Forty-five years of research on entrepreneurship education: a review and bibliometric analysis from Scopus dataset

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Received: 02 August 2022; Revised: 11 April 2023; Accepted: 25 May 2023
https://doi.org/10.38203/jiem.023.2.0070

Abstract

In recent years, the number of publications related to entrepreneurship education (EE) has increased rapidly. This change requires a systematic review and evaluate the trends, changes and development of this subject. Based on the bibliometric analysis, this paper investigates 1782 EE-related documents published between 1977 and 2022 from Scopus database to assess the growth trajectory of publications, most cited papers, key authors, most prolific countries, and institutions. The results show an explosive growth in the academic literature on EE in the last decade. In addition, results of bibliographic coupling of documents and co-occurrence of authors’ keywords analyses reveal three main schools of thought in EE research including EE in higher education, EE and entrepreneurial intention, and motivation of EE. The paper contributes to the existing literature by providing a comprehensive picture of EE. More importantly, the study calls

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for more research on the relationship between EE and big data, EE and self-efficacy, and EE and deep learning.

**Keywords:** Entrepreneurship education, Entrepreneurial intention, Motivation, Innovation, Bibliometric review

### 1. Introduction

Entrepreneurship education (EE) has gained increasingly more attention in higher education since the mid-20th century in America, and then has spread globally. Scholars emphasize the contribution of EE programs to passion, knowledge and skills of learners in entrepreneurship (Meyer *et al.*, 1991; Sherkat & Chenari, 2022). In addition, EE has significant impacts on the community such as fostering business start-up rates and online courses opening (Nabi *et al.*, 2017). EE is an important factor of socio-economic development and national prosperity (Hindle & Rushworth, 2002). However, it also brings challenge to both educators and learners due to the increasing usage of online technologies and critical thinking skills (Gunkel, 2017; Ratten & Usmanij, 2020).

Although EE has been explored from different aspects, it is essential for a more profound understanding of tracking the growth trajectory, changes and gaps of EE studies. Thus, the aim of this research is to visualize the trends and provide more comprehensive understanding about EE studies over the past forty-five years. Additionally, the study contributes to the literature by reviewing the latest and hottest topics about EE, then suggesting the new direction for further research in the near future. With 1782 publications retrieved from Scopus database in the period of 1977 to June 2022, our study attempts to answer the following research questions:

- **What is the total volume, and growth trajectory of research on entrepreneurship education?** (RQ1)
- **Who are the key authors in the entrepreneurship education literature?** (RQ2)
- **Which are the most prolific countries and journals?** (RQ3)
- **What are the main schools of thought in entrepreneurship education research?** (RQ4)
- **What latest topics in entrepreneurship education research have received the greatest attention in the literature?** (RQ5)

The next section of this paper provides the brief overview of EE, including the definitions and previous bibliometric reviews on it. After that, the research methodology will be discussed, focusing on data and VOSviewer analyses. Then, the results are analyzed. Firstly, the paper illustrates the volume and growth trajectory of research on EE. Secondly, the key authors, the most prolific countries, and publishers are described. Thirdly, three perspectives and the latest topics on EE are discussed. The paper ends with conclusions and the limitations of the research.
2. Conceptual framework

Definitions of entrepreneurship education

Many definitions of EE have been proposed. Linan (2004) described EE as all education and training activities to perform entrepreneurial intention, or elements which impact that intention such as feasibility, desirability and knowledge of the entrepreneurial activities. Alberti et al. (2004) explained EE as the structured and formal dissemination of competences, which are needed to become entrepreneurs. According to Hannon (2005), EE can be classified into three categories including “the contextual application of entrepreneurial characteristics and qualities (entrepreneurship), a state of being (entrepreneurial), and the creation of an entrepreneurial climate and support structure (entrepreneurism)”. Boon et al. (2013), Ratten and Usmanij (2020) characterized EE as an experience-based learning method to develop entrepreneurial competences.

