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A bibliometric analysis of the vocational education and training (VET) literature in economics

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Abstract
The literature on Vocational Education and Training is more than six decades old. The current review provides a bibliometric analysis of the literature employing 447 Scopus-indexed documents from 1965 to 2023 in the subject area of "Economics, Econometrics and Finance". This is the first attempt to analyze VET-related literature published in ABS-listed journals in Economics. We reveal the current trends and show that publications grew substantially after 2014. Four clusters were identified and the most important themes were found to be: "vocational education and skill formation", "vocational training and labor market outcomes", "human capital and economic growth" and "apprenticeship contracts and training costs". Based on the current knowledge structure, we discuss future directions of research.

Keywords: vocational education, vocational training, human capital, labor market outcomes, skill formation, bibliometric analysis
JEL Classification Codes: I20, J24, J30

1. Introduction

The transition from school-to-work is a dynamic process often characterized by uncertainty. Vocational education and apprenticeship can facilitate the former by increasing the employment prospects of graduates (Ryan, 2001). At the individual level, academic education provides general skills to young graduates, whereas vocational education favours specific skills that can lead to higher wages (Eggenberger et al., 2018; Oswald-Egg and Renold, 2021). The

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German dual system of Vocational Education and Training (VET) is one of the most successful skill formation programs in upskilling and integrating young people into the labour market (Baethge and Wolter, 2015). However, the positive effects of VET do not persist. The short-term gains of vocational education can turn into a disadvantage over the life cycle (Brunello and Rocco, 2017; Hampf and Woessmann, 2017).

At the labour market level, vocational training programs provide unemployed people, especially female workers or disadvantaged people in developing countries, with new skills to improve both employability and earnings (Attanasio et al., 2017; Bandiera et al., 2020). Rapid technological change deeply affected local labour markets, reducing the adaptability of workers with specific skills to higher quality jobs and diminishing earnings later in life. This led to shifting young people's interests and preferences to more general skills usually acquired in universities (Dauth et al., 2021; Hanushek et al., 2017).

Apprenticeship training is a temporary contract arrangement, that helps young workers acquire early labor experience and upgrade their skills (Caicedo et al., 2022). At the policy level, apprenticeship training contracts, vastly regulated by guilds and by governments, increased on-the-job training (Dustmann and Schönberg, 2009; Wallis, 2008) as well as firm productivity (Cappellari et al., 2012; Gnocato et al., 2020). However, significant training costs of paid apprenticeships discourage firms' willingness to increase the number of apprentices. Thus further incentives at a policy level, such as training subsidies, are necessary (Caicedo et al., 2022).

At the macroeconomic level, public policies favoring skill-specific vocational education over general education might explain the slower technology adoption by firms and the economic growth gap between Europe and the US in the '70s and '80s (Krueger and Kumar, 2004). However, in developing countries, vocational education has significantly affected GDP growth rates (Siddiqui and Rehman, 2017) and increased returns to skill accumulation for young women (Maitra and Mani, 2017).

Ensuring the smooth transition of young people from school to work is of great importance to advanced economies for both individuals and the entire society. Previous attempts to analyze VET literature have either provided a visualization of the interdisciplinary research from a broader perspective of social sciences (Tian et al., 2023) or reviews focusing on important aspects in the field of education, such as the transferability of VET system (Li and Pilz, 2023) or VET reform implementation (Caves et al., 2021).

