ONLINE TRAINING FOR THE LABOUR FORCE: A BIBLIOMETRIC ANALYSIS OF CURRENT TRENDS

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Abstract:

The increasing integration of online training into the labour force has transformed traditional workforce development strategies, offering flexible and scalable solutions to skill enhancement. However, the rapid proliferation of research in this field necessitates a comprehensive analysis to discern patterns, trends, and gaps. This study presents a bibliometric analysis of online training in the labour force, utilising data sourced from the Scopus database. A total of 1,042 records were retrieved and analysed using Scopus Analyzer and VOSviewer software. The analysis aimed to uncover publication trends, prominent authors, key journals, influential institutions, and core thematic areas. Methodologically, the study adhered to bibliometric protocols, employing citation mapping, co-authorship networks, and thematic clustering. Key findings revealed an exponential publication growth over recent years, with significant contributions from North America and Europe. VOSviewer analysis highlighted major thematic areas such as e-learning technologies, workforce productivity, and the role of digital tools in skill development. The study also identified a concentration of research in a limited number of high-impact journals, underscoring the dominance of established platforms in disseminating knowledge. Despite these advancements, the findings highlight gaps in empirical studies focusing on developing regions and sector-specific applications. This bibliometric analysis contributes to understanding the evolving landscape of online training in the labour force, providing valuable insights for researchers, policymakers, and practitioners aiming to address existing challenges and leverage future opportunities in this dynamic domain.

Keywords:

Online Training, Labour Force

Introduction

Online training has become an essential component of workforce development, particularly in the context of the rapidly evolving global labour market. Research indicates that online training can significantly enhance the preparedness of students and workers for remote job roles, ensuring they possess the necessary skills to thrive in such settings. Universities and training institutions play a crucial role in this transition, as they are responsible for equipping the next generation of workers with the competencies required for remote professional opportunities (Manko, 2019). Moreover, the adoption of online collaborative learning (OCL) methods has shown promise in fostering solidarity and promoting learning among labour organisation members, further underscoring the potential of online training to build a strong sense of community and enhance educational outcomes (Bélanger, 2008).

The effectiveness of online training programs is also evident in various organisational contexts. For instance, the International Training Centre of the International Labour Organization (ITCILO) reported a dramatic increase in enrolments for their online training activities during the COVID-19 pandemic, with a significant proportion of participants expressing a preference for digital training in the future (Zawacki-Richter et al., 2022). Additionally, the development of reliable and valid evaluation tools, such as the Questionnaire to Evaluate Online Training in the Workplace (CEFOAL), has enabled organisations to assess the impact of online training on factors such as pedagogical design, tutor performance, and learning transfer (Rodríguez-Santero et al., 2020). These findings highlight the importance of well-designed online training programs in enhancing job performance and satisfaction, ultimately contributing to the overall effectiveness of the labour force.

Literature Review

Research highlights online training's transformative potential while identifying areas requiring further exploration. Firk et al. (2024) discussed the detrimental effects of digital anxiety in finance functions, showing that digital training, peer support, and transformational leadership alleviate its impact and foster engagement. Similarly, Zia et al. (2024) identified digital resources like training and communication as critical in enhancing digital engagement and innovative behaviours among technological professionals. Lathabhavan and Kuppusamy (2024) further supported the significance of digital training and leadership in bolstering performance during crises in small and medium-sized enterprises. Interactive and gamified training systems are emerging as effective strategies for engaging employees. Bitrián et al. (2024) demonstrated the value of gamification in enhancing satisfaction and cybersecurity behaviours by reducing vulnerability to phishing. These findings align with Núñez et al. (2024), who explored business game simulators to enhance crisis preparedness and foster innovation through immersive training. Mourelatos et al. (2024) added to this discussion by showing that online training during the pandemic reduced task completion times and improved job outcomes in crowdsourced labour markets.

