

Scientific Productivity and Collaboration Networks in Lifelong Learning: A Longitudinal Bibliometric Analysis (1963-2022)

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ABSTRACT

In the post-pandemic era, lifelong learning (LLL) emerged as the key to professional development and the core competency of all disciplines. Even globally, there is a dearth of evidence based bibliometric analysis, notably on LLL. This study addresses this gap by examining the data retrieved from the Elsevier Scopus database. A systematic search method was adopted to retrieve 1806 publications from 790 journals from 1963 to 2022. The R package, Biblioshiny, was used for data analysis, including productivity/performance analysis, citation analysis, and collaboration network analysis of social structure. The findings showed that the number of publications has significantly increased over time. A large number of studies were published in 2022. Overall, 85 countries contributed to LLL. Among them, the United States was the most productive with 787 publications, and the United Kingdom was the country with 4731 citations. Learning was the trending topic, and skill development was an emerging theme in LLL. The results will aid the stakeholders in identifying largely unexplored areas of research that need more attention and funding. This study outlines not only the current scientific developments but also the potential future of LLL research. This study will also be used as a resource for researchers and teachers in LLL. Future research directions in this area of knowledge are also outlined.

Keywords: Lifelong Education, Teacher Education, Heutagogy, Skill Development, Scopus Database, R Biblioshiny, PRISMA, Scientometrics.

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INTRODUCTION

Lifelong Learning (LLL) is more than any type of education, which includes formal, non-formal, and informal learning. LLL can enhance the research activities of an institution that is successfully placed in the global ranking. LLL attracts significant attention across all areas of individual, social, and professional life. The advancement of LLL and its integration into everyday life influences how people are exposed to knowledge, learning, decision-making, development, etc. In the post-pandemic era, the educational sector needs digital skills and training. As a result, LLL emerged as a great boon for teachers' professional updates and practices. The current epidemic has forced educational institutions to rely solely on online learning, bringing LLL to the forefront. With globalisation and digitization in education,

LLL has risen to prominence on the agendas of national and international organizations, as well as in national education policies.^[1] LLL is the key to development in many areas and aspects. The need for LLL is emphasised in the context of ongoing societal transformations, new challenges, the total digitalization of communicative interactions, and the automation of many kinds of professional work.^[2] LLL is essential for both personal and professional purposes, is a self-directed, voluntary process that lasts from birth until death.^[3]

Literature Review

Research and publication enhance not only the teaching-learning process but also advance researcher, teacher, institution, and country. Research is essential for growth in every nation's system of higher learning.^[4] The essential function of all disciplines of knowledge is research, which involves a range of intellectual activities.^[5] One of the evidence-based outcomes of research is a publication, and the outcomes of publications are bibliometric data. These secondary data in each field need to be systematically retrieved from a database and analyzed for guiding ongoing and



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future research. The use of bibliometrics is significantly extending to all disciplines.^[6] At the institutional, national, and international levels, bibliometrics is playing a greater role in the governance of research.^[7] Measurement of scientific research and its effects is a significant task that the domain's stakeholders perform regularly. Research assessment is an essential requirement when it comes to financing, ranking, image, and reputation of researchers and organizations.^[8] Collaboration and citation are vital in the world of research and publications. An individual's contribution to the body of knowledge is acknowledged through citation.^[9] For exploring and analyzing large volumes of scientific data, bibliometric analysis is a widely used and effective method.^[10] International collaboration networks that link the many stakeholders in the innovation process are becoming more important.^[11] PRISMA flow diagram summarizes the outcomes of the search and selection process, and the data base (s), and provides data inclusion and exclusion criteria based on the number of records found.^[12] This study makes use of the PRISMA inclusion and exclusion criteria flow diagram since it is a more systematic approach to data selection and specifies database(s) that is evidence-based in bibliometric and systematic literature reviews. The literature review additionally indicates the prevalence of LLL in various developmental dimensions and domains.

Lifelong Learning in Teacher Preparation

Teacher training will be insufficient if it concentrates just on technological abilities while ignoring the required attitudes for LLL.^[13] LLL is an important outcome of teacher education and training. As teacher preparation has a dynamic nature, the knowledge gained in teacher training will mostly not be enough in later professional life. LLL fulfils this gap and provides updates. Teachers in secondary and higher education face the challenge of maintaining their knowledge and skills as well as continuing professional development, which is referred to as LLL. LLL in higher education is one of the main strategies to enhance quality in teaching, research, and extension activities. LLL has recently evolved as an innovative learning technique aimed at satisfying individuals' demand for continuous and unlimited learning.^[14]

Lifelong Learning in Job Markets

In order to assure a sustainable and evolved society in the 21st-century industrial setup, individuals are desirous to obtain a worldwide kind of learning as they prefer to follow the notion of "earning while learning".^[15] LLL must be envisioned as a stepping stone toward creating a progressive and knowledge-based society. Because it promises to improve and assure continued employability, LLL has attracted the attention of major research fields across the world. However, the significance of higher education institutions as learning organisations in developing LLL attitudes among young people has received little attention.^[16] LLL has several advantages, including economic development

and personal fulfillment.^[17] LLL is essential for professionals^[18] to achieve job satisfaction.^[19]

Lifelong Learning in Skill Development

LLL has been viewed historically through a Eurocentric lens, with a heavy emphasis on skill development for knowledge-based economies and society.^[20] LLL allows professionals to keep their skills up to date to meet the difficulties of their changing work contexts. Innovative skills are needed in the context of the knowledge-based economy, and they will be enhanced with LLL. Rapid technological advancement causes abilities to deteriorate more quickly than in the past, while new technologies create skill gaps in employees and require the acquisition of necessary skills and LLL.^[21] Individual and national economic progress is facilitated by skill development. India has the benefit of having a larger young population ranging in age from 25 to 40 years, but there is a significant increase in the number of people with high technical and employable skills. Skill development is not a one-time activity, and it has to be a constant effort to upgrade oneself to the current advancement in technology.^[22] Nowadays, focusing on individual progress and everyday living necessitates the concept of LLL.^[23] The rapid speed of change requires continual skilling and reskilling through LLL.^[24]

Lifelong Learning in Professional Development

LLL advances a person's development, an institution's growth, society's welfare, and a country's progress. Learning is a component of human personal and professional growth that takes place throughout life in a range of informal and formal settings.^[25] LLL is important for advancing educational objectives and professional growth.^[26] LLL strengthens professional practice worldwide. It enables a professional to stay relevant by learning new skills. LLL attracts the attention of numerous professionals, as this is the key reason for their development. The ability to engage in LLL is critical not just for individual achievement, but also for the long-term survival of businesses, economic sectors, and entire regions/destinations.^[27] LLL is connected to quality assurance, competency, and professionalism.^[28] LLL is seen as an essential foundational competence.^[29] LLL is the capacity to expand one's knowledge and abilities in social, personal, and professional settings.^[30] An LLL mentality is an approach to work that is marked by interest, creative planning, and perseverance.^[31]

Research Gap

From the Scopus database, which is interdisciplinary in nature,^[32] the researchers found only two papers in LLL research with bibliometric data findings. In 2021, Do *et al.*, published a paper, "Research on lifelong learning in Southeast Asia: A bibliometrics review between 1972 and 2019," with bibliometric analysis only on the publication productivity of Southeast Asia in LLL.^[33] Nylander *et al.*, in 2022, published a bibliometric-oriented article in which they found the main themes that have been prevalent within the

"*International Journal of Lifelong Education*".^[34] There is a research gap of evidence-based bibliometric analysis, particularly on LLL, in the global scenario. This study aims to address this gap by examining the productive authors, sources, highly cited documents, trend topic, theme evaluation, country production, country citation, and corresponding author's country. It will also aid in the identification of the social structure of collaboration networks among authors, institutions, and countries related to LLL at the global level.

Study Objectives

Specifically, this study addresses the research objectives listed below.

1. To perform productivity/performance analysis to figure out the annual scientific production, author productivity (Lotka's law), the top productive authors, sources, trending topics, thematic evaluation, the corresponding author's country, and country production in LLL research.
2. To conduct citation analysis to identify the number of citations received by countries and the top 20 cited documents in LLL research.
3. To undertake collaboration network analysis of social structure in LLL research to find out the authors' collaboration network, institutions' collaboration network, and countries' collaboration network.

METHODOLOGY

In this study, bibliometric analysis which is more systematic and quantitative was employed by using R Biblioshiny.^[32] The steps of the approach were as follows: First, "lifelong learning" and "lifelong education" were searched as keywords in the Scopus database. The articles published in LLL between 1963 and 2022 have bibliometric data that was retrieved. Second, the data were chosen based on inclusion and exclusion standards. Third, the scientific production of the data was examined using bibliometric analysis. Utilizing productivity/performance analysis, citation analysis, and collaborative network analysis, these data were then visualized through R Biblioshiny,^[35] Datawrapper, and Microsoft Excel, Microsoft Word used for the presentation of data in tables.