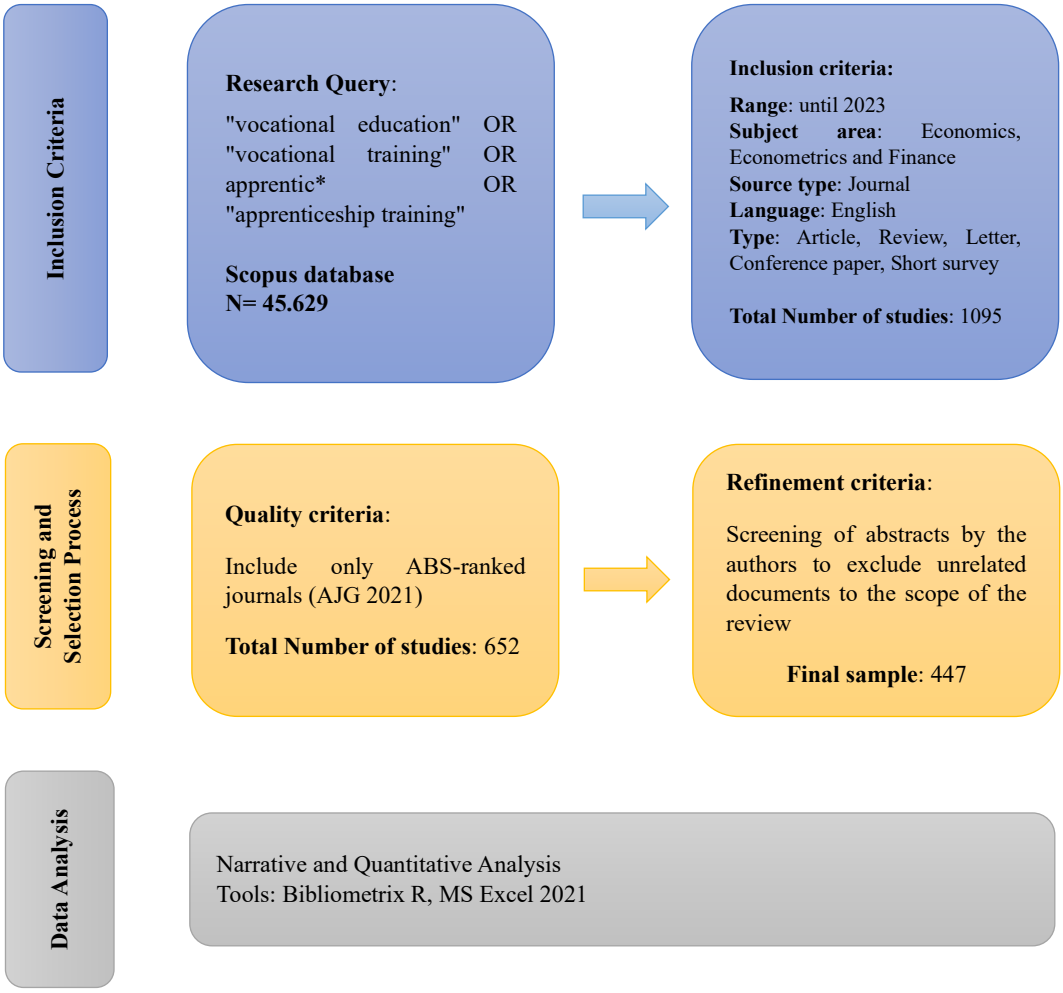
Focusing on economics journals, we analyze the literature on VET by emphasizing on human capital formation. We present the current trends and identify research gaps in the VET-related literature. To achieve this goal, we review the knowledge structure of VET by addressing three research questions: (1) What is the landscape of research on VET literature? (2) What is the current state of research on VET and how did it evolve? and (3) What are the future research venues in this field of research?

The contribution of this study includes two aspects. We analyze current trends in the VET literature by offering a performance analysis of scientific actors (authors, journals and countries), and by presenting the current trends in the literature that is published in the ABS-listed economics journals. Furthermore, it unravels the evolution of the literature on VET and identifies the development trend of future research.

2. Data screening and selection process

The review focuses on peer-reviewed ABS-ranked journals (AJG 2021) to ensure higher quality of selected documents and uses Scopus to achieve extensive coverage in social sciences (Mongeon and Paul-Hus, 2016). The authors performed a search using the string "vocational education" OR "vocational training" OR apprentic* OR "apprenticeship training" in the titles, abstracts, or keywords. The initial search yielded 45,629 documents spanning from 1931 to the present date (July 1st, 2024). However, after using the inclusion criteria and the screening and selection process described in Figure 1 in detail, the final document list comprised 447 English-language articles and reviews from 1965 to 2023 (Abramo and Oxley, 2021).