Integrating electronic Human Resource Management (e-HRM) practices has demonstrated significant organisational benefits, particularly in enhancing performance and development. Alhelal and Abdelwahed (2024) emphasised the role of e-HRM elements, such as e-training and e-performance appraisals, in organisational development in Saudi Arabia. Hussein and Jaaffar (2024) highlighted the mediating role of trust in improving academic staff performance through e-HRM in Jordan, while Herzallah and Ayyash (2024) underlined the importance of e-HRM components, such as e-selection and e-training, in improving outcomes in educational

institutions. These findings collectively pointed to e-HRM as a transformative force in modern organisations. Mental health and well-being have also emerged as crucial considerations in workforce training. Jones et al. (2024) reported significant improvements in resilience and reduced stress and anxiety through online training programs focusing on counselling approaches. Similarly, de Wit et al. (2024) demonstrated the benefits of trauma-informed training in equipping mental health workers to manage pandemic-related challenges, emphasising the importance of self-care. Digital training has also been pivotal in addressing the challenges of remote work during the pandemic. Lathabhavan and Griffiths (2024) illustrated the importance of technology ease, managerial support, and peer collaboration in enhancing self-efficacy and training transfer among remote employees. Pham et al. (2024) extended this by showcasing how digital HRM practices, such as training, enable employees in the hospitality sector to adopt work-at-home models. These findings highlighted the adaptability and necessity of digital training in sustaining productivity and resilience in remote work settings.

Despite its advantages, challenges persist in achieving equitable access to online training. Lane et al. (2024) identified gender disparities in recruiter outreach for tech training programs, which disproportionately disadvantage women, and called for inclusive policies to rectify this. Bilderback et al. (2024) emphasised the role of virtual training in advancing sustainable development goals, fostering inclusivity, and reducing workforce inequalities. Decius et al. (2024) discussed the effectiveness of various learning forms, finding that informal and self-regulated learning positively impact employability, while formal training often lacks significant outcomes. These findings revealed critical areas for improvement in training methodologies. Economic disruptions such as the COVID-19 pandemic have influenced training preferences. Dauth and Lang (2024) showed that while interest in continuing vocational training fell during the pandemic, engagement in online training increased significantly. This shift underscores the growing preference for flexible and accessible learning platforms. Innovations such as business game simulators and nonviolent communication training offer additional promise. del Val Núñez et al. (2024) highlighted simulators' potential for immersive learning, while Korlipara and Shah (2024) demonstrated that nonviolent communication training fosters sustainable behavioural change and interpersonal improvement.

Future research should focus on long-term outcomes, equity in training access, and leveraging advanced technologies to address evolving workforce needs. The collective evidence points to the transformative potential of online training, which has provided systemic challenges and methodological gaps.

Research Questions
This study answered five research questions as below:
1. What are the research trends in online training according to the year of publication?
2. Who and how much has been published in the area with regard to the authors?
3. Who are the top 10 authors based on citation by research?
4. What are the popular keywords related to the study?
5. What are the co-authorship countries' collaboration?

Methodology

Bibliometrics involves the aggregation, management, and analysis of bibliographic data derived from scientific publications (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). This field encompasses basic descriptive statistics, such as identifying publishing journals, publication years, and key author classifications (Wu & Wu, 2017), as well as advanced methodologies like document co-citation analysis. Conducting a bibliometric analysis requires an iterative process, including selecting relevant keywords, performing a literature search, and conducting a detailed analysis to develop a robust bibliography and ensure reliable outcomes (Fahimnia et al., 2015). To maintain data integrity, the SCOPUS database was chosen as the primary source for data collection (Al-Khoury et al., 2022; di Stefano et al., 2010; Khiste & Paithankar, 2017; Gu et al., 2019). Publications retrieved from Elsevier's Scopus, renowned for its comprehensive coverage, spanned the period from 2004 to December 2024, forming the foundation for subsequent analysis.

Data Search Strategy

Advanced searching in the Scopus database refers to the use of specialised techniques and structured queries to retrieve highly specific and relevant academic literature. Unlike basic searches that rely on simple keyword inputs, advanced searching employs Boolean operators, field codes, wildcards, proximity operators, and filters to refine and optimise search results. Tables 1 and 2 show the search string and the search criteria.

