A worldwide bibliometric and network analysis of work-based learning research

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Abstract

Purpose – During the last few years there has been an increase of interest in work-based learning (WBL), which can be understood as a process of both developing workplace skills and promoting labor force productivity. This paper aims to map the scientific landscape related to WBL research worldwide.

Design/methodology/approach – combined bibliometrics and network analysis techniques to analyze data of scientific publications related to WBL indexed at the Web of Science (WoS) Core Collection.

Findings – results show an increase of publications over time: Education & Educational Research as the most frequent research area to which the articles were assigned, the UK and Australia as the main countries and Monash University (Australia) and Middlesex University (England) as the main organizations producing knowledge on WBL.

Originality/value – By offering a global scientific landscape of WBL research published so far, the authors aimed to contribute to future academic debates and studies in this field of knowledge.

Keywords Work-based learning, Bibliometric analysis, Network analysis

Paper type Literature review

Introduction

Work-based learning (WBL) is a term with multiple meanings, a concept that encompasses a wide range of activities, concerns and areas of work-based research. In this scenario, the idea of WBL and learning at work is accepted as a strategic necessity for many organizations and different professions (Park and Lee, 2018; Nevalainen *et al.*, 2018; Orr and Gao, 2013). Learning at work occurs through engagement in routine and non-routine problem solving influenced by a community of practice and shaped through trusted, socially cognizant guidance (Raelin, 2000). Other aspects stand out, such as the need to promote learning activities at work, since this enhances apprentices' competence development and prepares them for professional development on the job (Messmann and Mulder, 2015).

WBL can also describe a relationship between learning and work, but defining WBL is challenging, as the literature is often vague and contradictory (Burke *et al.*, 2009).

Lester and Costley (2010) argue that the term "work-based learning" refers to all and any learning situated in the workplace or arising directly from workplace concerns (Lester and Costley, 2010). According to the European Training Foundation (ETF), "*the term WBL cannot be clearly distinguished from other terms used to refer to practice-based learning in a work context; several close (and interchangeable) synonyms are found in the literature, including employment-based learning, on-the-job training, enterprise-based learning and, in some contexts, workplace learning*" (ETF, 2013). The Inter-Agency Group on Technical and Vocational Education and Training (IAG-TVET), established by UNESCO in 2008, states that "*Work-based learning refers to all forms of learning that takes place in a real work environment. It provides individuals with the skills needed to successfully obtain and keep jobs and progress in their professional development*" (UNESCO, 2017).

WBL is also used to describe higher education programs in which the learning that takes place is carried out mainly at work, through work and is for work purposes (Garnett, 2016). WBL is linked to the vocational education and training (VET) mission to help learners acquire knowledge, skills and competences which are essential in working life. In summary, the contemporary literature related to WBL can be categorized into three distinct areas: WBL in secondary schools, WBL in higher education, in general and WBL related to foundation degrees (Burke *et al.*, 2009).

Some reports in the literature indicate efforts for workforce development through WBL (Dafoulas *et al.*, 2010; White, 2012). In the United States of America (USA), the term "Workforce Development" has evolved to describe any one of a relatively wide range of national and international policies and programs related to learning for work. Thus, several state and federal legislation portions in the USA use the term to describe various youth vocational training, adult training and retraining and related employment initiatives (Jacobs and Hawley, 2009). However, WBL is not only workforce development and can cover unpaid work, even when involved in real work that leads to the production of real goods and services (Sweet, 2014). Furthermore, it is emphasized that part of the learning of different professionals in the workplace is informal rather than formal and involves a combination of learning from other people and learning from personal experience (Williams, 2003; Eraut, 2004, 2007).