Figure 1. Literature Screening and Research Process



Source: authors´ elaboration

Bibliometric analysis is a quantitative approach that allows researchers to analyze in depth aggregated bibliographic data (Zupic and Čater, 2015). To address the research questions,

performance and network analysis were conducted using MS Excel to analyze publication volume and impact and the Bibliometrix package in R to map current research themes and reveal future research directions (Aria and Cuccurullo, 2017; Donthu et al., 2021).

3. Results

3.1. Scientific performance of literature

We will address the first research question by employing a performance analysis. Performance analysis evaluates the contribution of research actors by using measures based on publication and citation number such as total publications, number of contributing authors, total citations, *h*-index, citation per cited publication (Zupic & Čater, 2015). Table 1 presents the main information of the literature on VET. The collection includes 447 documents from 119 journals and cites 15,226 references. Over a large period of 58 years, 787 authors contributed to the bibliography in VET with 21.92% international co-authorships and 137 single-authored documents.

Table 1. Description of the data

Main Information		**Author Information**	
Timespan	1965:2023	Authors	787
Sources (Journals, Books, etc.)	119	Authors of single-authored publications	123
Documents	447	Authors of multi-authored publications	665
Annual Growth Rate %	5.71		
Document Average Age	14.4	**Author Collaboration**	
Average citations per doc per year	21.74	Single-authored documents	137
References	15226	Co-Authors per documents	2.15
		International co-authorships %	21.92
Document Type			
Article	433		
Conference paper	2		
Review	11		
Short survey	1		

Source: authors´ elaboration

The top 10 most productive authors based on the total number of publications are reported in Table 2. Wolter S.C., affiliated with the University of Bern and the Swiss Coordination Centre for Research in Education, is the most prolific author in VET-related literature with 10 publications and a 6 h-index, followed by Backes-Gellner U., affiliated with the University of Zurich, with 8 publications and Prais S.J., affiliated with the City University, with 6 publications and a 5 h-index respectively (Table 2).

Table 2. Top 10 most prolific authors

Rank	Author	NP	TC	h-index	PY-start
1	Wolter S.C.	10	167	6	2006
2	Backes-Gellner U.	8	136	5	2010
3	Prais S.J.	6	165	5	1983
4	Steedman H.	5	112	5	1986
5	Brunello G.	5	129	4	2004
6	Schweri J.	5	111	4	2006
7	Polidano C.	5	32	3	2011
8	Fitzenberger B.	4	82	4	2005
9	Wallis P.	4	243	4	2008
10	Zwick T.	4	138	4	2005

Source: authors´ elaboration

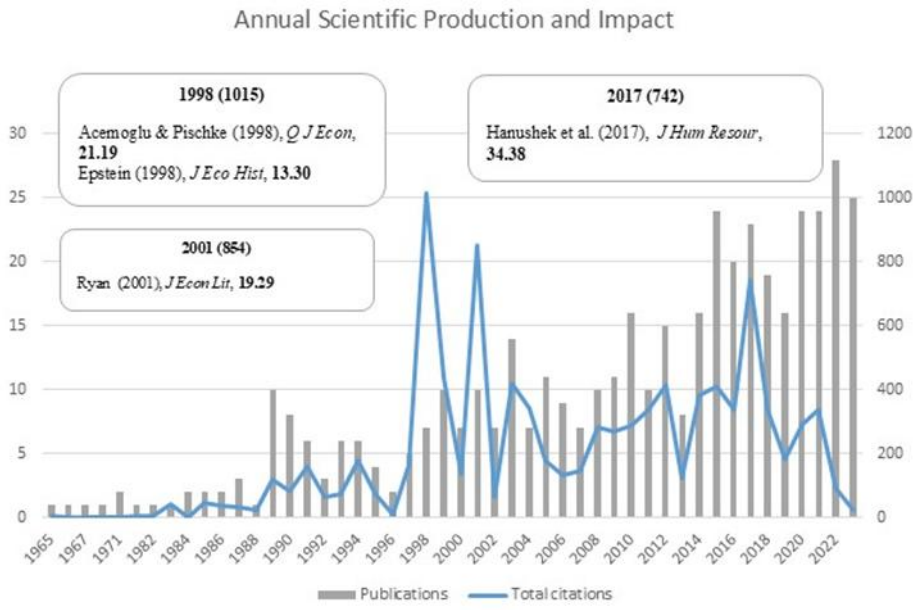
Note: *NP* = number of publications, *TC* = number of total citations, *h*-index = *h* number of publications receiving at least *h* citations and *PY-start* = year of first publication