Previous bibliometric research on entrepreneurship education

There have been some research on this subject using bibliometric analysis such as those conducted by Kakouris and Georgiadis (2016), Johann et al. (2020), and Deveci (2022). The most significant one was by Kakouris and Georgiadis (2016). Based on 7726 publications with the keyword “entrepreneurship” extracted from Scopus database in the 1980-2012 period, Kakouris Georgiadis (2016) reveal that there is poor evidence on the relationship between entrepreneurship research and the three aspects of EE including lifelong learning, vocational training, and career counselling. They proposed that there were still many research gaps on the topic such as experimental learning, advanced learning processes and education for innovation. However, this review only identified 345 out of 7726 articles that combined entrepreneurship and education. Johann et al. (2020) examined 146 articles from Web of Science (WoS) database from 2009 to 2019 to broaden the knowledge about design thinking and EE research in the school context. The authors emphasized the important role of design thinking as a valuable tool for teaching entrepreneurship today. Furthermore, Deveci (2022) also investigated WoS sources with 352 abstracts between 1991 and 2020 to document the most cited articles, most prolific authors, most productive journals and countries that contributed to EE literature. The keywords “enterprise education,” “entrepreneurial education,” and “entrepreneurship education” were searched provided the descriptive and evaluative results on bibliometric information. A systematic search was not mentioned in this research.

Although some studies employed bibliometric methodology to review on EE, they only focused on specific periods of time or particular perspectives. What makes this study different from the previous bibliometric analysis is the longer time range (from 1977 to June 2022), which enables the authors to capture the development and explain the three approaches to EE. Moreover, the latest topics that received the greatest
attention in the literature could also be highlighted. Our analysis employs 1782 documents from the Scopus database, and reveals three focal clusters, which are EE in higher education, entrepreneurship intention, and motivation of EE.

3. Research methodology

The bibliometric analysis was used because it is very helpful in discovering the status and growth of scientific publications on specific topics (De Bakker et al., 2005; Yu et al., 2016; Lee & Hew, 2018). Moreover, this method has been widely used as a quantitative tool to provide descriptive and evaluative results in recent years (Zarczynska, 2012; Ellegaard & Wallin, 2015; Merigo et al., 2015).

The Scopus database was chosen due to its with wider coverage of high-quality journals. Using the search engine, the keywords “entrepreneurship education” was found with the title, abstract and keywords of publications. The query string is as follows:

```
TITLE-ABS KEY (ENTREPRENEURSHIP EDUCATION) AND (LIMIT-TO (DOCTYPE, “ar”)) OR LIMIT-TO (DOCTYPE, “cp”) OR LIMIT-TO (DOCTYPE, “ch”) OR LIMIT-TO (DOCTYPE, “bk”) AND (LIMIT-TO (SUBJAREA, “SOCI”)) AND (LIMIT-TO (LANGUAGE, “English”))
```

Thus, 1782 documents of mixed types including articles, conference papers, books and book chapters were filtered by Scopus. In the next step, we classified these publications to provide the following bibliometric information:

(1) The growth trajectory of publications
(2) Most cited papers
(3) Key authors
(4) Most prolific countries and institutions
(5) Bibliographic coupling of documents analysis
(6) Keywords co-occurrence network analysis

The VOSViewer 1.6.18 software was utilized to examine the similarities between different topics such as authors, countries, institutions, journals, keywords and other bibliometric information. Van-Eck & Waltman (2014) confirmed that “the number of co-occurrences of two keywords is the number of publications in which both keywords occur together in the title, abstract, or keyword list.” Based on VOSViewer, the authors expected to visualize the map and provide a clearer explanation of EE research.

Our research uses the factional counting method instead of the ordinary full counting method, as recommended by Van-Eck and Waltman (2014). In the case of the fractional counting method, highly cited publications play a less important role in the construction of a bibliographic coupling network. In the same way, publications with a long reference list play a less important role in the construction of a co-citation network.