Data Selection (Exclusion and Inclusion Criteria)

To identify the articles related to LLL, a systematic search in the Scopus database ^[36,37] was used on the 1st of January 2023. TITLE ("Lifelong Learning" OR "Lifelong Education") was used as the string to search for documents with "Lifelong Learning" or "Lifelong Education" as the title word. The criteria used to search the articles published in LLL include document type, source type, and language TITLE ("Lifelong Learning" OR "Lifelong Education") AND (LIMIT-TO (LANGUAGE, "English")) AND

(LIMIT-TO (SRCTYPE, "j")) AND (EXCLUDE (PUBYEAR, 2023)) AND (EXCLUDE (DOCTYPE, "er")) AND (LIMIT-TO (DOCTYPE, "ar")) OR LIMIT-TO (DOCTYPE, "ed") OR LIMIT-TO (DOCTYPE, "re") OR LIMIT-TO (DOCTYPE, "cp")). After the initial search, 2074 records were found, among them, 268 records were excluded, and 1806 articles were found eligible for further consideration. The information was downloaded in CSV format. The reasons for exclusion include the missing abstract, source, and author information. A final list of 1806 records was identified and finally used for further analysis, as shown in Figure 1.

Main Information of the Dataset

As presented in Table 1, A total of 3408 authors contributed 1806 documents with a total of 60631 references, related to LLL research from 790 Scopus-indexed journals, including articles, conference papers, editorials, and review papers published from 1963 to 2022, which spread around six decades. The average number of authors per article was 1.88, and only a total of 658 articles were published by single authors, indicating that multi-authorship is common in LLL research.

RESULTS AND FINDINGS

Scientific Productivity

Examining the annual research production in any field is essential to know the growth of the field. As shown in Figure 2, the number of publications in LLL research had increased dramatically from 1 in 1963 to 123 in 2022, with an average annual growth rate of 9.9 per cent and 12.14 average citations per document, suggesting high potential for publication growth and citation.

Highly Productive Authors

Identifying the most productive authors is an important objective when measuring a field's scientific output. Table 2 shows the top authors who have published the more number of articles in LLL. The authors in the table are grouped by publication count, gender, institution, discipline, and geographic origin. The gender of authors is determined by the institutions where they work. Richard Edwards tops the list of most prolific authors with 15 publications, followed by John Holford with 13, Marcella Milana with 12, Stephen Gorard with 11, and Shibo Guo with 11. With a total of 104 documents, the top author's publication count ranges between 7 and 15, with 95 by male authors and 9 by a female author. The gender analysis of the top authors indicated that majority were male with 9 authors and only one female author from Australia. Authors' country affiliations showed that five of the top ten authors are from the United Kingdom followed by two from Canada, Germany, Italy and Canada have one author each. The disciplines of the top authors are organized as follows: eight are from the school/department of education, one is from LLL, and another one is from human science.

Author's Productivity (Lotka's Law)

The frequency distribution of scientific productivity was analyzed using Lotka's law. Table 3 presents the total number of contributing authors, which was 3408. Richard Edwards is the most prolific author, with 15 articles, followed by John Holford with 13 articles, Marcella Milana with 12 articles, and Stephen Gorard and Shibao Guo with 11 each. From the remaining, Stephen Roche, Richard Waller, and Sue Webb with 9 articles each; Steven Hodge with 8 articles; John Field, Patricia A. Gouthro, and Susan Jackson with 7 articles each; 7 authors published 6 articles each; 18 authors published 5 articles each; 27 authors published 4 articles each; 50

authors published 3 articles each; 272 authors published 2 articles each; and a total of 3022 authors published 1 article each.

Highly Productive Sources

Analysis of source production helps researchers in the area keep up to date with their research. The analysis revealed that LLL publications were supported by 790 journals. Table 4 lists the name of the sources (journals), their publication count, total citations received, Citescore (2021), the publishers, and the country from which they are published. The top 20 sources for LLL publications are ranked, with The International Journal of Lifelong Education at the top. It covers 3205 citations and 232

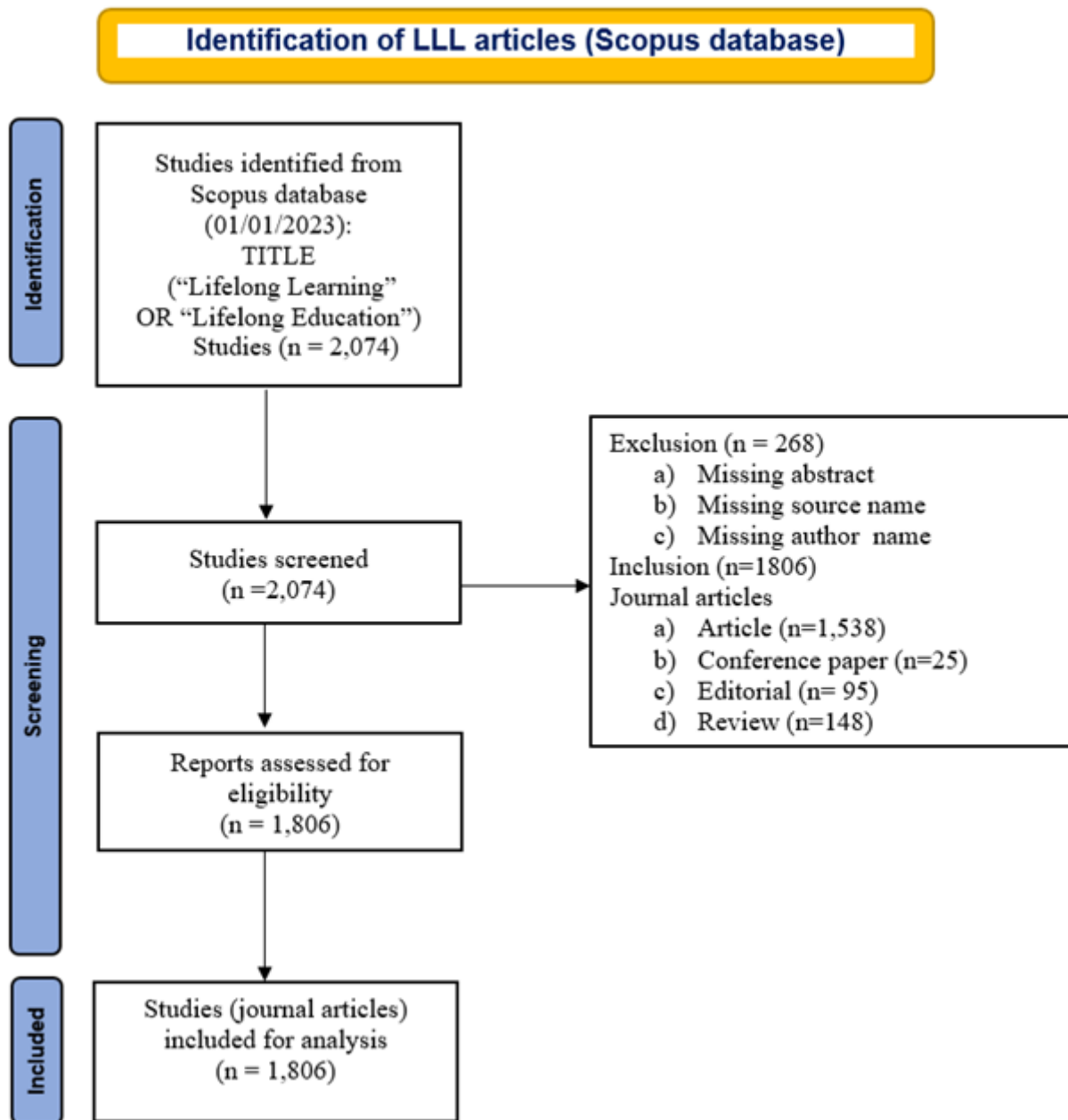


Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA-2020) flow diagram detailing steps in the exclusion and inclusion criteria of Scopus data.

Table 1: Main Information of the LLL Bibliometric Dataset.

Main Information About LLL Data	
Timespan	1963:2022
Sources (Journals)	790
Documents	1806
Average years from publication	12.4
Average citations per document	12.14
Average citations per year per doc	1.108
References	60631
DOCUMENT TYPES	
Article	1538
Conference paper	25
Editorial	95
Review	148
DOCUMENT CONTENTS	
Keywords Plus (ID)	2459
Author's Keywords (DE)	2966
AUTHORS	
Authors	3408
Author Appearances	4074
Authors of single-authored documents	658
Authors of multi-authored documents	2750
AUTHORS COLLABORATION	
Single-authored documents	795
Documents per Author	0.531
Authors per Document	1.88
Co-Authors per Documents	2.25
Collaboration Index	2.71

documents. The United Kingdom tops the list of countries with 13 journals. The British Journal of Educational Technology tops the Citescor (2021) list with a score of 9.6, while Taylor and Francis are ranked first among publishers with nine journals.