Like other active forms of teaching and learning, such as project-based learning or problem-based learning (PBL), WBL can act as a catalyst for broader cultural changes, in the sense of incorporating sustainability and scientific literacy in higher education institutions (Wall *et al.*, 2017; Lopes *et al.*, 2020). In this context, an increasing number of study programs in educational institutions have been incorporating work-based component in them, both for initial education and continuing professional development (Iredale *et al.*, 2013; Gonon, 2017). Thereby, there has been an expansion of universities' involvement in the development of the workforce through means such as part-time in-service courses and bespoke programmes for employers (Costley and Armsby, 2007; Lester and Costley, 2010; Christensen *et al.*, 2017; Hamilton, 2019). The European cooperation on VET from the European Union (EU) institutions, of the its Member States, social partners and European VET providers have agreed on a set of objectives for the period 2015–2020 which, among others, establishes WBL promotion in all its forms with special attention to apprenticeship, as well as stimulating innovation and entrepreneurship (https://ec.europa.eu/education/).

Thus, it is possible to verify and state that different communities, research groups and entities define the WBL. For some, it is only paid work, while others have a more comprehensive definition, adopting concepts of learning in the workplace and / or applying specific teaching and learning practices linked to different educational levels. On the other hand, others have not linked it to formal learning with specific educational institutions.

Bibliometrics and Social Network Analysis (SNA) are frequently used to map different fields of knowledge (Hauser-Davis *et al.*, 2017; Albuquerque *et al.*, 2019; Taddeo *et al.*, 2019). There are examples of such studies in educational research. The same techniques were also used to map

the knowledge produced on PBL (De Pinho *et al.*, 2015), provide a comprehensive picture and a holistic view of the workplace e-learning domain (Cheng *et al.*, 2014) and to provide an overview of use of Facebook as a resource to teaching and learning (Lopes *et al.*, 2017).

From this perspective, this paper aims to map the scientific landscape related to WBL research worldwide in general. To do so, we combine bibliometrics and network analysis techniques, identifying variables that aid researches in this area to form collaborative networks with established scientists in this regard. Thus, the article describes the status of research on WBL through data such as the evolution of publications over time, identification of main journals, frequent research areas and most scientifically productive countries and organizations. It also explores the global cooperation network of these countries and institutions, also identifying important authors and studies on this topic. From this set of findings, another broader objective is to generate evidence that can inform and contribute to managers, researchers, policy makers in decision-making for research planning and development of financing strategies on WBL in different countries and continents.

Materials and methods
Bibliometrics and network analysis techniques were applied to generate qualified information on WBL from scientific publications indexed at Thomson Reuters' Web of Science (WoS) Core Collection. Scientific publications related to WBL were gathered using the following query, applied to the WoS advanced search mode.

ts = ("work-based learning")
Refined by: DOCUMENT TYPES: (ARTICLE OR REVIEW)
Timespan: All years.
Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.

We used the tag topic (ts), which searches for the term WBL in the publications' titles, abstracts and keywords. We set the query to retrieve only the document types of articles or review articles, as they usually report on the results of more advanced stages of research (Gonzalez-Albo and Bordons, 2011). The timespan covered all publication years (1945–September 2019) and all citation indexes were used: Science Citation Index Expanded (SCI-EXPANDED); Social Sciences Citation Index (SSCI); Arts & Humanities Citation Index (A&HCI); Conference Proceedings Citation Index- Science (CPCI-S); Conference Proceedings Citation Index- Social Science & Humanities (CPCI-SSH) and Emerging Sources Citation Index (ESCI).

The search was done in September 2019 and retrieved 410 records of publications, which were imported into the data/text mining software Vantage Point 10.0 for data treatment and analysis. Then, the following procedures were undertaken: removal of duplicated records using the ISI Unique Article Identifier (none were found); cleaning and standardization of the lists author affiliations and cited references using the software's list clean up tool and manual cleaning and building of co-occurrence matrices of research areas, countries and author affiliations.

Then, the matrices were imported into the software Gephi 0.9.2, where we build the networks using the Force Atlas 2 algorithm. To obtain a more reasonable picture of recent knowledge flows related to WBL, the network timespan refers to the 2014–2019 period (until September), which covers 54.1% of the total publications. In network analyses, a long sample period may introduce bias into the results by including past information, when the aim is to obtain a picture of contemporary trends in the area. This occurs if, for example, certain organizations did most of their research long ago, but no longer play an important role in the network (Santoro *et al.*, 2011).