4. Results and findings

RQ1. Volume, growth trajectory of research on entrepreneurship education
The study found that the first paper on EE was published in 1972. Figure 1 shows the number of documents published per year for EE between 1972 and 2021. From 1977 to 2001, the number of publications was very limited, ranging from 1 to 4 articles per year with the exception in 1994 with 7 articles. From 2002 to 2010, there was a growing interest in research on EE as the number of publications increased from 6 papers in 2002 to 23 papers in 2009, and 79 papers in 2010. Data shows an average increase of 67% per year in this period. After a slight increase between 2011 and 2015, the number of papers increased tremendously to 186 in 2019, and 262 in 2021. It is observed that from 2016 to 2021, there were 1046 papers published, accounting for 58.7% of the total number of papers in this field.

**RQ2. Key authors in entrepreneurship education literature**

In response to RQ2, an analysis of the most prolific authors on entrepreneurial education was conducted. The studies had 3441 authors, among which 2686 authors were cited at least one time.
Figure 2: Top twenty authors based on number of publications

Source: Authors

Figure 2 shows the top twenty most prolific authors based on the number of publications. Fayolle and Matlay, who published their first articles on EE in 2005 and 2003. They also had the highest number of publications of 31, with the number of citations per document being 93.5 and 41.9, respectively. Johansen followed with 11 articles, and other authors in the top twenty had from 7 to 10 publications. Gailly had only 6 publications but ranked first in terms of the number of citations, at 253.2. Gailly has been known to co-author with Fayolle on several papers on EE. With the same number of publications, at 6 papers, Jill Kickul and Luke Pittaway earned 179.3 and 170 citations per document, respectively. Kuratko (2005) was the author who had the most influential article in the selected field titled “The emergence of entrepreneurship education: Development, trends, and challenges in the Entrepreneurship: Theory and Practice”, cited 1178 times. The article examined the emergence of EE and highlighted the trends and challenges in EE in the 21st century.

RQ3: Most prolific countries and publishers

Based on the number of documents, an analysis of the most prolific countries in the research field with citations, and citations per document is presented in Table 1. China tops the list with 308 publications in total, followed by the United States (277) and the United Kingdom (194). It is worth noticing that these three countries contributed nearly 44% of the total publications in this field. Although China had the highest number of articles, the number of citations per document was only 2.83. The United States and the
United Kingdom had the highest number of citations, at 10,511 and 8,165, respectively. Other countries, including Malaysia, Germany, France, Finland, Indonesia, Australia, Italy, India, Spain, Sweden, Portugal, Canada, Denmark, South Africa, Ireland, Russia Federation, and Norway had a lower number of publications, ranging from 36 to 70. France and Ireland stood out with the highest citations per document, at 53.83 and 53.59, respectively.