TABLE 1: The Search String

Scopus	TITLE-ABS-KEY ((("Online train*" OR "e-train*" OR "virtual train*" OR
Date of Access:	"electronic train*" OR "digital train*" OR "remote train*") AND ("labo#r force" OR
November 2024	"workforce" OR "employee*" OR "human resource*" OR "worker*" OR "manpower"
	))) AND PUBYEAR > 2003 AND PUBYEAR < 2025 AND (LIMIT-TO (
	LANGUAGE, "English"))

TABLE 2: The Criterion Of Searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	2004 - 2024	>2024

Data Analysis

VOSviewer is a powerful and intuitive bibliometric tool developed by Nees Jan van Eck and Ludo Waltman at Leiden University in the Netherlands (van Eck & Waltman, 2010, 2017). Known for its ability to visualise and analyse scientific literature, this software is widely appreciated for its simplicity and versatility. It excels in generating network visualisations, clustering related items, and creating density maps, making it particularly useful for exploring research trends and connections. VOSviewer's interactive design and regular updates ensure researchers can efficiently navigate large datasets and uncover meaningful insights. A standout feature of VOSviewer is its ability to convert complex bibliometric datasets into clear, visually engaging maps and charts. A strong emphasis on network visualisation helps researchers analyse co-authorship networks, keyword co-occurrence patterns, and citation relationships.

For this research, datasets were collected from the Scopus database, covering publications from 2004 to 2024. These datasets included key bibliometric elements such as publication year, titles, author names, journal details, citations, and keywords, all formatted in PlainText. Using

VOSviewer version 1.6.20, these data were analysed through clustering and mapping techniques to produce insightful visualisations. Unlike traditional methods like Multidimensional Scaling (MDS), which focuses on calculating similarity metrics such as cosine or Jaccard indices, VOSviewer employs a unique approach for normalising co-occurrence frequencies. Specifically, it uses the association strength (AS_{ij}), a technique that ensures the relative positioning of items in low-dimensional spaces reflects their actual relatedness (van Eck & Waltman, 2010; Appio et al., 2014). This approach not only enhances the interpretability of bibliometric maps but also reinforces the software's value as a cutting-edge tool for bibliometric analysis (Van Eck & Waltman, 2007) :

$$AS_{ij} = \frac{C_{ij}}{W_i W_j},$$

which is "proportional to the ratio between the observed number of cooccurrences of i and j and the expected number of co-occurrences of i and j under the assumption that co-occurrences of i and j are statistically independent" (Van Eck and Waltman, 2010, p. 531; Van Eck & Waltman, 2007).

Result and Discussion

What are the Research Trends in Online Training According to the Year of Publication?
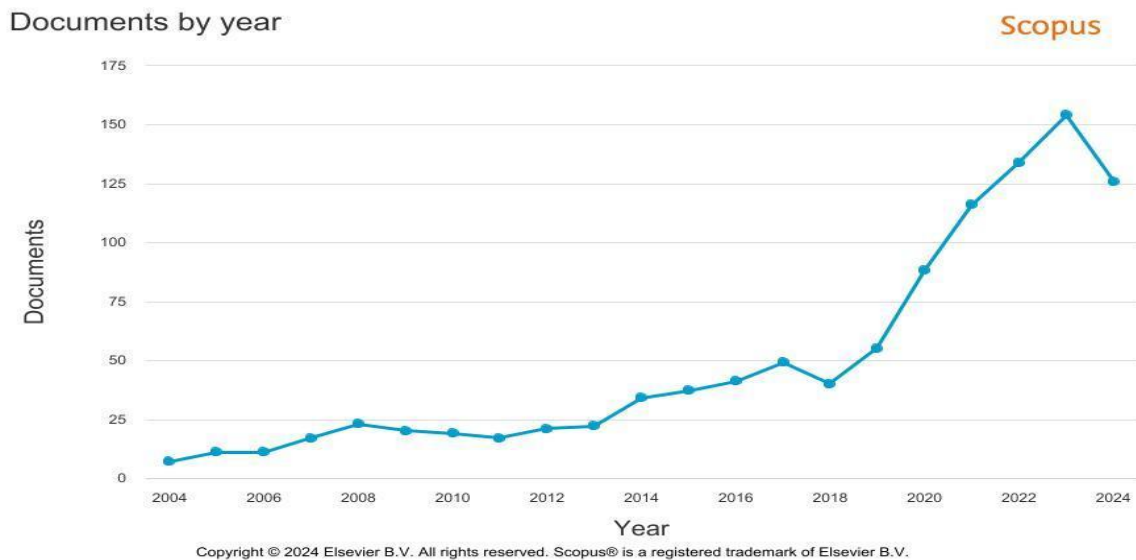
FIGURE 1: Plotting Document Publication by Years