Eight publishers actively participated in LLL research, according to the grouping of the top 20 sources as reported by the publications. The list of eight publishers is headed by Taylor and Francis with nine journals, followed by Wiley-Blackwell with three, Springer Nature with two, SAGE with two, the Multidisciplinary Digital Publishing Institute (MDPI) with one, Inderscience Publishers with one, Adult Learning Australia with one, and Kamla-Raj Enterprises with one.

Countries' Production

The stakeholders use a country's scientific productivity in any subject as a guide for evaluating the country's gap in that field. An analysis of the global contribution to LLL research was conducted, and the contributions of each country were

measured and colour-coded on a map of the world as a bubble; the bigger the bubble size, the higher the frequency as visualized in Figure 3. The publication in this field includes contribution from a total of 85 countries and regions. With 787 publications, the United States leads the world in productivity. The United Kingdom comes in second with 650, followed by Canada with 226 publications, China with 198, Australia with 162, Germany with 152, Spain with 131, the Netherlands with 114, and Turkey with 110. The countries with fewer than 100 publications include Malaysia with 90, South Korea with 66, Italy, and Thailand with 65 each. These countries are followed by Ukraine with 59, Greece with 54, Portugal, and Sweden with 50 publications each, as well as Austria with 43, South Africa with 38, and India ranked 20th in productivity with 35 publications.

Countries' Citation

In every scientific publication, a citation is an acknowledgement that records the progress of an author, a source, a country, etc. On a world map, the measurement of the number of citations obtained by each country was analyzed and colour-coded as visualized in Figure 4. The United Kingdom is the most cited nation with 4731 citations, followed by the United States with 3064, Germany with 1638, and Canada with 1169. These are the top five countries with more than 1000 citations. The countries that received more than 100 citations include Australia with 965; the Netherlands with 733; Belgium with 503; China with 476; Spain with 425; Sweden with 298; Austria with 256; Turkey with 252; Italy with 219; Hong Kong with 187; Denmark with 174; Japan with 165; Georgia with 129; Singapore with 128; Korea with 116; and South Africa with 102 citations.

Trending Topics

Trending topic analysis as per Author's Keywords, as in Figure 5, informs researchers about current research gaps as well as gaps that have already been addressed in a given area. The trend topic analysis of the documents indicates that learning is the prime concern of authors in all years of LLL publications. The thrust area of publication in 2006 was concerned with distance learning, followed by constructivism and teaching in 2007; educational policy and research in 2008; qualifications in 2009; pedagogy, agency, globalization, public libraries, and vocational training in 2010; employment, social inclusion, sustainable development, the United Kingdom, and knowledge economy in 2011; curriculum, innovation, workplace learning, e-learning, and learning in 2012; reliability, teachers, policy, information literacy, and education in 2013; informal learning, teacher training, policy, the European Union, and adult learning in 2014; distance education, discourse analysis, life-long learning, self-regulated learning, and motivation in 2015; skills, human capital, professional development, continuing education, and lifelong learning in 2016; China, medical education, older adults, higher education, and adult education in 2017; Africa, self-efficacy, teacher education,

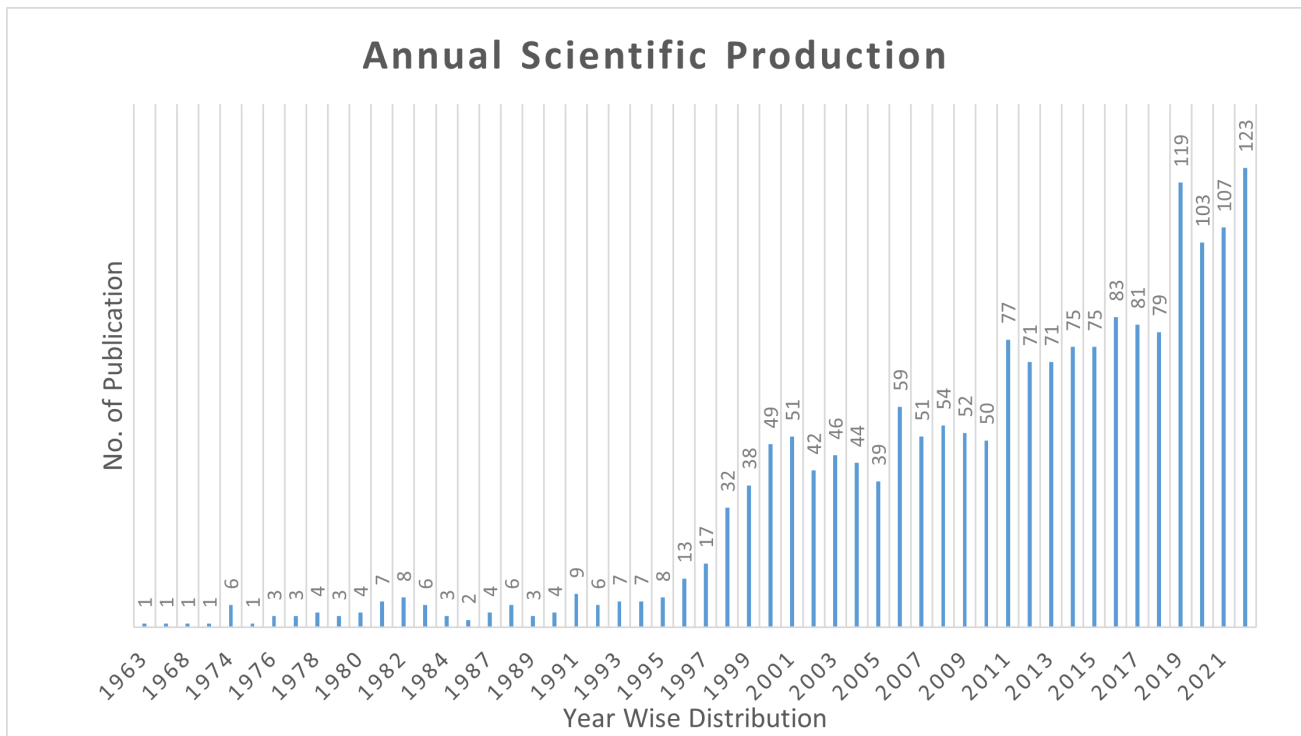


Figure 2: Annual Scientific Productivity of LLL Research, 1963-2022.

Table 2: Top 10 Productive Authors.

Rank	Author Name	Publication	Gender	Affiliation	Department/ Specialization	Country
1	Richard Edwards	15	Male	University of Stirling	School of Education	United Kingdom
2	John Holford	13	Male	University of Nottingham	School of Education	United Kingdom
3	Marcella Milana	12	Male	University of Verona	Department of Human Sciences	Italy
4	Stephen Gorard	11	Male	University of York	Department of Educational Studies	United Kingdom
5	Shibao Guo	11	Male	University of Calgary	School of Education	Canada
6	Stephen Roche	9	Male	UNESCO Institute for Lifelong Learning	Lifelong Learning	Germany
7	Richard Waller	9	Male	University of the West of England	Department of Education	United Kingdom
8	Sue Webb	9	Female	Monash University	School of Education Culture and Society	Australia
9	Steven Hodge	8	Male	Griffith University	School of Education and Professional Studies	Australia
10	John Field	7	Male	University of Stirling	School of Education	United Kingdom

continuing professional development, and lifelong education in 2018; critical thinking, vulnerability, gender, employability, and self-directed learning in 2019; digital literacy, heutagogy, lifelong learning tendency, young adults, and catastrophic forgetting in 2020; COVID-19, deep learning, learning analytics, and online learning in 2021.

Globally Highly Cited Documents

Highly cited papers serve as role models for scholars interested in learning about the developments in their fields of study. The highly cited documents in LLL as per the Scopus database are presented in Table 5. Among the total 10 articles, 6 articles are

Table 3: Author's Productivity.

Documents written	No. of Authors	Proportion of Authors
1	3022	0.887
2	272	0.08
3	50	0.015
4	27	0.008
5	18	0.005
6	7	0.002
7	3	0.001
8	1	0
9	3	0.001
11	2	0.001
12	1	0
13	1	0
15	1	0
Total No. of Authors: 3408		

single-authored, 3 are multi-authored and 1 is double authored document.