Table 1. Number of publications on entrepreneurial education groups by countries

<table>
<thead>
<tr>
<th>ID</th>
<th>Country</th>
<th>Documents</th>
<th>Percent (%)</th>
<th>Citations</th>
<th>Citations per document</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>308</td>
<td>17.28</td>
<td>871</td>
<td>2.83</td>
</tr>
<tr>
<td>2</td>
<td>United States</td>
<td>277</td>
<td>15.54</td>
<td>10511</td>
<td>37.95</td>
</tr>
<tr>
<td>3</td>
<td>United Kingdom</td>
<td>194</td>
<td>10.89</td>
<td>8165</td>
<td>42.09</td>
</tr>
<tr>
<td>4</td>
<td>Malaysia</td>
<td>70</td>
<td>3.93</td>
<td>581</td>
<td>8.30</td>
</tr>
<tr>
<td>5</td>
<td>Germany</td>
<td>67</td>
<td>3.76</td>
<td>1388</td>
<td>20.72</td>
</tr>
<tr>
<td>6</td>
<td>France</td>
<td>59</td>
<td>3.31</td>
<td>3176</td>
<td>53.83</td>
</tr>
<tr>
<td>7</td>
<td>Finland</td>
<td>58</td>
<td>3.25</td>
<td>1406</td>
<td>24.24</td>
</tr>
<tr>
<td>8</td>
<td>Indonesia</td>
<td>56</td>
<td>3.14</td>
<td>309</td>
<td>5.52</td>
</tr>
<tr>
<td>9</td>
<td>Australia</td>
<td>52</td>
<td>2.92</td>
<td>1570</td>
<td>30.19</td>
</tr>
<tr>
<td>10</td>
<td>Italy</td>
<td>50</td>
<td>2.81</td>
<td>521</td>
<td>10.42</td>
</tr>
<tr>
<td>11</td>
<td>India</td>
<td>50</td>
<td>2.81</td>
<td>305</td>
<td>6.10</td>
</tr>
<tr>
<td>12</td>
<td>Spain</td>
<td>49</td>
<td>2.75</td>
<td>1726</td>
<td>35.22</td>
</tr>
<tr>
<td>13</td>
<td>Sweden</td>
<td>49</td>
<td>2.75</td>
<td>1095</td>
<td>22.35</td>
</tr>
<tr>
<td>14</td>
<td>Portugal</td>
<td>45</td>
<td>2.53</td>
<td>662</td>
<td>14.71</td>
</tr>
<tr>
<td>15</td>
<td>Canada</td>
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<td>2.30</td>
<td>1593</td>
<td>38.85</td>
</tr>
<tr>
<td>16</td>
<td>Denmark</td>
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<td>2.19</td>
<td>719</td>
<td>18.44</td>
</tr>
<tr>
<td>17</td>
<td>South Africa</td>
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<td>2.13</td>
<td>339</td>
<td>8.92</td>
</tr>
<tr>
<td>18</td>
<td>Ireland</td>
<td>37</td>
<td>2.08</td>
<td>1983</td>
<td>53.59</td>
</tr>
<tr>
<td>19</td>
<td>Russia Federation</td>
<td>36</td>
<td>2.02</td>
<td>149</td>
<td>4.14</td>
</tr>
<tr>
<td>20</td>
<td>Norway</td>
<td>35</td>
<td>1.96</td>
<td>1061</td>
<td>30.31</td>
</tr>
</tbody>
</table>

Source: The authors’ calculation

The papers included in the dataset were published in 623 academic journals. Figure 3 shows a list of journals with the highest number of documents related to EE. The top five journals are Journal of Education and Training (108 articles); Journal of Entrepreneurship Education (87); Industry and Higher Education (56); Frontiers in Psychology (51); International Journal of Management Education (36). Journal of
Education and Training is also known for the highest number of citations, at 4102 times, followed by the Journal of Small Business Management, at 3207 times.

**RQ4: Three approaches to entrepreneurship education**

**Figure 3:** Top twenty journals with maximum publication on entrepreneurial education

**Figure 4.** Science mapping of documents related to entrepreneurship education based on bibliographic coupling analysis between 1977 and 2022

**Notes:** The network shows 97 documents, minimum number of citations per document: 80
With a threshold of 80 minimum citations per documents, the bibliographic coupling of documents results presented 97 documents, however only 92 documents are grouped into 7 clusters: Cluster 1 (38 documents), Cluster 2 (28), Cluster 3 (11), Cluster 4 (7), Cluster 5 (3), Cluster 6 (3), Cluster 7 (2). It should be noted that EE literature focused on three conceptual themes.