The figure reveals a progressive growth trajectory with notable trends. From 2004 to 2014, there was a gradual but relatively modest increase in the number of published documents, reflecting a steady yet limited interest in the topic during the early stages of digital training adoption. A slight decline in publications around 2010 may suggest a temporary stagnation in research interest or a shift in academic focus. However, beginning in 2015, the figure demonstrates a marked upward trend, indicating an intensification of academic engagement and a growing recognition of online training's relevance to workforce development. The sharp rise in publications between 2018 and 2022 represents a pivotal phase, driven by the COVID-19 Pandemic's impact on work and learning dynamics, which amplified the demand for online

training. The peak in 2023 reflects a culmination of this trend, underscoring heightened research activity during the pandemic and its aftermath. However, the slight decline in 2024 suggests either a stabilisation in scholarly attention or the accumulation of the year's publications have yet to be counted. Overall, the consistent upward trajectory over two decades highlights the increasing importance of online training as a critical area of practice for workforce development.

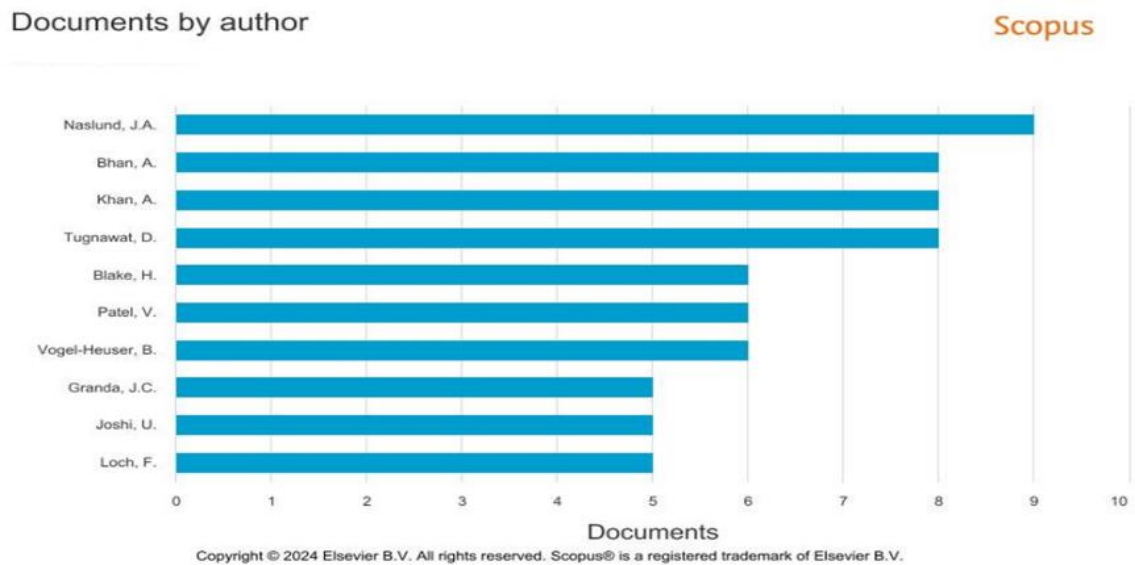*Who and How Much Has Been Published in the Area with Regard to the Authors?*

Figure 2: The Authors and Their Number of Publications

Table 3: The Authors and Their Number of Publications Percentage

Author Name	Number Of Document	Percentage (%)
Naslund, J.A.	9	0.864
Bhan, A.	8	0.768
Khan, A.	8	0.768
Tugnawat, D.	8	0.768
Blake, H.	6	0.576
Patel, V.	6	0.576
Vogel-Heuser, B.	6	0.576
Granda, J.C.	5	0.480
Joshi, U.	5	0.480
Loch, F.	5	0.480

The figure indicates that J.A. Naslund has authored the highest number of documents; nine, A. Bhan, A. Khan, and D. Tugnawat follow closely, contributing eight documents each, reflecting their prominent role in shaping research discussions. The next cluster of authors, including H. Blake, V. Patel, and B. Vogel-Heuser, have published six documents each, emphasising their notable involvement in advancing the discourse on online training in the labour force. The distribution of authorship underscores a concentrated yet collaborative research landscape,

where a small group of highly active researchers has driven the development of this field. The dominance of these authors also implies their potential influence on shaping future research directions, methodologies, and applied practices in the domain of online workforce training. Their contributions likely encompass a variety of subtopics, including technological innovations, pedagogical frameworks, and workforce adaptation strategies.