The first among the top cited papers, is “*Continual Lifelong Learning with Neural Networks: A Review*,”^[38] a five-authored paper with country collaboration from Germany, the United States, and the United Kingdom. The article describes how animals and humans both have the capacity for lifelong learning, which is supported by a wide variety of neurocognitive processes.

The second is the single-authored paper from the United Kingdom, “*The Design of Personal Mobile Technologies for Lifelong Learning*,”^[39] The author presents a theory of technology-mediated lifelong learning.

The third, “*Heutagogy and Lifelong Learning: A Review of Heutagogical Practice and Self-Determined Learning*,”^[40] is a single-authored paper from the United States. The author offers a framework for debate and investigation into heutagogy, which is a type of self-directed learning that is based on andragogy's practices and ideas.

The fourth, “*The Concept of Intelligence and Its Role in Lifelong Learning and Success*,”^[41] is a single-authored paper from the United States. The notion of intelligence put forth in this article includes the cognitive skills required for environmental adaptation, context selection, and context moulding. The definition's applicability to comprehending contemporary ideas, intelligence testing, and the function of intelligence in lifelong learning is examined.

The fifth, “*The Myth of Cognitive Decline: Non-Linear Dynamics of Lifelong Learning*,”^[42] is a five-authored paper from Germany. According to the authors, as experience increases, memory search needs to change, which is reflected in how older people

function. A set of simulations demonstrates how learning models spontaneously develop as people learn, leading to the performance patterns seen throughout adulthood. The models accurately pinpoint higher diversity in older persons' cognitive abilities and anticipate that older adults will exhibit greater sensitivity to subtle variations in the characteristics of test stimuli than younger adults.

The sixth paper, “*Education, Lifelong Learning, Inequality, and Financial Access: Evidence from African Countries*,”^[43] is a single-authored paper from Belgium. In 48 African countries between 1996 and 2014, this author looked at how financial access impacts how far education and lifetime learning may reduce inequality. The three educational indicators are enrollment in primary school, secondary school, and tertiary school.

The seventh paper, “*Behavioural Intention, User Behaviour and the Acceptance of Electronic Learning Systems: Differences between Higher Education and Lifelong Learning*,”^[44] is a three-authored paper from Spain. To investigate the aspects influencing the acceptability of e-learning systems, the authors suggest a TAM3-based model with the addition of two further variables: personal innovativeness in the field of information technology and perceived interaction. To accomplish this, higher education and lifelong learning in two different contexts were taken into consideration.

The eighth paper, “*Education Techniques for Lifelong Learning*,”^[45] is a single-authored paper from the United States. The author contends that research on adult education supports the argument that instructing adults requires a different strategy than instructing kids and teenagers (pre-adults). Teachers may improve their facilitation skills by having a better understanding of adult learning principles.

The ninth paper, “*Self-assessment in Lifelong Learning and Improving Performance in Practice*,”^[46] is a two-authored paper from the United States. The authors asserted that professionalism, which necessitates lifelong learning and results in increased performance in practice, is a key element of medical competence.

The tenth, “*Towards Process-oriented Teaching for Self-directed Lifelong Learning: A multidimensional perspective*,”^[47] is a single-authored paper from the Netherlands. The author presents the idea that learning throughout life requires self-direction. As a result, process-oriented education, which attempts to promote self-directed lifelong learning, requires a wide-ranging and multifaceted theoretical foundation.

Corresponding Author's Country

Figure 6 exhibits the corresponding author's country with Single-Country Publications (SCP) and Multiple-Country Publications (MCP). The top five countries overall are the United Kingdom with 250 SCP and 19 MCP, followed by the United States with 225 SCP and 16 MCP, Canada with 72 SCP and 6

Table 4: Top 20 Productive Sources.

Rank	Source	Publication	Citation	Publisher	CiteScore (2021)	Country
1	International Journal of Lifelong Education	232	3205	Taylor and Francis	1.5	The United Kingdom
2	International Review of Education	76	576	Springer Nature	3.6	The Netherlands
3	Studies in the Education of Adults	26	419	Taylor and Francis	1.4	The United Kingdom
4	British Journal of Educational Technology	22	615	Wiley-Blackwell	9.6	The United Kingdom
5	Research in Post-Compulsory Education	22	91	Taylor and Francis	1.0	The United Kingdom
6	Adult Education Quarterly	18	384	SAGE	2.7	The United Kingdom
7	Educational Gerontology	18	263	Taylor and Francis	1.9	The United Kingdom
8	European Journal of Education	17	337	Wiley-Blackwell	2.8	The United Kingdom
9	Sustainability (Switzerland)	17	131	MDPI	5.0	Switzerland
10	Studies in Continuing Education	16	270	Taylor and Francis	3.2	The United Kingdom
11	Journal of Education Policy	15	558	Taylor and Francis	6.0	The United Kingdom
12	Australian Journal of Adult Learning	13	45	Adult Learning Australia	1.3	Australia
13	Compare	13	336	Taylor and Francis	3.5	The United Kingdom
14	Journal of Continuing Higher Education	12	33	Taylor and Francis.	1.3	The United States
15	Anthropologist	11	39	Kamla-Raj Enterprises	NA (discontinued)	India
16	Comparative Education	11	264	Taylor and Francis	4.0	The United Kingdom
17	Asia Pacific Education Review	10	33	Springer Nature	2.8	The Netherlands
18	British Educational Research Journal	10	174	Wiley-Blackwell	3.5	The United Kingdom
19	International Journal of Continuing Engineering Education and Life-Long Learning	10	32	Inderscience Publishers	1.1	The United Kingdom
20	Journal of Adult and Continuing Education	10	25	SAGE	1.8	The United States

MCP, Australia with 47 SCP and 10 MCP, and China with 43 SCP and 11 MCP. Among the top 20, Turkey, South Africa, and India made intra-country collaborations and left inter-country collaborations.

Theme Evaluation

Theme evaluation serves as a road map for the researcher's current and future actions in any research. The conceptual

structure of theme evolution based on the author's co-word analysis generates clusters of keywords that are the themes. Figure 7 indicates the four quadrants, including the upper-right quadrant with self-directed learning, continuing education, workplace learning, and training as motor themes (important and well-developed). The lower-right quadrant with self-directed and regulated learning, teacher training, continuing professional development, information literacy, and e-learning as fundamental

Country Production - LLL Research (1963-2022)

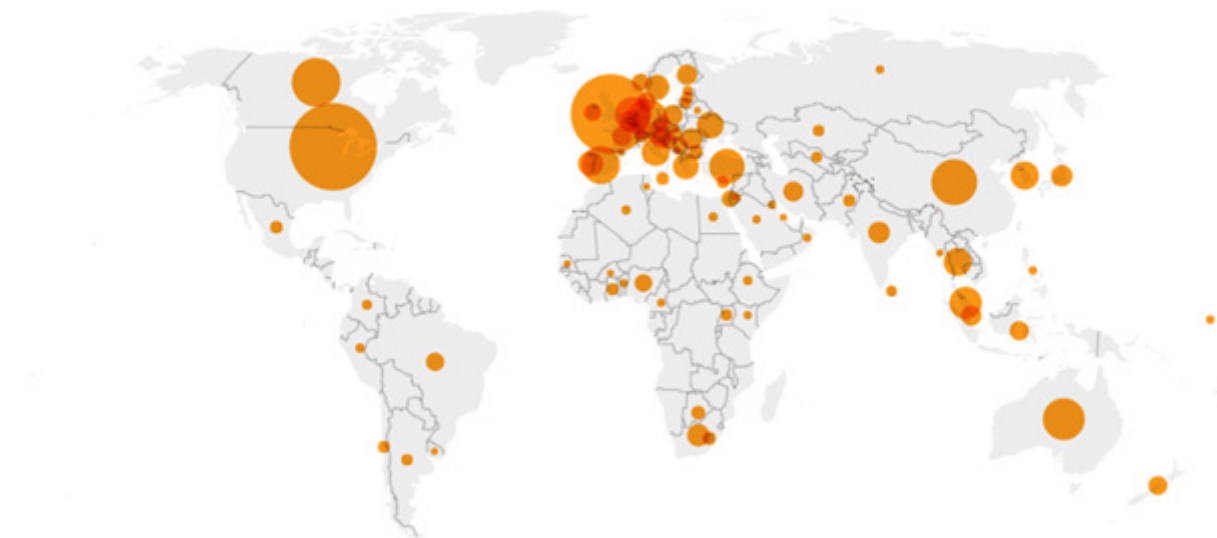


Figure 3: Countries' Productivity in LLL.

