understanding that entrepreneurs are 'born', not 'made'. Early entrepreneurship research had a strong focus on personality traits, which are considered to be enduring characteristics either inherited in one's genes or established through (early childhood) socialisation. A shift from entrepreneurial traits to entrepreneurial behaviour developed rather slowly. Gartner (1989) was one of the first who stated: "'Who is an Entrepreneur?'" Is the wrong question'. When behaviour becomes more prominent than traits, the next question is: What is the right, i.e. *competent* entrepreneurial behaviour (Morris et al. 2013)? Competent behaviour successfully leads to desired outcomes, such as the intention to start a business and to develop it to a supplier of products and services demanded and bought by customers. Competence can be learned. Then, entrepreneurs are not only 'born' but can be 'made', which means that entrepreneurship is can be subject to education.

Both entrepreneurship and education scholars contribute to EE research, as reflected by the distribution of publications among both disciplines. However, the involvement of multiple further scientific disciplines shows that EE becomes an increasingly interdisciplinary field.

Similarly, the three-digit number of source titles demonstrates the strong proliferation of EE research. Again, both entrepreneurship and education journals are almost equally responsible for publishing EE research. Whereas the three most productive outlets relate to education, two of the highest cited journals relate to entrepreneurship and one to (management) education. However, this has to be seen against the background that, on average, the citation rate on business and management articles is higher than on education articles, as, for example, represented by the journals' CiteScores or Impact Factors. A simple reason for this is that there are more business and management researchers than education researchers. In accordance with the generally higher citation rate in business and management research, it is not surprising that the most cited researchers also belong to this discipline. Interestingly, the performance ranks found in our results differ from those found by Aparicio, Iturralde, and Maseda (2019), confirming that EE is a very dynamic research field. Gabrielsson et al.'s (2020) journal list shows greater similarities to ours, but includes some deviations due to the use of another database.

When interpreting the two research clusters identified in the co-citation analysis, it has to be kept in mind that the co-citation mapping is a statistical analysis based on joint citation patterns. Even as the assumption that strongly connected publications share content-wise similarities is rational, the clusters can be fuzzy, i. e., one cluster can contain multiple research themes and the research themes can overlap. In this co-citation analysis on the EE literature, a predominant research theme in the red cluster are psychological constructs relating to entrepreneurship. In particular, entrepreneurial attitudes are examined by Fayolle and Gailly (2015) and Rauch and Hulsink (2015), whereas Oosterbeek, van Praag, and Ijsselstein (2010) broach the issue of entrepreneurial motivation. Entrepreneurial intentions or volition, as another psychological construct, is thematised by authors such as Bae et al. (2014), Fayolle and Gailly (2015), Rauch and Hulsink (2015), von Graevenitz, Harhoff, and Weber (2010), and Wilson, Kickul, and Marlino (2007). The common thread in the green cluster is less sharp. Several articles use entrepreneurial variables that are more directly observable such as entrepreneurial behaviour and skills (Honig 2004; Neck and Greene 2011) and creating a new venture (Rideout and Gray 2013). Most other articles have a much broader scope as they relate to entrepreneurship education (Katz 2003; Kuratko 2005; Pittaway and Cope 2007) or even entrepreneurship in general (Shane and Venkataraman 2000). As the co-citation analysis centres around references, it is

no surprise that more general articles are frequently cited. Interestingly, the EE articles appearing in the two clusters only relate to the outcomes of EE but not to the pedagogical questions on how to teach and learn entrepreneurship.

As the co-citation analysis can only provide a first impression of the subdivision of a research field, we conducted an in-depth review of the 25 most cited articles on an annual basis to gain further insights. A closer look at them shows the key research themes in EE (Table 4), which attracted the highest attention in the EE community, as measured by high annual citations. Some of the articles focus on outlining future research directions and are, therefore, not included in Table 5.

Based on these findings, we propose a research framework (Figure 5) and identify shortcomings of prior research, which should be overcome in the future. The key research themes can be roughly split up between pedagogical themes and the outcomes of EE, whereas the main emphasis, quantitatively, is on the latter. It becomes obvious that the outcomes – also called effects or impacts – dominate as fundamental research themes. In other words: What is the purpose of EE (O'Connor 2013)?

As mentioned before, a fundamental assumption is that entrepreneurship fosters economic growth or, more generally, generates societal progress by providing better ways for the satisfaction of needs, as products and services become cheaper, easier, or more convenient. However, among the 25 most cited publications, only one, Rideout and Gray (2013), ranked 16th on annual citations, addresses the creation of a new venture as the 'ultimate' outcome of EE. A reason for that might be that entrepreneurship programmes only have a very indirect impact on the establishment of new ventures.

How should success of EE be measured instead (McMullen and Long 1987; Vesper and Gartner 1997)? A more direct impact is on the students or entrepreneurs *in spe*. Just like engineering programmes aim at generating competent engineers, entrepreneurship programmes should produce competent entrepreneurs. Engineering programmes would not be evaluated on the basis of which

Table 5. Research themes in the top 25 most cited articles (on an annual basis).