In the networks, the size of the nodes reflects their weighted degree, which is the sum of connected nodes weighted by the number of co-occurrence between nodes. Only nodes with a

higher than average degree were labeled (the degree of a node is the sum of its ties). The networks of countries and research organizations reflect authors' affiliation information. All countries and research areas are shown in their networks, while the network of research organizations shows only the ones that published at least two articles or review articles.

Results and discussion

It is possible to verify that there is a significant increase in the specialized literature of studies on WBL in the last decade. The number of WBL publications has increased over time, but mainly in the last 5 years ($n = 225$), when 54.0% of the total articles where published (Figure 1). The results also show that WBL is not a very new concept. It appeared in the USA (Hoyt, 1994; Stern and Rahn, 1995) and the UK (Boddy *et al.*, 1995) at least 24 years ago. One of the first studies published in the UK shows that geography students at Liverpool John Moores University could include a module in WBL, for which they received academic credit as part of the core program in their final year of training (Jackson, 1995). It should also be noted that variations in publication numbers are common in bibliometric studies, many times this occurs through the release of special issues about the topic being analyzed. For example, in 2018 there was a special edition entitled *Work-based and vocational education as catalysts for sustainable development*, released by the *Higher Education, Skills and Work-Based Learning* journal.

Several scientific journals published the articles observed in the bibliometric evaluation conducted. Figure 1 displays that *Higher Education, Skills and Work-Based Learning* published the highest number of articles (12.0%), followed by the *Journal of Interprofessional Care* (7.1%), *Nurse Education Today* (4.4%) and *Studies Higher Education* (2.4%). The 2018 impact factor of the most frequent journals ranged from 1.34 to 4.61. Three journals had no impact factor in 2018. The publications *Higher Education, Skills and Work-based Learning* and *Journal of Vocational Education & Training* are indexed in the *Emerging Sources Citation Index*, although they do not have an Impact Factor, their citations are counted in the Journal Citation Reports. It is also emphasized that the majority of journals focus on higher education and vocational learning, presenting seventeen journals with different scopes and approaches. Moreover, Figure 2 shows the most frequent research areas for WBL-related research in all years and the network for these publications from 2014 to 2019. Articles can be assigned in more than one research area, which reflects the subject areas they fit into. Most of the publications were indexed in *Education & Educational Research* (62.0%), followed by *Health Care Science & Services* (13.7%) and *Nursing* (11.5%). Taken together, the results pointed in Figures 1 and 2 support that the contemporary literature related to WBL can be divided into three areas: WBL in secondary schools, WBL in higher education and WBL related to foundation degrees (Burke *et al.*, 2009).