The first and largest cluster (red color) showed the publications about EE in higher education. Leading authors in this school of thought include Kuratko (2005; 1178 citations), Pittaway and Cope (2007; 789), Katz (2003; 665), Neck and Greene (2011; 604), Gorman et al. (1997; 572), Henry et al. (2005; 361), and Fayolle and Gailly (2008; 353). These scholars emphasized the increase in the number of colleges and universities that offer courses on EE. They also discussed the curricular, teaching method, learning process and experiential learning and so forth. Also, studies in this theme have investigated the importance of EE in higher education institutions (Mitchell, 2006; Matlay, 2014) and the critical role of educators in nurturing entrepreneurism in students (Vesper et al., 1997; Carayannis et al., 2003; Hannon, 2005). Neck and Greene (2008) introduced practice-based methods including coursework, serious games and simulations, design-based thinking, and reflective practice to improve entrepreneurship ability in students. However, Henry et al. (2005) questioned whether entrepreneurs can be taught or are born. Their results pointed out the need for evaluating entrepreneurship programs to ensure at least some aspects of entrepreneurship can be taught successfully. This point of view was in line with Cooper et al. (2004), Blenker et al. (2011) and Pittaway and Edwards (2012). The second cluster (green color) represents the relationship between EE and entrepreneurial intention. Key scholars in this school of thought are Bae et al. (2014; 678 citations), Martin et al. (2013; 641), Nabi et al. (2017; 475), Fayolle and Gailly (2015; 464), Von Graevenitz et al. (2010; 428), Piperopoulos and Dimov (2015; 297); Rauch and Hulsink (2015; 296), Zhang et al. (2014; 295). They described the role of EE as a predictor of entrepreneurial intention in higher education institutions. For example, Zhang et al. (2014) employed Ajzen’s theory of planned behavior and Shapero’s entrepreneurial event model as well as entrepreneurial cognition theory to insist that there is a significant positive relationship between EE and entrepreneurial intention. Other scholars supported for these results such as Fayolle and Gailly (2015), Rauch and Hulsink (2015), Entrialgo and Iglesias (2016), Jena (2020). However, in some research, the correlation between EE and entrepreneurial intentions showed mixed results. Bae et al. (2014) stated that the linkage between EE and post-entrepreneurial intention was not significant. Von Graevenitz et al. (2010) found that intentions declined somewhat although the EE program yielded significant, positive effects on students’ entrepreneurial skills. This result is in line with the studies of Volery et al. (2013); Nabi et al. (2018). Furthermore, this second school of thought also concern
the moderating role of gender (Shinnar et al., 2014; Westhead and Solesvik (2016) or entrepreneurial family background (Jena, 2020) in the relationship between EE and entrepreneurial intention.

The third cluster (blue color) is associated with the motivation of EE. Although smaller than the first and second cluster, it actually includes more influential researchers and higher citation impact. Most cited papers in this theme can be listed as Oosterbeek et al. (2010; 690 citations), Fayolle (2013; 360); Morris et al. (2013; 277); O’Connor (2013; 188); Packham et al. (2010; 168); Pache and Chowdhury (2012; 115). Students on EE programs have different forms of motivation for studying entrepreneurship. Hytti et al. (2010) revealed that they had both intrinsic and extrinsic motivation which was likely to have impact students’ outcome satisfactions. Pache and Chowdhury (2012) insisted that social EE made students aware of different logics including social welfare logic, commercial logic, and public-sector logic and acquire skills in order to create innovative hybrid strategies. The examination of other motivations implied that EE is involved the development of entrepreneurial identity (Donnellon et al., 2014) or competency development (Morris et al., 2013). Additionally, there is an increasing tendency for government policy to develop entrepreneurship because of its apparent economic benefit (O’Connor, 2013).

The results of keywords co-occurrence network analysis can be seen in Table 2. The results described that the most recurring keywords was “Entrepreneurship education” (770 occurrences), “Entrepreneurship” (250), “Education” (165), “Entrepreneurial intention” (78), “Entrepreneurialism” (60), Innovation (48). The minimum threshold of 5 occurrences per keyword was set and led to the results of 132 items with 10 clusters. The biggest cluster with 20 keywords shows that “Entrepreneurship education” linked to “higher education”, “education”, “business education”, “knowledge”, “skill”, “e-learning”, “attitude”, “start-up”, etc. This result of keywords co-occurrence network reaffirms the first theme of EE literature - EE in higher education. Furthermore, the second theme- EE and entrepreneurial intention is also emphasized with keywords “Entrepreneurial intention” (occurrences: 111, total link strength: 214). In this sense, keywords co-occurrence network analysis can provide important evidence on the basic keywords of the schools of thought under review.