Although the earliest publication in our sample was in 1965 (Correa, 1965), VET-related literature started to grow during the 1990s and increased substantially after 2014 (Figure 2). Figure 2 presents the annual scientific production and impact of publications on VET and highlights the most influential years (1998 and 2017) by presenting total citations and most cited articles. Acemoglu and Pischke (1998) publication on apprenticeship training is the most influential document with 572 citations and 21.19 average citations per year (ACY). Ryan's (2001) work on school-to-work transition received 463 citations and 19.29 ACY, whereas Epstein's (1998) publication on apprenticeship and technological change in the preindustrial economy received 359 citations and 13.30 ACY (Table 3).

The top 10 most prolific journals based on the total number of citations appear in Table 4. These journals account for 42.38% of the literature on VET and 2768 total citations. Economics of Education Review published the most articles (54, 12.11%) and 866 citations. Labour Economics was second with 29 publications (6.5%) and 454 citations followed by Education Economics with 27 publications (6.05%) and 339 citations.

Figure 3 presents the most productive and influential countries affiliated with authors published in VET-related literature. The USA is the most productive and influential country with 172 publications, 972 citations and 21.60 average citations (AC). This is followed by Germany with 140 publications, 725 citations and 21.30 AC and the UK with 115 publications, 649 citations and 18.50 AC.

Figure 2. Publications and citations per year



Source: authors´ elaboration

Table 3. Top 10 most cited publications

Rank	Publications	Source	Total Citations (TC)	TC per Year
1	Acemoglu & Pischke (1998)	Quarterly Journal of Economics	572	21.19
2	Ryan (2001)	Journal of Economic Literature	463	19.29
3	Epstein (1998)	Journal of Economic History	359	13.30
4	Hanushek et al. (2017)	Journal of Human Resources	275	34.38
5	Blattman et al. (2014)	Quarterly Journal of Economics	176	16.00
6	Keep & Mayhew (1999)	Oxford Review of Economic Policy	166	6.38
7	Aakvik (2001)	Oxford Bulletin of Economics and Statistics	159	6.63
8	Krueger & Kumar (2004)	Journal of Economic Growth	132	6.29
9	Dauth et al. (2021)	American Economic Journal: Applied Economics	125	31.25
10	Attanasio et al. (2011)	Journal of the European Economic Association	125	8.93