Country Citation-LLL Research (1963-2022)

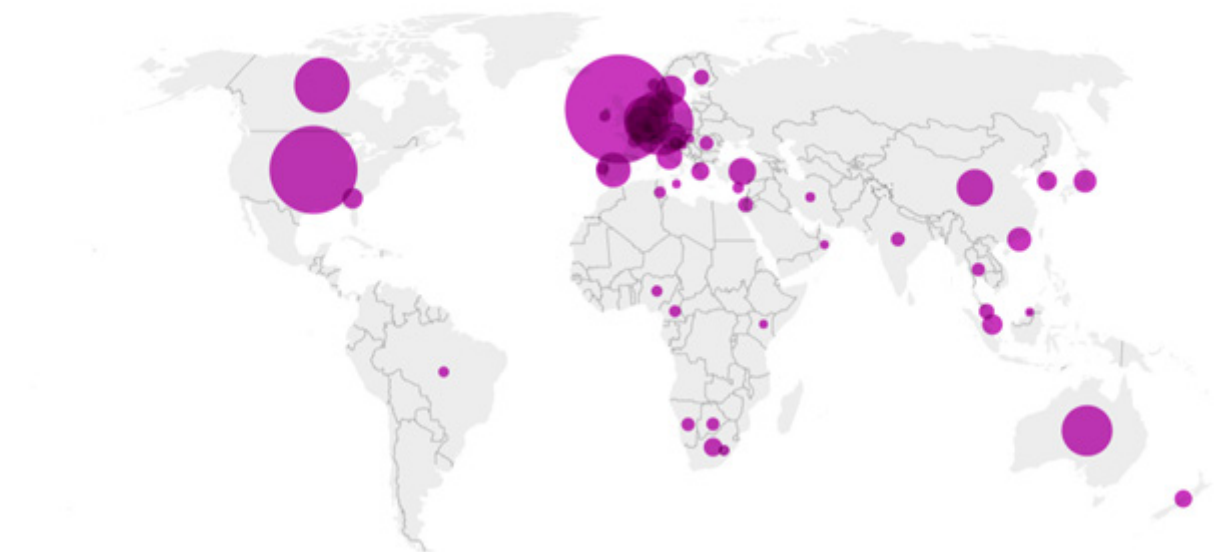


Figure 4: Countries' citations in LLL.

themes (highly developed). The lower-left quadrant with skill development as an emerging or declining theme (developing or marginal). Finally, the upper-left quadrant has lifelong education and older adults as niche themes (transversal).

Authors' Collaboration Network

Collaboration in research and publication is an essential key for advancement since it benefits authors, institutions, and countries as a whole in multiple ways. Figure 8 depicts author collaboration in article publishing as five coloured clusters. The first cluster includes Holford J, Milana M, Waller R, Webb S, and Hodge S; the

second cluster includes Finsterwald M, Schober B, Lüftenegger M, Spiel C, and Wagner P; the third cluster includes Goard S, Selwyn N, Rees G, and Fevre R; the fourth cluster includes Koper R and Tattersall C; and the fifth cluster includes Brady EM, Hansen RJ, Thaxton SP, and Knopf RC.

Institutions' Collaboration Network

The goal of universities around the globe is to produce new knowledge via departmental research endeavors.^[48] Institutions of higher learning act as centres of innovation and knowledge generation.^[49] In research on lifelong learning, collaboration is

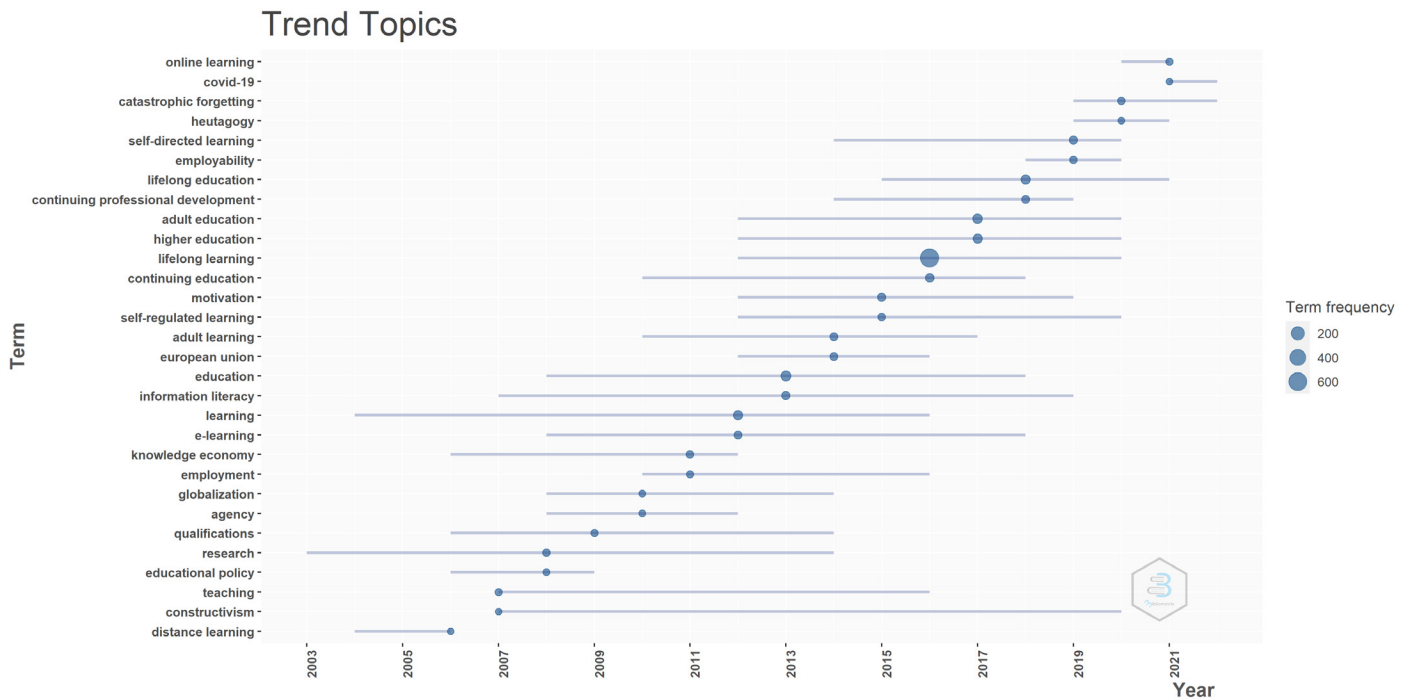


Figure 5: Trending Topics in LLL Research.

Table 5: Top 10 Cited Documents

Rank	First author and Year	Article Title	Scopus Citation	Journal	Volume and Issue No.
1	Parisi et al., (2019)	Continual Lifelong Learning with Neural Networks: A Review	829	Neural Networks	113
2	Sharples (2000)	The Design of Personal Mobile Technologies for Lifelong Learning	625	Computers and Education	34 (3-4)
3	Marie (2012)	Heutagogy and Lifelong Learning: A Review of Heutagogical Practice and Self-Determined Learning	347	International Review of Research in Open and Distance Learning	13(1)
4	Sternberg (1997)	The Concept of Intelligence and Its Role in Lifelong Learning and Success	217	American Psychologist	52 (10)
5	Ramscar et al., (2014)	The Myth of Cognitive Decline: Non-Linear Dynamics of Lifelong Learning	203	Topics in Cognitive Science	6(1)
6	Tchamyou (2020)	Education, Lifelong Learning, Inequality, and Financial Access: Evidence from African Countries	200	Contemporary Social Science	15(1)
7	Agudo-Peregrina et al., (2014)	Behavioural Intention, User Behaviour and the Acceptance of Electronic Learning Systems: Differences between Higher Education and Lifelong Learning	167	Computers in Human Behavior	34
8	Collins (2004)	Education Techniques for Lifelong Learning	159	Radiographics	24(5)
9	Duffy and Holmboe (2006)	Self-Assessment in Lifelong Learning and improving Performance in Practice	157	Jama	296 (9)
10	Bolhuis (2003)	Towards Process-Oriented Teaching for Self-Directed Lifelong Learning: A Multidimensional Perspective	151	Learning and Instruction	13 (3)