Key research themes	Author(s)	Ranks by C/Y
<i>Pedagogy</i>		
Student target group	Maresch et al. (2016)	12
Course contents	Edelman, Manolova, and Brush (2008); Vesper and Gartner (1997)	21, 22
Experiential teaching and learning	Gartner and Vesper (1994); Honig (2004)	13, 23
Action-based teaching and learning	Rasmussen and Sorheim (2006)	18
Teaching and learning in groups	Rasmussen and Sorheim (2006)	18
<i>Outcomes</i>		
Entrepreneurial attitudes	Fayolle and Gailly (2015); Rauch and Hulsink (2015)	4, 11
Entrepreneurial motivation	Oosterbeek, van Praag, and Ijsselstein (2010)	5
Entrepreneurial intention (volition)	Bae et al. (2014); Fayolle and Gailly (2015); Karimi et al. (2016); Maresch et al. (2016); Piperopoulos and Dimov (2015); Rauch and Hulsink (2015); von Graevenitz, Harhoff, and Weber (2010); Wilson, Kickul, and Marlino (2007); Zhang, Duysters, and Cloodt (1987)	1, 3, 4, 8, 10, 11, 12, 15, 17
Entrepreneurial self-efficacy	Piperopoulos and Dimov (2015); Wilson, Kickul, and Marlino (2007)	3, 8
Entrepreneurial skills	Honig (2004); Morris et al. (2013); Neck and Greene (2011); Oosterbeek, van Praag, and Ijsselstein (2010); von Graevenitz, Harhoff, and Weber (2010); e.g. opportunity identification (Karimi et al. 2016)	5, 6, 10, 13, 14, 15
Entrepreneurial human capital	Martin, McNally, and Kay (2013)	2
Entrepreneurial behaviour	Rauch and Hulsink (2015)	11
New venture creation	Rideout and Gray (2013)	16

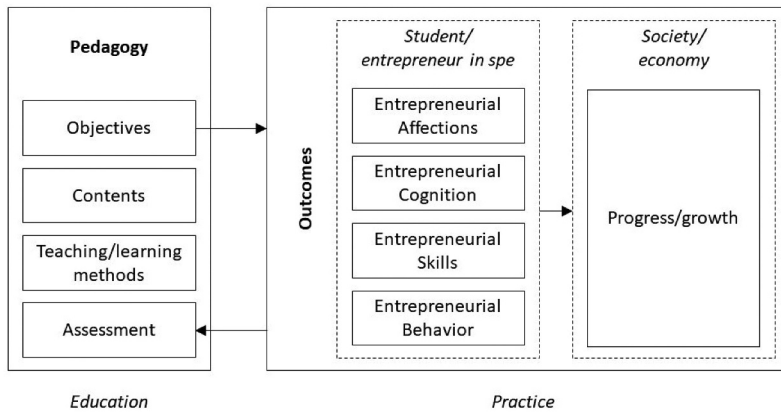


Figure 5. Research framework.

machines their students develop in their later lives. Rather, such programmes aim to equip the students with personal requirements that enable them to develop machines. The same applies to EE. Already the 25 most cited papers address several intrapersonal spheres, which we would classify as affections (especially attitudes), cognition (also attitudes, motivation, intention/volition, self-efficacy), skills (including human capital as the economic value perspective on an individual's set of knowledge and skills), and behaviour. Considering the number of papers, the clear emphasis is on entrepreneurial intention, i.e. not only the motivation to start a new company but also to act accordingly, and on entrepreneurial skills, which enable competent entrepreneurial behaviour.

Compared to the strong emphasis on the outcomes of EE, the actual *educational* aspects of EE fall short. This is not only demonstrated by the lack of articles with this focus in the co-citation analysis but also by the low share of papers (6 out of 25) and their lower annual citation ranks in the citation-based review. This finding is quite striking. In EE research, the emphasis is not on 'education' yet. Despite the attributed relevance of EE, as represented by the vast discussion of its possible or aspired outcomes, and its fast growth, its pedagogy is still almost a black box. A reason for this might be that EE, in fact, is not as mature as Katz (2003) stated. The still very strong focus on outcomes can be interpreted as establishing legitimacy, which can be observed in the rather early stages of new scientific fields.

For EE to become a matured sub-discipline of pedagogy, it is obligatory to open the black box and to deal with its typical questions in greater detail. Based on a 1994 survey among business schools teaching entrepreneurship, already Vesper and Gartner (1997) plead for an increased awareness for objectives and pedagogical perspectives of EE programmes. This demand is still valid. Fundamental questions are: (1) Objectives: The objectives of entrepreneurship programmes strongly relate to their outcomes. Do they in teaching practice? (2) Contents: What do/should we teach specifically (Edelman, Manolova, and Brush 2008; McMullen and Long 1987)? (3) Teaching/learning methods: How do/should we teach (McMullen and Long 1987)? (4) How do we assess the students' and, in turn, the programmes' success (McMullen and Long 1987; Vesper and Gartner 1997)?

5. Conclusion

To organise and integrate the EE research field, we use bibliometric performance analyses. Our results show an exponential growth in publications and citations over the last decade. The highly interdisciplinary field is dominated by both business and educational researchers. The most productive journals and book series are *Education + Training*, *Industry and Higher Education*, and *Annals in Entrepreneurship Education*. The journals with the highest impact are the *Journal of Business*

Venturing, Academy of Management Learning and Education, and the *Journal of Small Business Management*. The most productive authors are A. Fayolle, M. H. Morris, and T. Lans. The most citations were assembled by A. Fayolle, H. Honig, and M. H. Morris. Based on a review of the 25 most-cited articles, we identify and quantify the most relevant research themes and integrate them into a research framework that we propose for future research.

Disclosure statement

No potential conflict of interest was reported by the authors.

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