Source: authors´ elaboration

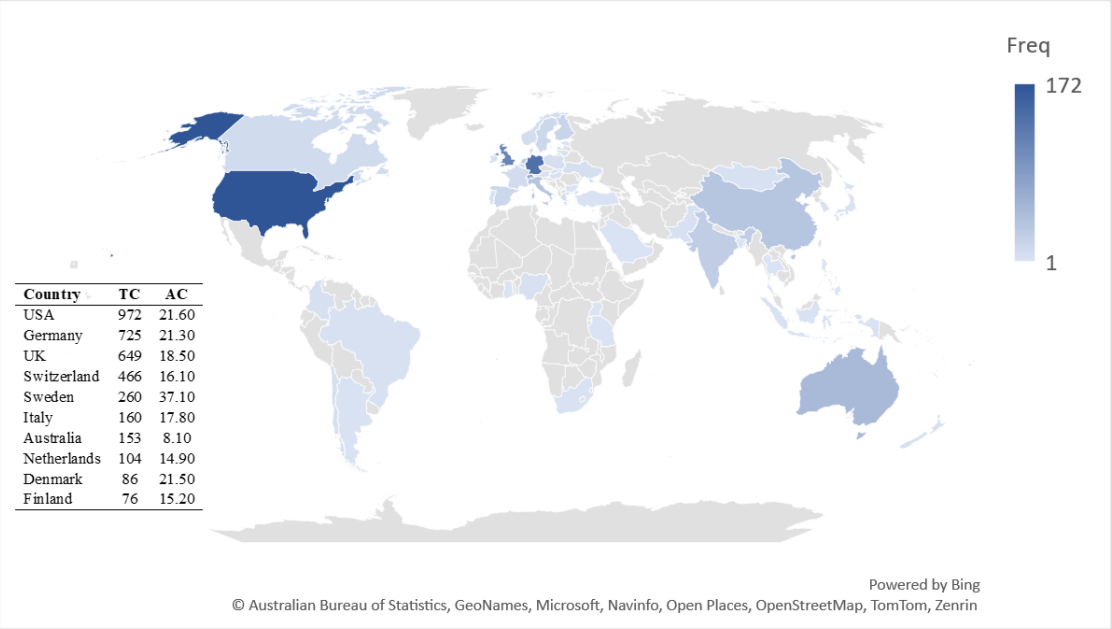
Table 4. Top 10 most frequent journals

Journals	NP	TC	Ratio %
Economics of Education Review	54	866	12.11
Labour Economics	29	454	6.50
Education Economics	27	339	6.05
National Institute Economic Review	14	312	3.14
Indian Journal of Labour Economics	13	55	2.91
Applied Economics	12	132	2.69
Jahrbucher fur Nationalokonomie und Statistik (The Journal of Economics and Statistics)	12	108	2.69
Work, Employment and Society	10	312	2.24
Oxford Economic Papers	10	150	2.24
Australian Economic Review	8	40	1.79
Partial sum	**189**	**2768**	**42.38**
Other journals	257	6950	58.62
Total sum	**447**	**9718**	**100.00**

Source: authors´ elaboration

Note: *NP* = number of publications, *TC* = number of total citations and *Ratio%* = percentage of a journal's publications out of the total number of publications (447)

Figure 3. Geographic distribution of publications, total citations and average article citations



Source: authors´ elaboration

Note: *Freq* = number of publications, *TC* = number of total citations and *AC* = average citations

3.2. Overview of clusters and future research direction

Science mapping analysis allows us to address the second and third research questions. Network analysis can uncover key themes, trends and research gaps in a specific area by creating a nodal network of bibliographic data (Donthu et al., 2021). The current review uses a two-dimensional thematic map generated by the Bibliometrix package in R to uncover current trends in VET bibliography.

Centrality and density measures are generated using abstract keywords for wider coverage (this is due to a high proportion of missing values in authors' keywords (42%)). Density measures the degree to which a research theme is developed by measuring keyword internal connectedness, whereas centrality measures the degree to which a specific research theme correlates to a research field (Cobo et al., 2011; Sun et al., 2024). We found that 393 publications (88% of our sample) formed four clusters that reflect the current state of knowledge on VET literature. They consist of two basic themes and two niche themes (Figure 4).