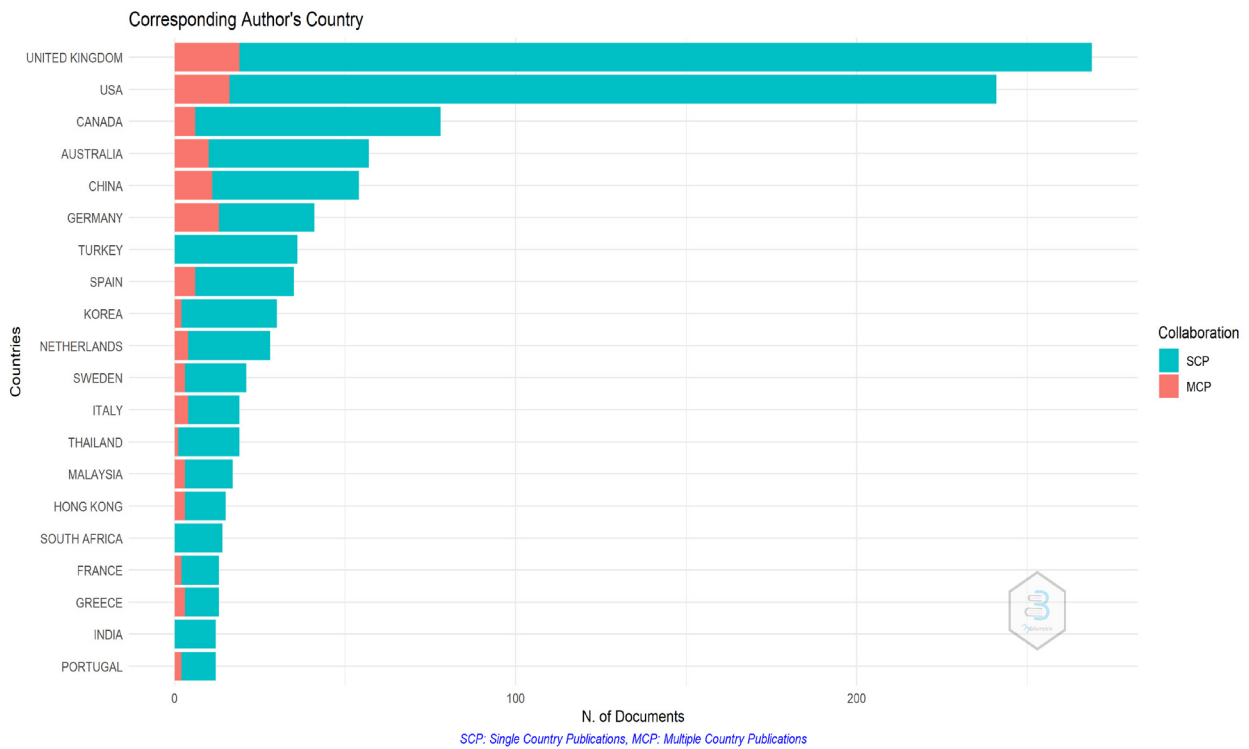


Figure 6: Corresponding Author's Country.

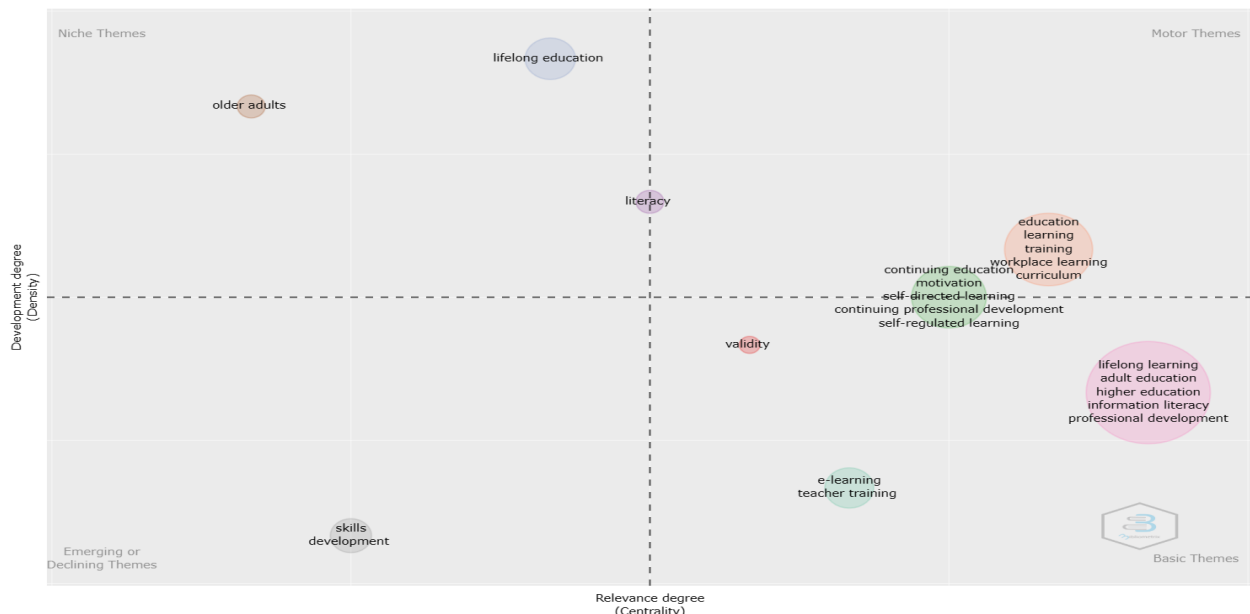


Figure 7: Conceptual Structure of Theme Evaluation.

crucial among higher education institutions. Publication productivity in the field of lifelong learning promotes the creation and dissemination of evidence-based knowledge as well as the development of collaboration networks that disseminate all forms of learning; formal, non-formal, and informal. Figure 9 depicts institutional collaboration in article publications as eight colour-coded clusters and twenty-one institutions. The first cluster includes the University of Vienna in Austria and Utrecht

University in the Netherlands. The second cluster includes the University of Toronto in Canada, the University Health Network in Canada, and York University in Canada. The third cluster, which has the strongest association among all clusters, includes the University of Nottingham in the United Kingdom, Griffith University in Australia, the University of Verona in Italy, Monash University in Australia, and the University of the West of England in the United Kingdom. The fourth cluster includes

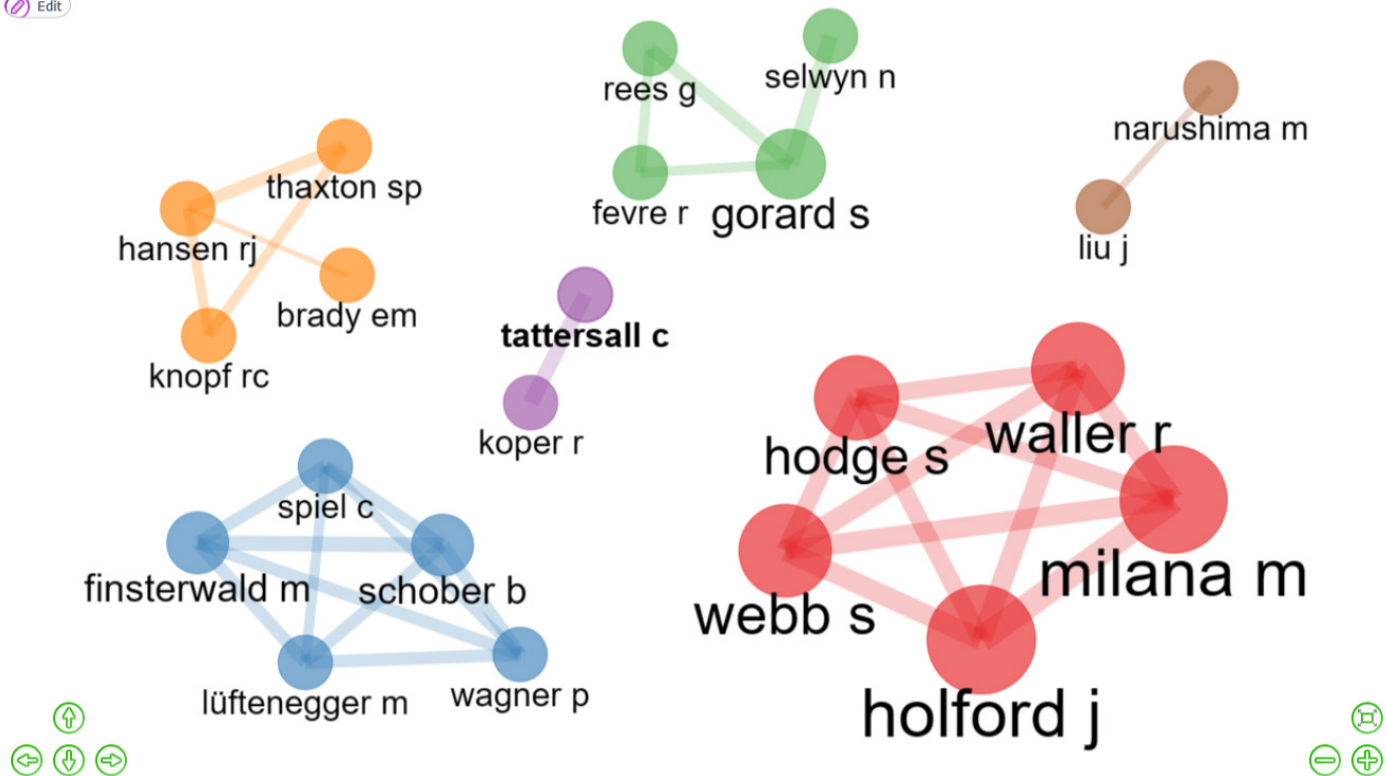


Figure 8: Social Structure of the Author's Collaboration Network.

the University of Huddersfield in the United Kingdom and the African Governance and Development Institute in Cameroon. The fifth cluster includes Northwestern University in the United States, Arizona State University in the United States, and Hobart and William Smith Colleges in the United States. The sixth cluster includes the National University of Singapore in Singapore and the University of Melbourne in Australia. The seventh cluster includes Aarhus University in Denmark and the University of Maribor in Slovenia. The eighth cluster includes the Bucharest University of Economic Studies in Romania and the University Politehnica of Bucharest in Romania.