Who Are the Top 10 Authors Based on Citation by Research?

Table 4: Citations of the Top 10 Authors

No.	Authors	Title	Year	Source Title	Cited By
1.	Alhamad et al. (2022)	The Effect of Electronic Human Resources Management on Organisational Health of Telecommunications Companies in Jordan	2022	International Journal of Data and Network Science	200
2.	Shaw et al. (2009)	The Impact of Information Richness on Information Security Awareness Training Effectiveness	2009	Computers and Education	196
3.	Buntrock et al. (2016)	Effect of a Web-Based Guided Self-Help Intervention for Prevention of Major Depression in Adults with Subthreshold Depression: A Randomised Clinical Trial	2016	JAMA - Journal of the American Medical Association	187
4.	Goff et al. (2017)	A Global Call from Five Countries to Collaborate in Antibiotic Stewardship: United We Succeed, Divided We Might Fail	2017	The Lancet Infectious Diseases	165
5.	Damiani et al. (2018)	Augmented and Virtual Reality Applications in Industrial Systems: A Qualitative Review Towards the Industry 4.0 Era	2018	[No source information available]	161
6.	Chen et al. (2021)	Role of Government to Enhance Digital Transformation in Small Service Business	2021	Sustainability (Switzerland)	140
7.	Swift & Hwang (2013)	The Impact of Affective and Cognitive Trust on Knowledge Sharing and Organisational Learning	2013	Learning Organization	129
8.	Amjad et al. (2021)	Effect of Green Human Resource Management Practices on Organisational Sustainability: The Mediating Role of Environmental and Employee Performance	2021	Environmental Science and Pollution Research	124
9.	Wan et al. (2012)	The Effects of Self-Regulated Learning Processes on E-Learning Outcomes in Organisational Settings	2012	Journal of Management Information Systems	124

No.	Authors	Title	Year	Source Title	Cited By
10	Dorrian et al. (2007)	Simulated Train Driving: Fatigue, Self-Awareness and Cognitive Disengagement	2007	Applied Ergonomics	114

The table highlights the top 10 most-cited articles, showcasing the prominent studies and their influence on the field. The most-cited article by Alhamad et al. (2022) in the International Journal of Data and Network Science has garnered 200 citations, indicating its recent yet substantial impact on academic and practical discussions about workforce training. This is followed closely by Shaw et al. (2009) publication in Computers and Education with 196 citations and Buntrock et al. (2016) article in the Journal of the American Medical Association (JAMA) with 187 citations. These figures suggest that while recent studies like Alhamad et al. (2022) are rapidly gaining traction, earlier foundational research, such as Shaw et al. (2009) and Dorrian et al. (2007), remained highly relevant. The presence of articles published in high-impact journals such as The Lancet (Goff et al. (2017), cited 165 times) and Sustainability (Chen et al. (2021), cited 140 times) highlighted the interdisciplinary nature of research in this field. Additionally, studies like Damiani et al.'s (2018) article on augmented technologies and Swift and Hwang's (2013) article on learning platforms underscored the role of technology-driven innovations in shaping the future of training methodologies. Overall, the citation patterns and journal diversity affirm the growing importance of online training for workforce development.