<table>
<thead>
<tr>
<th>#</th>
<th>Keywords</th>
<th>Occurrences</th>
<th>Total link strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Entrepreneurship education</td>
<td>770</td>
<td>961</td>
</tr>
<tr>
<td>2</td>
<td>Entrepreneurship</td>
<td>250</td>
<td>485</td>
</tr>
</tbody>
</table>

Table 2. Top 20 Keywords which occurred the maximum number of times, in various publications related to EE
<table>
<thead>
<tr>
<th></th>
<th>Topic</th>
<th>R1</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Education</td>
<td>165</td>
<td>373</td>
</tr>
<tr>
<td>4</td>
<td>Entrepreneurial intention</td>
<td>111</td>
<td>214</td>
</tr>
<tr>
<td>5</td>
<td>Higher education</td>
<td>78</td>
<td>181</td>
</tr>
<tr>
<td>6</td>
<td>Entrepreneurialism</td>
<td>60</td>
<td>162</td>
</tr>
<tr>
<td>7</td>
<td>Innovation</td>
<td>48</td>
<td>87</td>
</tr>
<tr>
<td>8</td>
<td>Entrepreneurial education</td>
<td>41</td>
<td>51</td>
</tr>
<tr>
<td>9</td>
<td>Innovation and entrepreneurship education</td>
<td>41</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>Experiential learning</td>
<td>35</td>
<td>67</td>
</tr>
<tr>
<td>11</td>
<td>Entrepreneurial self-efficacy</td>
<td>33</td>
<td>70</td>
</tr>
<tr>
<td>12</td>
<td>Gender</td>
<td>30</td>
<td>76</td>
</tr>
<tr>
<td>13</td>
<td>Entrepreneurial intentions</td>
<td>30</td>
<td>65</td>
</tr>
<tr>
<td>14</td>
<td>Innovation and entrepreneurship</td>
<td>29</td>
<td>23</td>
</tr>
<tr>
<td>15</td>
<td>Students</td>
<td>26</td>
<td>76</td>
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<tr>
<td>16</td>
<td>Training</td>
<td>25</td>
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<tr>
<td>17</td>
<td>universities</td>
<td>24</td>
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<tr>
<td>18</td>
<td>Entrepreneurial learning</td>
<td>23</td>
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<td>19</td>
<td>pedagogy</td>
<td>23</td>
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</tr>
<tr>
<td>20</td>
<td>university</td>
<td>19</td>
<td>45</td>
</tr>
</tbody>
</table>

**RQ5: Topical trends in entrepreneurship education literature**
**Figure 5.** Network visualization map of co-occurrence of keywords

**Notes:** 132 keywords, minimum number of occurrences of a keyword: 5

Figure 5 represents the network visualization map of co-occurrence of keywords with the latest topic trend highlighted by lighter shaded nodes, namely: “innovation and entrepreneurship”, “big data”, “covid 19”, “academic entrepreneurship”, “entrepreneurial competence”, “individual entrepreneurial orientation”, “entrepreneurial attitude”, “entrepreneurial passion”, “self-efficacy”, “deep learning”. One of the hot topics is “innovation and entrepreneurship” (41 occurrences). Researchers revealed that a lack of innovation ability has led to poor performance in EE (Li, 2021; Liu, 2021; Afeli & Adunlin, 2022). As a result, it proposes some suggestions for stakeholders to develop an effective system of innovation and EE to satisfy the needs of individuals, communities, and society as a whole (Cooke, 2021; Duan et al., 2021). In addition, other latest topics also widen the future trends in EE studies such as EE and big data, EE and self-efficacy, EE and deep learning.