Countries' Collaboration Network

Figure 10 visualizes the country collaboration map of the publication collaboration of authors from various countries. The top five collaborations are between the United States and Georgia, with 17 publications, followed by the United Kingdom and Australia with 14, Oman and Romania with 12, Niger and Nigeria, the United Kingdom and Germany, and the United Kingdom and Italy with 11 each. With 40 publications, the United Kingdom has the most country collaborations, followed by the United States with 33, Canada with 19, Germany with 18, and Spain with 13.

DISCUSSION

The annual production analysis spans the 59 years of LLL Publication, from 1963 to 2022. In terms of overall article production, journal articles outnumber review papers, editorials, and conference papers. Multi-author collaboration is more common than in single-authored documents in LLL. Multi-authored documents are four times higher than single authored documents. Publication increased from one to two digits in 1997 and from two to three digits in 2019. The year 2022 had the most papers, with 123 publications. It is anticipated that there will be a probable upward trend in the upcoming years.

The adult education paradigm's common entity and state accountability marked the movement for lifelong learning's turning point at the end of the 1960s in a new political, social, and economic reality. UNESCO has been instrumental in shaping and advancing the conversation on lifelong learning since the 1970s. The Delors Report in 1996, "*Learning: The treasure within*," where "lifelong education" was replaced with the term "lifelong learning," was the founding document of the learning society and emphasized the four pillars of education: learning to be, learning to know, learning to do, and learning to live together. The Faure Report, "*Learning to be*," published in 1972, was a seminal work in LLL research.

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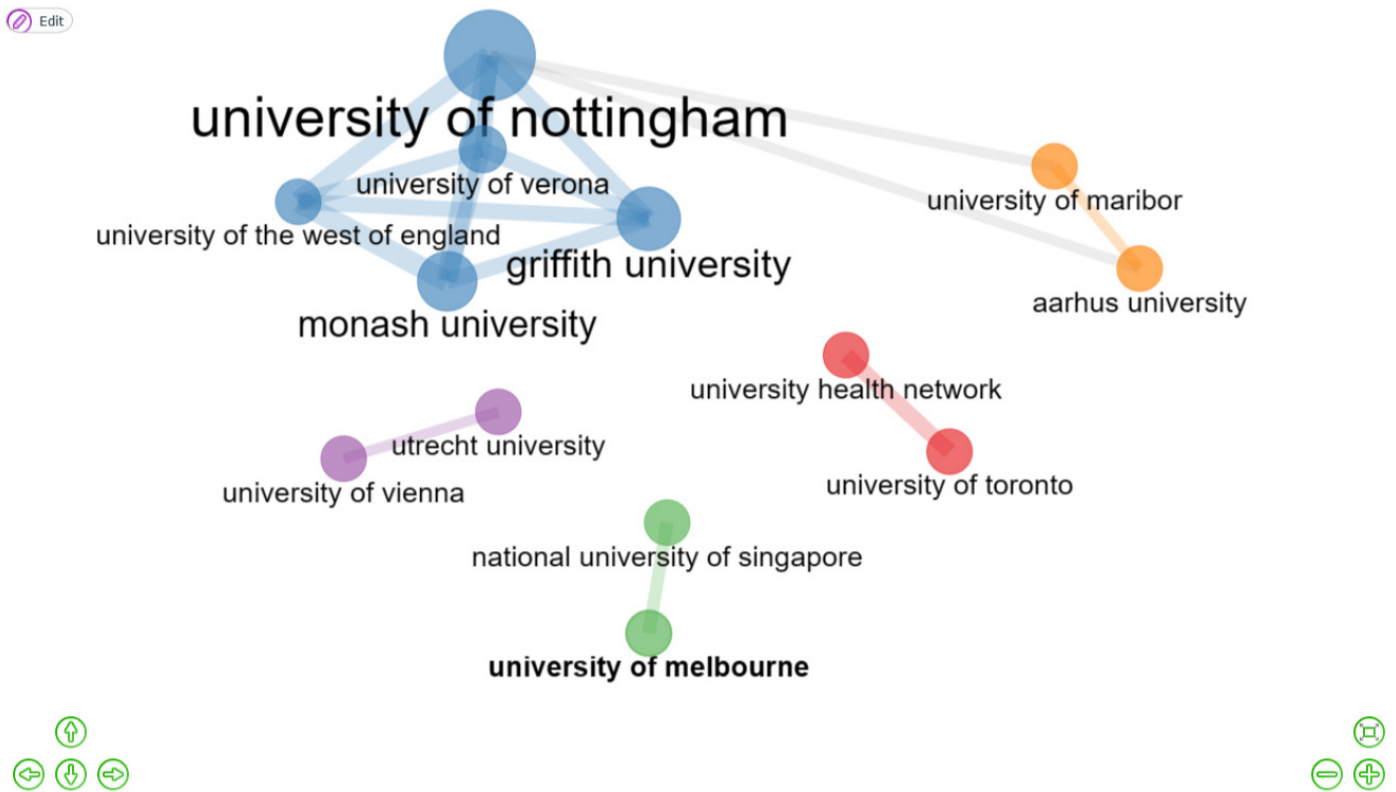


Figure 9: Social Structure of the Institutions' Collaboration Network.

Country Collaboration Map

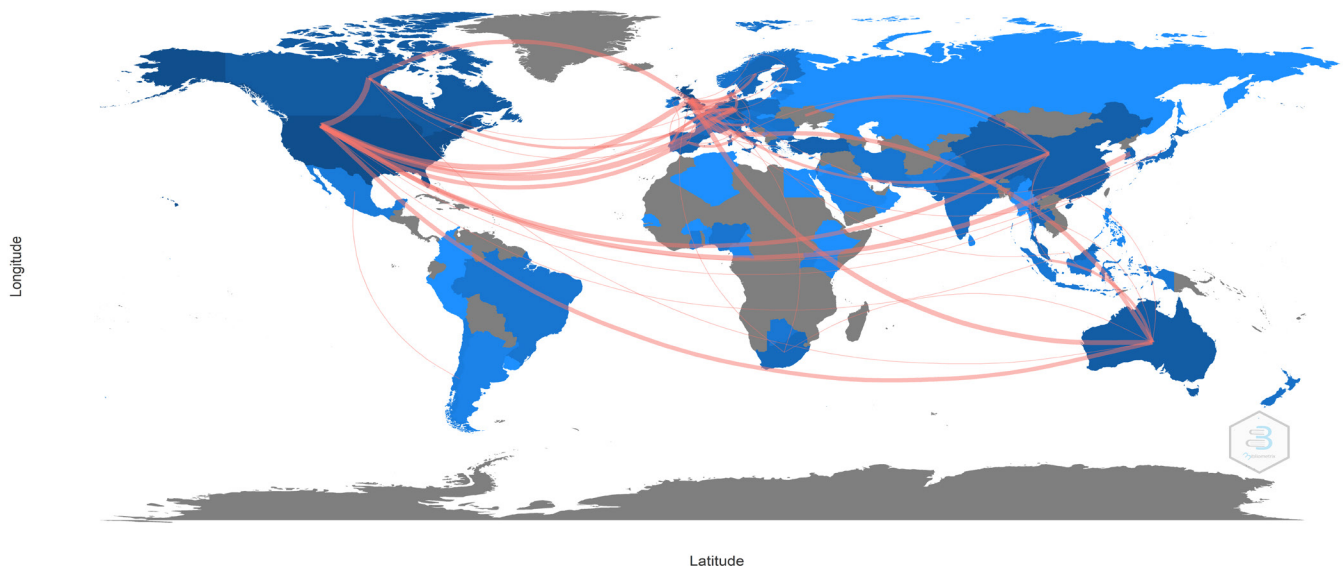


Figure 10: Social Structure of the Countries' Collaboration Map.