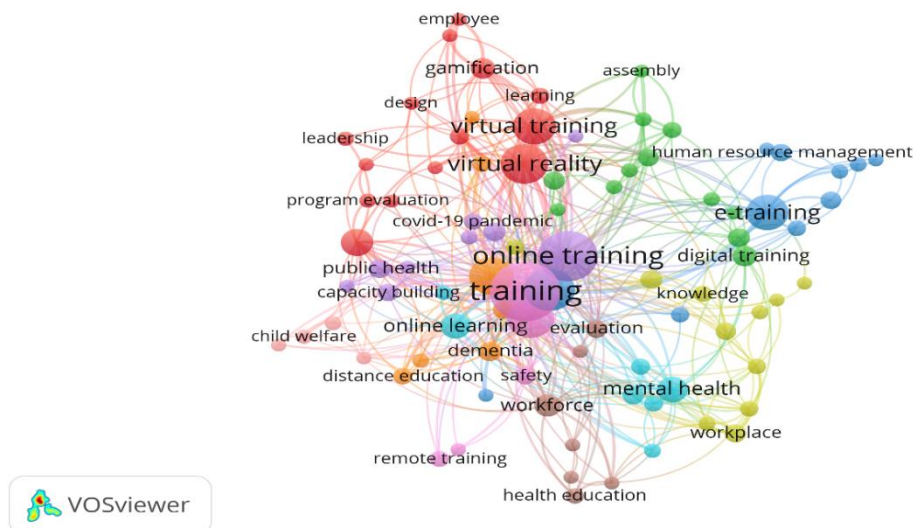***What are the Popular Keywords Related To The Study?***

Figure 3: Network Visualization Map of Keywords' Co-Occurrence

This figure explained the analysis of keywords related to online training for the labour force generated using VOSviewer software. Keyword, occurrences, and total link strength highlighted the frequency of keyword usage and the strength of their connections with other terms in the dataset. The results revealed key areas of focus in the research field, including technological innovations, mental health, and organisational practices. The keyword "training" stood out with the highest occurrences (124) and total link strength (174) , "online training" (86

occurrences, 68 link strength) and "e-learning" (60 occurrences, 57 link strength) demonstrated the centrality of digital and online modalities in workforce training discussions. Keywords like "virtual reality" (53 occurrences, 58 link strength), "gamification" (13 occurrences, 28 link strength), and "digital training" (13 occurrences, 13 link strength) pointed to innovative approaches being employed in online training. The prominence of "industry 4.0" (nine occurrences, 11 link strength) and "digital transformation" (six occurrences, five-link strength) suggested a growing interest in aligning training methodologies with modern technological advancements. Furthermore, "simulation" (eight occurrences, 16 link strength) reflected the role of realistic virtual environments in skill development and training effectiveness. Another critical theme emerging from the data is the intersection of training with mental health and well-being. Keywords like "mental health" (21 occurrences, 42 link strength), "burnout" (seven occurrences, 18 link strength), and "stress" (seven occurrences, 21 link strength) indicated a strong research focus on the psychological impacts of training, particularly in workplace settings. The inclusion of "workforce development" (23 occurrences, 32 link strength) and "workplace" (10 occurrences, 21 link strength) highlighted the relevance of training in fostering professional growth while addressing challenges like retention, motivation, and organisational commitment. These findings suggested an interdisciplinary approach in the field, combining elements of technology, psychology, and organisational development to create more comprehensive and impactful training programs for the labour force. Overall, the network visualisation map provides a valuable overview of the research landscape on online learning.

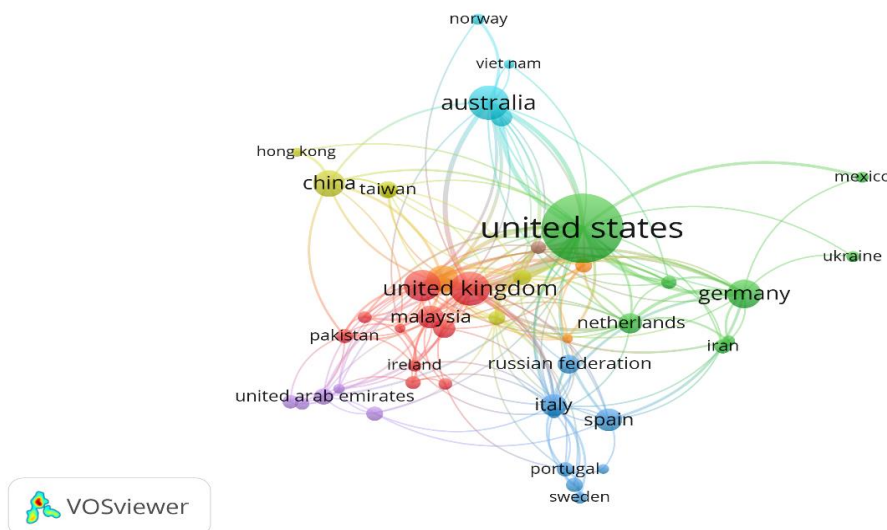*What are Co-Authorship Countries' Collaboration?*