**5. Discussions, conclusions and limitations**

In this paper, we conducted bibliometric analyses of the publications on EE published between 1977 and June 2022. By exploring and reviewing 1782 Scopus-indexed documents, the research provided a broad picture of the literature. Twenty-five years from the first articles in 1977 to 2001, the interest in EE nearly stayed constant (25 years, 39 publications in total). The number of research papers has grown strongly during the
Deveci (2022) examined a bibliometric study on EE in educational contexts, and also found a similar trend after 2001. However, due to the shorter period, the author determined that most articles were published in 2017. Our results demonstrated that research on EE may continue to grow over the next decade.

Prof. Alain Fayolle is the most prolific author with the highest number of publications, at 31, and the highest number of citations, at 2900. He is currently a Professor at Emlyon Business School (France), which is known as the most productive institution in terms of the number of publications. The results revealed that China, the United States and the United Kingdom are the leading countries for EE research. The United States ranked second in terms of the number of publications but was the country with the highest citations. Furthermore, the journal with the highest number of publications and citations is the Journal of Education and Training. Regarding the productive journals, the current research findings coincide to a certain extent with that of Deveci (2022) and Gabrielsson et al. (2020)

Our research contributes to the literature by providing a comprehensive understanding on the topics of EE. We performed an analysis of the keywords and identified three main conceptual themes in EE literature, including EE in higher education; the relationship between EE and entrepreneurial intention; and the motivation of EE. More importantly, we revealed that recent studies have investigated how to promote the integration of EE and innovation under the Background of "Internet +" (Lin & Zhou, 2022) or based on big data (Yang & Xie, 2022; Hao et al., 2021) or through the application of information technology (Yadan & Mengdan, 2021). Our findings suggest that later research should pay attention to certain aspects such as “innovation and entrepreneurship”, “self-efficacy”, and “deep learning”.

With the development of information technology, the inherent traditional teaching method is declining. Schools and universities need a novel teaching method to cultivate students. Therefore, big data, as an important new driver of innovative EE in the Internet era, promoting the reform of teaching platform and the personalization of education. At the same time, the future research on EE and big data should be addressed. We propose some new topics such as the development of EE curriculum reform based on big data analysis, explore the big data teaching model in EE.

In addition, our research results question about how university students’ attitudes toward EE affect entrepreneurial self-efficacy, especially in the post-pandemic context. Self-efficacy refers to individuals’ conscious beliefs in their own skills and abilities to accomplish tasks and reach goals. When people are confident in themselves, they tend to perform better on tasks. Furthermore, in education settings, self-efficacy is known as an important entrepreneurial characteristics in promoting entrepreneurial intention of
students. Hence, some research directions such as the benefits of entrepreneurial education to entrepreneurship self-efficacy and the mediating effect of self-efficacy in the relationship between EE and entrepreneurial intention should be considered.

Last but not least, little is known about the mechanism of deep learning that can be applied on EE. Taking the advantage of deep learning technologies such as fault tree analysis (FTA), it is possible to analyze the factors of EE or evaluate the reliability of IEE classroom teaching for college teachers and students and so on. Deep learning is a subfield of machine learning research and is a very useful method to explore EE based on interpreting images, audio and texts. Therefore, this is the new “room” for the further research.

The most significant limitation of the paper is that we only rely on the studies that were indexed by the Scopus database. While it is a comprehensive source, there might be studies that have contributed significantly to the research on EE but are not in the Scopus database. Further studies may overcome this limitation with other databases such as the Web of Science to perform similar analyses. In addition, the database only includes papers written in English, and papers written in other languages were not included. Finally, the review only uses VOSviewer as the main instrument to generate, visualize and analyze bibliometric networks. Therefore, other scholars may use different instruments to further understand the data and detect additional research gaps.

Acknowledgment: This research is funded by Foreign Trade University under research program FTURP02-2020-01.

References