A network was built based on the co-occurrences of articles in different research areas, emphasizing the knowledge plurality of WBL publications and complements the previous analysis (Figure 2). The nodes are the research areas and the edges represent article co-occurrences in different research areas. Although all research areas are on the network, only nodes with more than one connection are labeled. Thereby, the research area *Education & Educational Research* is the first central area for WBL, having the highest number of articles and is the one with the highest number of co-occurrences with other research areas, giving it the greatest centrality degree on WBL research today. Another important research area is *Social Sciences – Other Topics*, although it does not have a high frequency of articles, it has a high degree of centrality and makes connections with other research areas increasing the amplitude of the network. On the other hand, the research area "Public Environmental & Occupational Health" is also relevant in the network with a weighted degree above the average, linking research areas that are not related to the central node (Education & Educational Research).
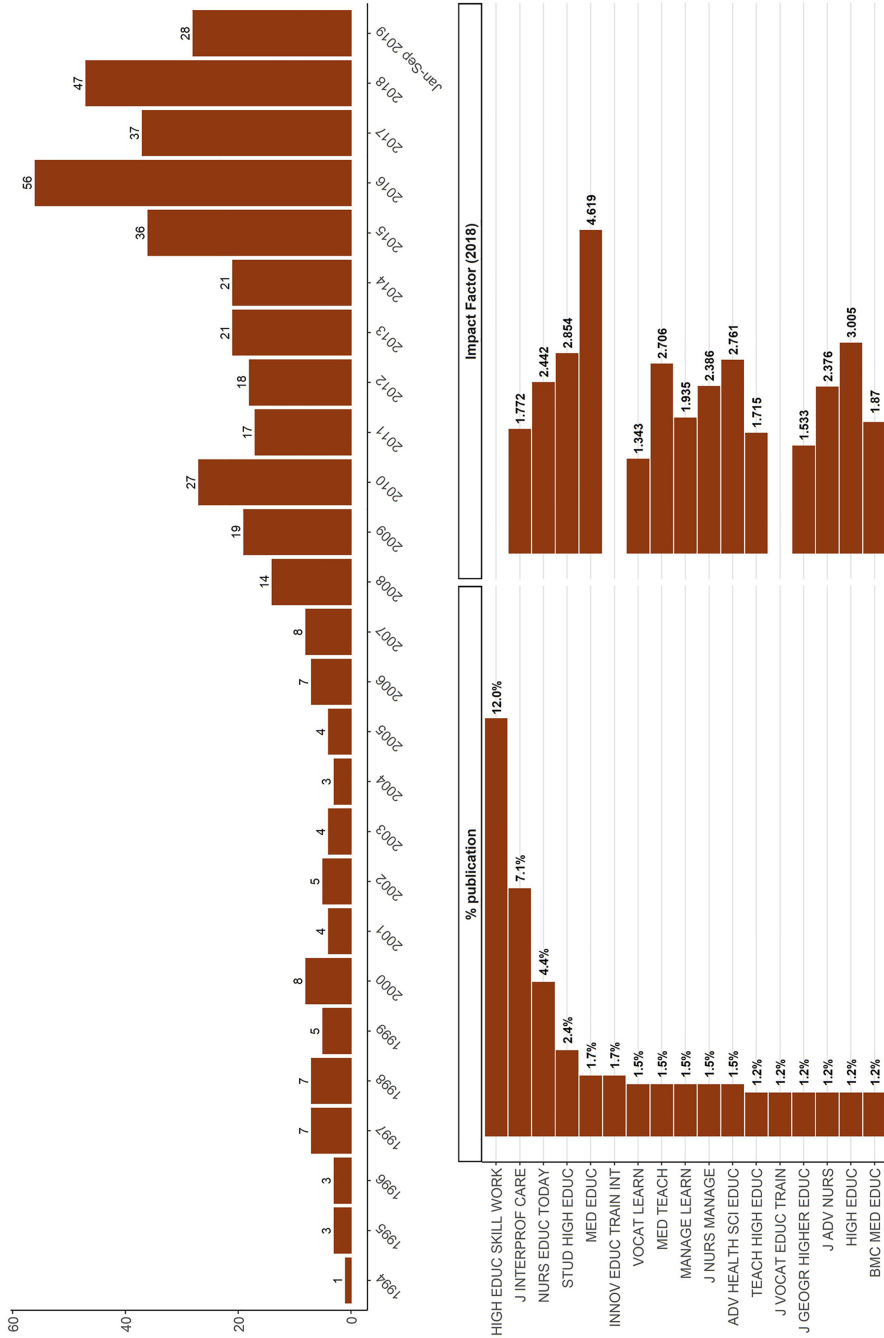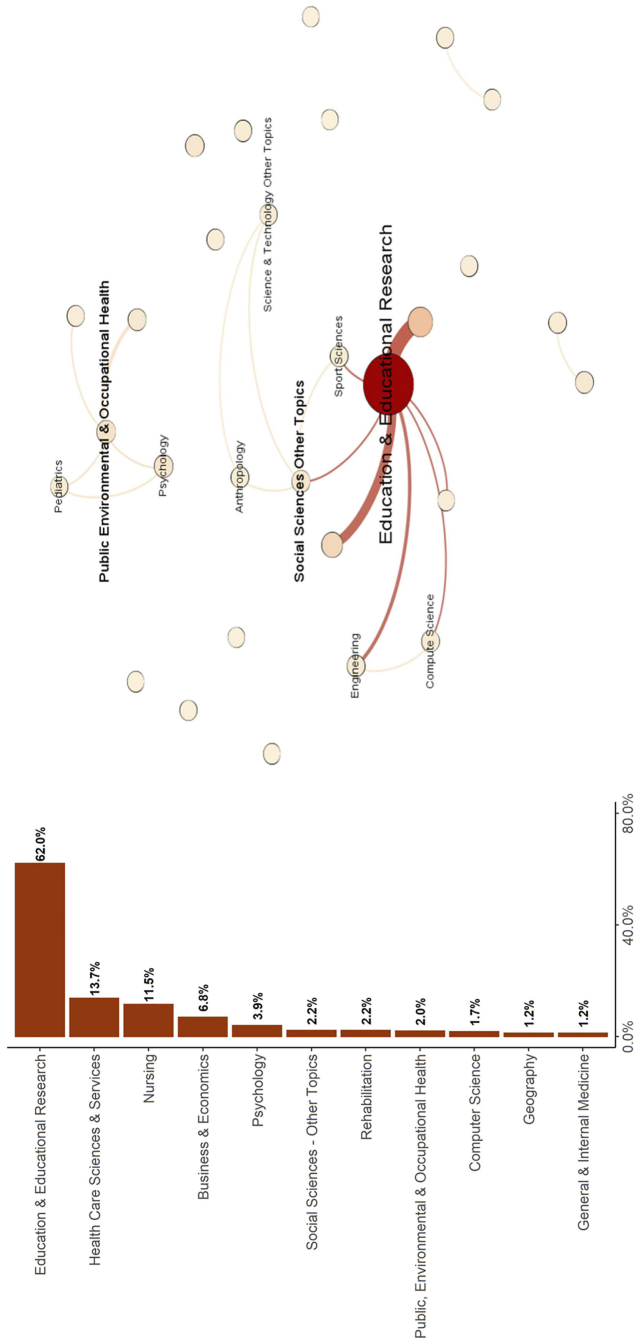
Figure 2.
Main research areas
and network of
research areas