Figure 4: Countries Whose Authors Collaborate on the Publications of Online Training Articles

This figure presented bibliometric data on country-level co-authorship collaborations related to online training for the labour force. The United States led the dataset with 347 documents, 3,362 citations, and the highest total link strength (116), reflecting its dominant role in fostering collaborations in this field. The United Kingdom followed with 75 documents, 691 citations, and a total link strength of 79, highlighting its extensive international connections. Other notable contributors include Australia, Canada, and Germany, which demonstrated high levels of research activity and citations, indicating significant contributions to the global discourse on

online training. The data also revealed emerging research hubs such as India (63 documents, 311 citations, 46 link strength), China (46 documents, 530 citations, 17 link strength), and South Korea (21 documents, 220 citations, 12 link strength) that reflect increasing engagement from Asian nations in the field. India's high total link strength suggested active collaboration with other countries. Similarly, Brazil and South Africa, despite their relatively lower number of documents, exhibited active collaboration within their respective regions and beyond. Collaboration patterns, as indicated by total link strength, highlighted the importance of international partnerships in advancing the field. Countries with moderate output, such as Switzerland (15 documents, 102 citations, 33 link strength) and the Netherlands (25 documents, 377 citations, 28 link strength), demonstrated significant global collaborations relative to their output. This suggested that smaller nations with focused research agendas can have a disproportionate impact through strategic partnerships. Additionally, regions like the Middle East (e.g., the United Arab Emirates with 16 documents, 242 citations, 15 link strength) and Africa (e.g., Nigeria with 10 documents, 38 citations, 15 link strength) reflected growing involvement in online training research. Overall, the data emphasised the global nature of research on online training for the labour force, with a mix of established leaders and emerging contributors actively shaping the field through collaborative efforts.

Conclusion

The analysis of research trends in online training reveals a significant evolution over the past two decades. Initially, the gradual growth in publications from 2004 to 2014 suggested a steady but relatively modest focus on digital training, reflecting the early stages of its adoption in workforce development. However, the marked increase beginning in 2015 underscores the growing recognition of online training's critical role, driven by technological advancements and the broader adoption of e-learning platforms. The sharp surge in publications from 2018 to 2022 aligns with the global shift to remote solutions during the COVID-19 pandemic, highlighting the necessity of virtual training. The authorship and citation analysis further highlight the field's diversity. The most prolific contributors have produced innovative work, while highly cited articles reveal a mix of enduring and emergent research priorities. Citations of studies published in prestigious journals such as The Lancet and JAMA illustrate the interdisciplinary significance of online training. These patterns demonstrate the field's responsiveness to evolving workforce demands, technological advancements, and global challenges.

The analysis of keyword occurrences and co-authorship collaborations in research on online training for the labour force highlights distinct trends. Keywords such as "training," "e-learning," and "online training" underscore the centrality of digital modalities in workforce development. In contrast, terms like "virtual reality," "gamification," and "digital transformation" reflect the increasing emphasis on innovative, technology-driven approaches. The focus on mental health, as evident in terms such as "stress" and "burnout," points to an interdisciplinary approach that integrates psychological and organisational considerations with training methodologies. Country-level co-authorship collaborations further emphasise the global scope of research in this field. Nations like the United States and the United Kingdom lead in research output and international partnerships, showcasing their central role in shaping discourse and innovation. Emerging contributors, including India, China, and South Korea, signal increasing engagement from diverse regions. At the same time, smaller countries such as Switzerland and the Netherlands demonstrate the potential for high impact through strategic collaborations. The participation of regions like Africa and the Middle East highlights the

expanding global interest in online training. These patterns affirm the interconnected nature of research on online training, driven by shared challenges and opportunities in workforce development worldwide.

In conclusion, the comprehensive analysis underscores the dynamic evolution, interdisciplinary significance, and global scope of online training research, highlighting its pivotal role in addressing workforce development through technological innovation and collaborative advancements.

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Conflicts of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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