The adult education paradigm might have paved the way for the first LLL publication in 1963, and the 24-year timeline between the Faure Report, "Learning to be," published in 1972, and the Delors Report's 1996 publication, "Learning: The treasure within," might have attracted researchers from around the world and

served as the primary catalyst for the jump from single-digit to double-digit publications in 1997. The Sustainable Development Goals (SDGs) of the 2030 Agenda for the United Nations replace the eight Millennium Development Goals (MDGs) for the period 2000–2015 with 17 SDGs for the subsequent 15

years. Academic contributions from LLL scholars were made during the United National Literacy Decade (UNLD): Education for All (2003-2012). The International Conference on Adult Education (CONFINTEA) is a UNESCO international (Category II) conference for policy discourse on Adult Learning and Education (ALE) and associated research and activism. Since the late 1940s, CONFINTEA has occurred every 12 to 13 years. The inaugural conference took place in Elsinore (Denmark) in 1949. This was followed by conferences in Montreal (Canada) in 1960; Tokyo (Japan) in 1972; Paris (France) in 1985; Hamburg (Germany) in 1997; and Belém (Brazil) in December 2009. In June 2022, Marrakech (Kingdom of Morocco) hosted the seventh International Conference on Adult Education (CONFINTEA VII). All the CONFINTEAs' agendas and recommendations were also the guiding sources of LLL. The majority of LLL publications were influenced by the national policies of each country on adult education, literacy development, continuing education, lifelong learning, and lifelong learning concerning the outputs of the CONFINTEAs, MDGs, UNLD, and SDGs.

This study finds gender inequality in author production, the United Kingdom's hegemony, and education as the most contributing discipline among the top 10 authors. Among the top 20 sources, the finding reveals that the majority of journals with the highest publishing output in LLL research are located in the United Kingdom. With nine journals contributing a large number of papers, Taylor and Francis is the major publisher of LLL publications. Wiley-Blackwell, Springer Nature, and SAGE are the next three publishers in line.

The spotlight of all publications, according to topic trend analysis, is learning, which is followed by pedagogy and vocational training in 2010, sustainable development and knowledge economy in 2011, workplace learning and e-learning in 2012, information literacy and policy in 2013, teacher training and adult learning in 2014, distance education and self-regulated learning in 2015, professional development and continuing education in 2016, medical education and higher education in 2017, teacher education and continuing professional development in 2018, employability and self-directed learning in 2019, digital literacy, heutagogy, and learning analytics and online learning in 2021. According to the most recent publications, the rising trends in LLL research are more focused on applications of LLL in higher education, teacher education, continuing professional development, employability, self-directed learning, digital literacy, heutagogy, learning analytics, and online learning.

In any scientific publication, review papers are more frequently read, viewed, and cited. With 829 citations, a review paper tops the list of highly cited papers in LLL research too. The majority of the papers focus on the application and solutions of LLL in neural networks, mobile technology, cognitive skills and abilities, income disparity, e-learning, information technology, adult learning, medical education, self-directed learning, social justice.

The development of specialist expertise in academic research leads to the formation of institutional and ideological barriers between teams of researchers. This necessitates more research collaboration and idea exchange.^[50] In the field of lifelong learning, which promotes a broad inter-disciplinary, multi-disciplinary, and trans-disciplinary approach, collaboration in research is extremely important. In this discipline, educators and learners are always working to improve literacy and multi-skill development, which results in positive changes and empowerment of a person or a community. The evaluation of worldwide institutional rankings facilitated the establishment of scholarly collaborations that enhanced the research environments in lifelong learning at educational establishments.

The intense pressure that academics and institutions are under to achieve publishing standards has made collaboration in research essential.^[51] Collaboration across countries helps to increase the impact and exposure of research, and joint publications have a significant impact on the quantity of citations obtained.^[52] The collaboration network of the social structure reveals the highest levels of collaboration among the five authors, namely Holford J., Milana M., Waller R., Webb S., and Hodge S. The findings of the corresponding author's country reveal that there is a greater prevalence of intra-country collaboration. The Association of Institutions publication reveals that intra-country institutional collaboration is the highest and most prevalent in LLL. Though the United States leads the United Kingdom in terms of publishing productivity, the United Kingdom leads the United States in terms of publication collaboration, followed by Canada, Germany, and Spain.

Theme evolution identifies that literacy is the central focal theme, skill development is the emerging theme, self-directed learning and workplace learning are important themes, and teacher training, continuing professional development, and information literacy are the highly developed themes in LLL research.

The global scholars or institutions closely conduct research on the social, economic and educational variables increase the collaboration network among them and positively strengthen the publication productivity in LLL research. The core variables which bring collaboration network among the authors and institutions and increased publication productivity are; distance learning, teaching, educational policy and research, pedagogy, globalization, public libraries, vocational training, employment, social inclusion, sustainable development, knowledge economy, curriculum, innovation, workplace learning, e-learning, learning, teachers, policy, information literacy, education, informal learning, teacher training, adult learning, distance education, discourse analysis, life-long learning, self-regulated learning, and motivation, skills, human capital, professional development, continuing education, lifelong learning, medical education, older adults, higher education, adult education, self-efficacy, teacher education, continuing professional development, lifelong

education, critical thinking, vulnerability, gender, employability, and self-directed learning, digital literacy, Heutagogy, lifelong learning tendency, young adults, COVID-19, deep learning, learning analytics, and online learning. It is further noted that the collaboration among the developed nations, allied education disciplines are the key factors in enhancing the collaboration networks and productivity in publication in LLL research.

Implications for Scientific Productivity and Collaboration Network for LLL

The study finds that globally the department of education contributes more in research collaboration and produce scientific publications on the variables related to education and learning inclusive of all forms; formal, non-formal and informal learning. The results reveal that the application of LLL has been the focal research aim in pedagogy, andragogy and Heutagogy. The disciplines of social sciences involved LLL in all developmental areas. Globally, researchers from all fields of education starting from school to higher education may take up LLL principles in interdisciplinary, multidisciplinary and trans-disciplinary research. Nowadays, it is evident that national and international funding agencies enhance collaboration in research. LLL area has more potential opportunities in not only in enhancing publication productivity but also enhance collaboration across researches, disciplines, institutions and countries. The study findings also strengthen the idea of scientific collaboration of researchers, institutions and countries in LLL increases publication productivity.

Theoretical and Practical Implications

This study contributed more to the field of LLL. First, the authors, sources, and top productivity analyses for each country were performed to assist current researchers and other stakeholders in monitoring the research development. Second, future researchers who can use a variety of research techniques, such as bibliometrics, systematic literature reviews, and mixed methods research, to explore the potential for collaborations with other authors in the field, institutions, and countries in particular, may build on the study's findings regarding the collaboration of authors, institutions, and countries. Third, this study identifies a trending topic, theme evaluation in LLL, as learning is the trending topic, skill development is the emerging theme, and self-directed learning, self-regulated learning, teacher training, continuing professional development, information literacy, and e-learning are the highly developed themes. These themes will serve as a guide for future field studies in determining research gaps. Fourth, this study will also be a resource for scholars and teachers, particularly those in the fields of education, adult education, and lifelong learning. Fifth, this study makes use of the analyses (productivity/performance analysis, citation analysis, collaboration network, and visualization), which are significant to the field of LLL. Finally, the core findings are important to

policy makers and funding agencies in forecasting the future directions of LLL.

Limitations and Future Directions

This study made use of the Scopus database, which is continually updated with new articles, journals, and citations. As a result, future bibliometric analyses of a given topic will reveal important changes. The study's other limitation is that the bibliometric analysis was limited to document types from journals such as articles, conference papers, editorials, and reviews that were published in English. Future research may concentrate on other database like Web of Science (WoS) and incorporate data from additional dimensions, such as books and other languages. This study employed R-Biblioshiny for data analysis; other bibliometric analysis tools may be employed in further studies. Future research on top-cited articles in LLL could combine bibliometric analysis and a systematic literature review or systematic literature review and topic modelling.

CONCLUSION

UNESCO and other global organizations' periodical initiatives on LLL, Countries' economic, social and education policies act as instrumental for research, publications in LLL giving opportunities for institutional and country collaboration. Hence, LLL has emerged as the key concern of inter-disciplinary, multi-disciplinary, and trans-disciplinary research. This study examines the publication productivity in LLL research with theme analysis and a collaboration network by using R Biblioshiny for the data retrieved from Scopus. The analysis shows that over six decades of research output in LLL, this study would act as a resource not only for LLL stakeholders interested in knowing the growth and development from 1963 to 2022 but also for the researchers who would employ bibliometric analysis in their select field. The implications of this study would gain more attention among the research community.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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