Among the 410 articles published between 1994 and 2019, it was possible to identify authors linked to institutions from 41 different countries. Thus, WBL is expanding as a field of study in European institutions; and the same process can be applied to the context of Australian and American institutions (Figure 3). Regarding countries with the highest percentage of articles in these years, the UK has more than 48.0% of the total publications, followed by Australia (15.1%) and the US (11.0%). This expressive number may relate to the use of WBL in the UK and other English-speaking countries for more than 30 years at higher education level (Stern, 1999; Wearne *et al.*, 2015; Symonds and O'sullivan, 2017; Talbot *et al.*, 2017b; Talbot *et al.*, 2017a; Hardwick-Franco, 2018). However, it is noteworthy a predominance of European countries generating and publishing knowledge on WBL (Jansen and Pineda-Herrero, 2019; Loos, 2007). These data may be explained by the European Union's policy on education, training and professional development (https://ec.europa.eu/education/policies/about-education-policies_en).

Figure 3 also presents an important network of collaboration between countries. The network is based on the authors' affiliation information from 2014 to 2019 and highlights the names of the countries with a higher than average degree. Two nodes (countries) will have an edge when authors from there share at least one article. The weight of the edge is given by the total number of articles shared between the two countries. On average, each country shares one article with three other countries. Besides that, the cluster map of the most frequently publishing organizations clearly indicates that the most frequent collaborations (thicker edges) occur between the UK and Australia; the UK and Finland; the UK and Spain and the UK and Belgium, respectively (Devins *et al.*, 2015; Tella *et al.*, 2016; Manley and Titchen, 2017). In summary, Figure 3 also highlights the UK as being the most central country in the network, considering the number of partners and the number of articles shared with other countries.