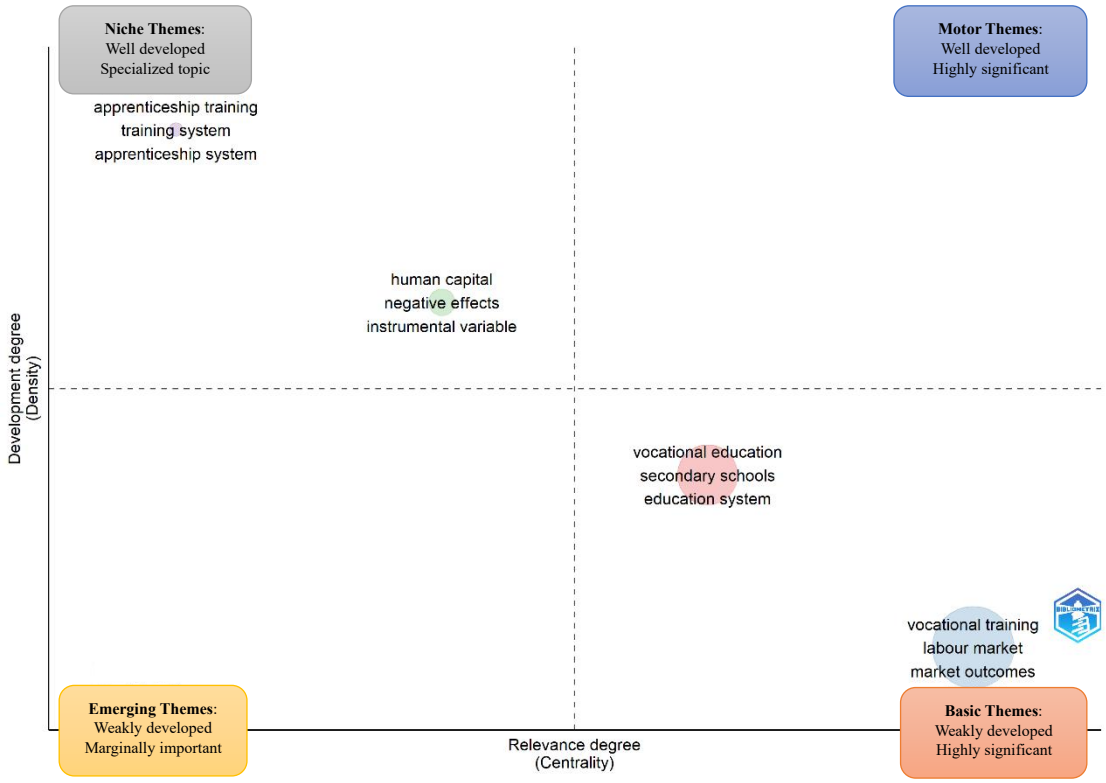
Specifically, the basic themes, “vocational education” and “vocational training”, are highly significant to the VET literature (high centrality), but not well-developed (low density). On the other hand, niche themes, “human capital” and “apprenticeship training” are well-developed (high density), but form specialized topics (low centrality) (Figure 4). Table 5 includes the most important cluster keywords, centrality, density, cluster frequency, the top 3 publications per cluster and total citations per publication. This information will be used in the analysis in the next section.

3.2.1. Vocational education and skill formation

The first cluster, Vocational education, includes 105 documents and has received 1596 citations. The most important keywords are “education system”, “dual vet” and “skill formation”. An important part of the bibliography on this cluster focuses on the debate concerning the impact of vocational education on skill formation and the persistence of the positive effects (Oswald-Egg and Renold, 2021). Specific skill vocational training yields higher wages to graduates compared to less specific training that experiences higher occupational mobility (Eggenberger et al., 2018). One part of the literature focuses on the returns to vocational (versus general) education (Hall, 2012; Meer, 2007) or the long-term disadvantages of vocational education over the life cycle, such as lower employment and lower wages (Brunello and Rocco, 2017) or lower adaptability to changing environments (Hampf and Woessmann, 2017).

Another part of the literature provided evidence of the German system of skill formation (dual system of VET) in contributing to the upskilling and integration of young adults into the labor market, leading to higher productivity levels in the German economy (Baethge and Wolter, 2015; Prais and Wagner, 1985; Steedman, 1993; Wiemann and Fuchs, 2018). However, since the mid-20th century, rapid changes introduced new challenges to the German VET program: study reforms, the shift towards higher education and the inability of VET to provide training places that respond to the market needs and the needs of low-qualified young people leaving school (Baethge and Wolter, 2015).

Figure 4. Thematic map based on document abstracts



Source: authors´ elaboration

3.2.2. Vocational Training and Labour Market Outcomes

Vocational training is the largest cluster with 165 documents and 4139 citations. The most important keywords include "labour market outcomes", "youth unemployment" and "vocational skills". This cluster focuses on the labour market outcomes. Evidence from the preindustrial economy indicates that technological innovation was induced by the craft guilds' ability to enforce vocational training and investment in skills (Epstein, 1998). Vocational training programs give unemployed people a chance to acquire new skills and increase their earnings, especially for female workers or young people in developing countries (Attanasio et al., 2011, 2017; Bandiera et al., 2020; Blattman et al., 2014), although worker age can create significant barriers to vocational training participation (Taylor and Urwin, 2001).

Conversely, automation technologies created new jobs that affected worker adaptability to technological and structural change by diminishing employment or earnings later in life and shifting young people away from vocational training toward universities (Dauth et al., 2021; Golsteyn and Stenberg, 2017; Hanushek et al., 2017). Subsidized work experience and training with an employer provide better outcomes than classroom vocational training (Carling and Richardson, 2004).