Among the fifteen countries with the most publications shown in Figure 3, only South Africa is not a high-income country. The country presents publications related to WBL with different professions, such as medicine, engineering and pharmacy (Ferrandez-Berrueco *et al.*, 2016; Naidoo *et al.*, 2017; Van Huyssteen and Bheekie, 2017; Maseko, 2018). The highlight of South Africa may be the result of the need to restructure higher education in the country, having as a strategy the insertion of the WBL in the formation of different professions (Maseko, 2018). Furthermore, the absence in Figure 3 of China and Brazil can also be highlighted, since they are countries with relevant scientific production (Regalado, 2010; Wu, 2019). Lack of investment in WBL as a teaching and curricular strategy may be one of the predominant factors to explain this distribution. For instance, no results are found in the search for the term "Work-Based Learning" ("*Aprendizagem Baseada no Trabalho*" in Portuguese) in the database of master's and doctoral dissertations from the Coordination for the Improvement of Higher Education Personnel (CAPES), belonging to the Ministry of Education of Brazil (https://catalogodeteses.capes.gov.br/).

Figure 4 presents the organizations with the highest number of WBL articles. Most of them are in England or Australia and they are all universities. The organization network included 259 institutions associated with the author's affiliations from articles published from 2014 onwards. In this network, nodes are the institutions, and the edges are the collaboration between them. Only organizations sharing at least one article with five other organizations are highlighted in the figure.

In terms of collaboration between organizations, Monash University (AU) is the most central institution, followed by Deakin University (AU), University of Wollongong (AU) and Queens University Technology (AU). Centrality degree is not about the number of publications, but the ability of the institution to collaborate. In this sense, higher collaborative organizations are usually leaders in knowledge exchanges.