Table 5. Clustering of publications based on document abstracts

N	Cluster	TP	TC	Keywords	Centrality	Density	Cluster Frequency	Top 3 Publications	TC
1	Vocational education (Basic)	105	1596	vocational education, secondary schools, education system, vocational schools, skilled workers, academic education, dual vet, skill formation, vet system, institutional change, education graduates	0.393	13.959	289	Fortwengel & Jackson (2016)	80
								Hall (2012)	69
								Baethge & Wolter (2015)	68
2	Vocational training (Basic)	165	4139	vocational training, labour market, market outcomes, training program, positive effects, administrative data, labour force, educational attainment, survey data, youth unemployment, school graduates, propensity score, labour economics, vocational skills, economic society, developing countries	0.427	11.172	467	Ryan, (2001)	463
								Epstein (1998)	359
								Hanushek et al. (2017)	275
3	human capital (Niche)	64	1349	human capital, negative effects, instrumental variable, longitudinal data, tertiary education, economic history, economic growth, unobserved heterogeneity, university education, treatment effects, child labor	0.341	16.263	127	Krueger & Kumar (2004)	132
								Emerson & Souza (2003)	120
								Bishop & Mane (2004)	87
4	Apprenticeship training (Niche)	59	1265	apprenticeship training, training system, apprenticeship system, apprenticeship contracts, panel data, training firms, training costs, apprenticeship programme, training positions, occupational mobility, gender segregation	0.212	19.555	113	Wallis (2008)	123
								Cappellari et al. (2012)	93
								Ryan & Unwin (2001)	66

Source: authors´ elaboration

3.2.3. Human capital and economic growth

Human capital consists of 64 documents and 1349 citations. The most important keywords include "human capital", "economic growth" and "unobserved heterogeneity". The bibliography assigned to this cluster focuses on economic growth. European education policies favoring skill-specific vocational training over "general" education might explain the growth gap between Europe and US during the rapid technological change in the 70s and 80s (Krueger and Kumar, 2004). When analyzing the human capital – growth nexus in Asia, the results indicate that vocational education affected growth rates in both East and South Asia (Siddiqui and Rehman, 2017). The benefits of a vocational education program can increase returns to skill accumulation for young women in developing countries (Maitra and Mani, 2017). Education policies that reduce gender inequalities in vocational education and apprenticeship training are necessary to encourage women to pursue STEM subjects (Cavaglia et al., 2020). Moreover, offering occupation-specific education can increase school attendance and improve labor market outcomes (Bishop and Mane, 2004). Issues of the harmful effects of inter-generational child labor on individual earning abilities as an adult are also examined (Emerson and Souza, 2003).

3.2.4. Apprenticeship contracts and training costs

Apprenticeship training consists of 59 documents with 1265 citations and the most important keywords include "apprenticeship contracts", "training costs", "occupational mobility" and "gender segregation". This cluster focuses on apprenticeship contracts and training costs. Guilds played a critical role in supporting the implementation of apprenticeship contracts to increase on-the-job training (Dustmann and Schönberg, 2009; Wallis, 2008). Unlike fixed-term contracts, temporary apprenticeship contracts can increase firm productivity by lowering the number of workers and inducing productive apprentices (Cappellari et al., 2012; Gnocato et al., 2020). However, a firm's willingness to train apprentices is significantly affected by the net cost of training during the apprenticeship period which depends on labour market regulations (Muehlemann et al., 2010; Wolter et al., 2006) or training quasi-market limitations (Ryan and Unwin, 2001). Thus, policy interventions for subsidized training can provide incentives to firms to increase the number of apprentices (Caicedo et al., 2022).