To integrate with this information, Table 1 shows a partial classification of 410 articles, considering the highest number of citations and indicating their authors. This ranking was produced considering papers with at least 45 citations. The table consists of fifteen titles,
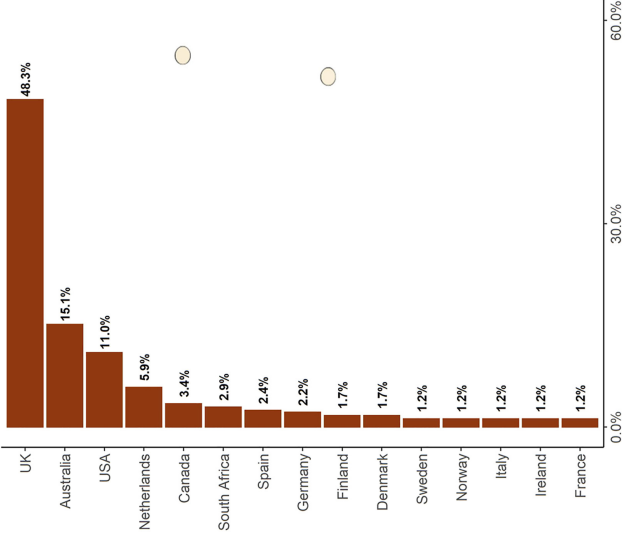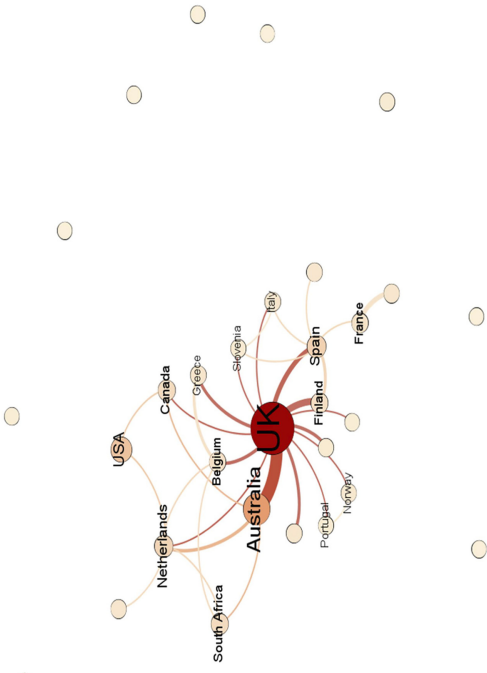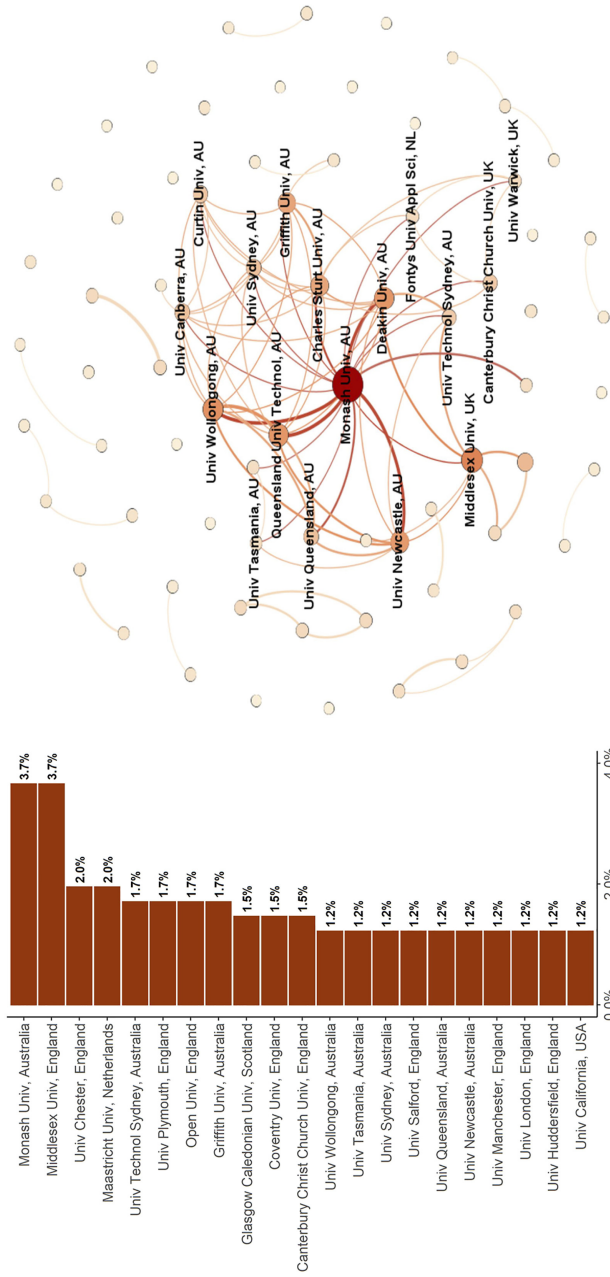
Figure 3.
Main countries and
network of countries

Title	Authors	Total of citations
(1) Perspectives into learning at the workplace	Tynjala (2008)	376
(2) Simulating entrepreneurial learning - Integrating experiential and collaborative approaches to learning	Pittaway and Cope (2007)	175
(3) A model of work-based learning	Raelin (1997)	147
(4) Capitalism and urbanization in a new key? The cognitive-cultural dimension	Scott (2007)	103
(5) Bridging theory and practice in the supervisory relationship: a sociocultural perspective	Spouse (2001)	92
(6) Pedagogical perspectives on the relationships between higher education and working life	Tynjala *et al.* (2003)	90
(7) Students learning from patients: Let's get real in medical education	Bleakley and Bligh (2008)	87
(8) Work-based learning at higher education level: value, practice and critique	Lester and Costley (2010)	84
(9) Pre-registration house officers and ward-based learning: A 'new apprenticeship' model	Bleakley (2002)	75
(10) Psychometric properties of an instrument to measure the clinical learning environment	Boor *et al.* (2007)	64
(11) Putting knowledge to work: A new approach	Evans *et al.* (2010)	58
(12) Tourism education and curriculum design: A time for consolidation and review?	Fidgeon (2010)	55
(13) Crossing Boundaries Between School and Work During Apprenticeships	Akkerman and Bakker (2012)	54
(14) General practitioners as supervisors in postgraduate clinical education: an integrative review	Wearne *et al.* (2012)	46

Table 1.
List of most cited papers (number of citations above 45)

whose citations in the literature ranged from 46 to 376. In addition, using the information obtained from WoS itself, a list was produced with researchers who published at least 4 articles. This list totaled 11 authors that are presented below:

(1) Costley, Carol - with 5 publications.

(2) Lester, Stan - with 5 publications.

(3) Palermo, Claire - with 5 publications.

(4) Teunissen, Pim W - with 5 publications.

(5) Blustein, David L - with 4 publications.

(6) Jackson, Debra - with 4 publications.

(7) Jee, Samuel D - with 4 publications.

(8) Schafheutle, Ellen - with 4 publications.

(9) Scheele, Fedde - with 4 publications.

(10) Stern, David - with 4 publications.

(11) Wall, Tony - with 4 publications.

The network's most central organization, Monash University, also has one of the most productive authors (Claire Palermo). Outside Australia, the most central institution is Middlesex University (the UK) and two of the most productive authors were affiliated there in *The Institute for Work-Based Learning* (IWBL) (Carol Costley and Stan Lester). Maastricht University (UM) does not appear in the network, because it reduced its number of articles

between 2014 and 2019. UM is one of the most productive institutions when considering all years and has expertise in a correlated area - PBL (De Pinho *et al.*, 2015). The development of integration between the WBL and the PBL is advocated by researchers linked to UM (Dolmans and Schmidt, 2010). One of the most productive authors presented in results (Pim W. Teunissen), has publications in collaboration with researchers from UM (Teunissen *et al.*, 2009; Wearne *et al.*, 2012; Wilbur *et al.*, 2020).

The articles with the highest number of citations and the list of 11 authors with at least 4 publications can be considered as a significant and current representation of important actors in the production of knowledge about WBL across the world (Table 1). These researches may constitute an initial or base grouping for future studies through interviews and/or questionnaires for investigative purposes. For example, evaluate the potential for joint use WBL with PBL and how WBL can be valuable for teaching topics such as biosafety, occupational safety and in assisting the concomitant integration between high school and vocational education.

Important issues on WBL raised by this set of articles include: (1) the nature of workplace learning is both different from and similar to school learning (both informal and formal) and that the worlds of education and work are moving closer to each other (Tynjala, 2008; Raelin, 1997; Tynjala *et al.*, 2003; Le Clus, 2011); (2) that one fundamental objectives of WBL is to maximize learning opportunities and experiences in different professions in order to facilitate career and professional development (Williams, 2010; Costley and Lester, 2012; Wearne *et al.*, 2012) and (3) advances to WBL theoretical and practical discussions in higher and vocational education (Lester and Costley, 2010; Evans *et al.*, 2010; Akkerman and Bakker, 2012; Attenborough *et al.*, 2019). These articles and authors, with others, can be considered as important for the advances of construction of knowledge about WBL.

Final considerations

Probably this is the first study to use bibliometric analysis and network analysis techniques to map research related to WBL worldwide. Moreover, the present study provides an interesting mapping to the WBL landscape and a concise view of the scientific knowledge distribution of publications around the world. Moreover, it reflects a growing interest of the scientific community on WBL as a teaching and learning strategy. In addition, to strengthening its development as a curricular practice and promoting research in several areas, such as overhauling corporate governance; inclusive workplaces, flexible working and disadvantaged groups; investment in skills, lifelong learning and well-being and re-balancing working practices and rights (Wall, 2017).

Finally, this bibliometric and network analysis can broaden the collaboration of research in this area, arouse interest in the development of WBL in other countries and stimulate further studies to deepen and elucidate the data and discussion held here.

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