3.2.5. Thematic evolution and future research areas

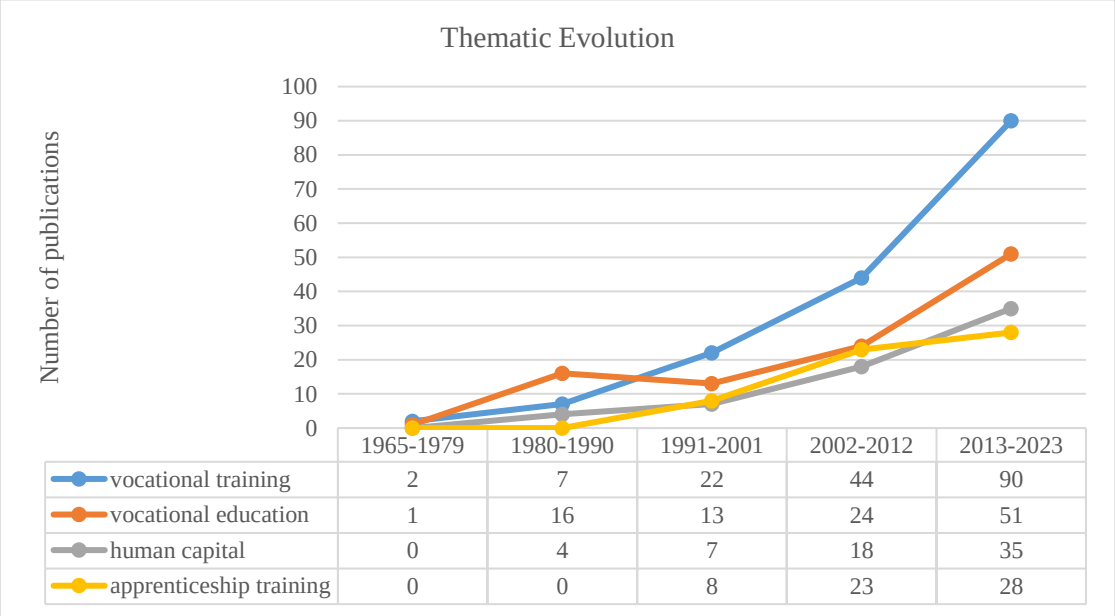
Figure 5 presents the evolution of the number of publications of each theme cluster. The vocational training cluster surged in the '90s, concentrating a large amount of literature during the last three decades. The vocational education cluster grew substantially in the '80s, declined the next decade and increased substantially after 2012. The increased research published in ABS-listed journals on themes related to vocational training and vocational education indicates that there is still room to explore these areas.

Specifically, vocational education-related topics, such as skill formation, dual VET system, the effect across the life cycle, and equality of educational opportunity, can be further developed at an individual level. Vocational training-related topics, such as labour market outcomes, returns to vocational education, market behavior on immigrants or gender differences, can be further developed at a firm level.

Niche themes, human capital and apprenticeship training, are specialized topics that gained greater attention after 2001. These specialized themes can also offer new research opportunities. Apprenticeship-related topics, such as subsidized apprenticeship, occupational gender

segregation, occupational mobility of apprentices, fixed-term versus temporary apprenticeship contracts and vocational training costs, can be further explored at the policy level in specific or a group of countries (e.g., EU). Human capital and economic growth-related topics, such as specific educational systems, returns to vocational education, heterogeneous returns to education, reducing the gender gap or promoting occupation skills, can be explored at the macroeconomic level.

Figure 5. Evolution of theme clusters



	1965-1979	1980-1990	1991-2001	2002-2012	2013-2023
vocational training	2	7	22	44	90
vocational education	1	16	13	24	51
human capital	0	4	7	18	35
apprenticeship training	0	0	8	23	28

Source: authors´ elaboration

4. Concluding remarks

This is the first attempt to analyze the literature on VET in the field of economics and reveal future research directions. We conducted a bibliometric analysis of 447 Scopus-indexed documents from 1965 to 2023. Performance analysis revealed the most prolific authors, journals and affiliated countries. Acemoglu & Pischke (1998) publication deeply influenced the literature growth during the 90s, but it was not until 2014 that publications on VET grew substantially.

Co-occurrence analysis revealed four theme clusters that consist of 88% of the sample. The results indicate that the main focus of the literature, accounting for 69% of the total publications, is on topics related to “vocational education and skill formation” and “vocational training and labor market outcomes”. These basic themes are highly significant and can be further developed. However, specialized topics “human capital and economic growth” and “apprenticeship contracts and training costs” rose substantially after 2001 and can also offer new research opportunities.

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