2020

Bibliometric analysis on global e-learning literature in Web of Science database: with special reference to Sri Lankan context

Mohamed Majeed Mashroofa
mashroof@seu.ac.lk

Mazuki Jusoh Prof
Management & Science University, Malaysia, keyjus@yahoo.com

Karuthan Chinna Prof.
Taylor's University, Malaysia, karuthan@gmail.com

Bibliometric analysis on global e-learning literature in Web of Science database: with special reference to Sri Lankan context

Mohamed Majeed Mashroofa[1,2], Mazuki Jusoh[2], and Karuthan Chinna[3]

[1]South Eastern University of Sri Lanka, Oluvil, Sri Lanka
mashroof@seu.ac.lk
[2]Management & Science University, Shah Alam, Selangor, Malaysia

keyjus@yahoo.com

[3]School of Medicine, Faculty of Health and Medical Sciences, Taylor's University, Malaysia
karuthan@gmail.com

Abstract

Study of existing literature on e-learning trend is a must in order to define the path for new research in the field. The objective of this study is to find the full range of scientific literature published since the emergence of the concept of e-learning. The researcher intended to get all of the literature published in the Sri Lankan context. Web of Science database search was carried out in January 2020 to understand the research trend. This study found 6934 results for e-learning after performing a basic search in Web of Science. This results covered 59784 citations. Though multilingual literature was found, 6,617 (95.43%) items were published in English language. Though different types of documents were included in the search result, journal articles were predominant with 5839 (84.21%) instances. USA and England accounted for 1003 (14.24%) and 828 (11.75%) papers respectively, which placed them as the countries that contributed the most. Considering the subject area broadly, the literature has been classified into 25 disciplines of which 1843 (26.57%) of publications falling into the Educational research category. The average number of citations per publication is recorded as 14.4. The top 25 institutions have published 1245 papers that received a total of 8026 citations excluding self- citations. The University of London is the most productive organization, has published 131 papers on e-learning. Among the authors, Huang, Yong-Ming of Southern Taiwan University of Science and Technology has published the most number of papers (19) on e- learning.

Keywords: Scientometric Analysis, Research Trend, Citation Analysis, E-Learning, Online Learning, Sri Lanka

Introduction

Rapidly developing technology has brought paradigm shifts in business, communication, banking, travel, law, tourism, medicine and education (Atan, 2015). E-Learning is the most significant paradigm shift brought in by ICT in the HE system all across the globe (OECD, 2005). E-Learning can be defined as "Learning that is facilitated and supported through the use of information and communications technology" (Mbengo, 2014). E-Learning offers profound advantages in several aspects. Bibliometric analysis of e-learning research trend seems to be lacking in literature. Therefore, this research study intends to address

this by asking the following questions.

1. What are the categories of documents, the publication trend, geographical distribution and scientific impact in terms of citations of e-learning literature that exist globally?
2. How are the status of research productivity and the growth trend of literature on e-learning?
3. Is e-learning research adequately established in Sri Lanka?

Objectives

The main objective of this study is to identify the pattern and extent of growth of Scientific Literature published globally on e-learning from 1995 to 2019 and as indexed in the Web of Science database. In addition, this study aims to identify the research trend on e-learning, specifically in the Sri Lankan context.

Specific objectives:

1. To identify the various types of literature on e-learning published from 1989 to Aug 2019
2. To identify the geographical distribution of origin of the literature on e-learning
3. To list out the languages mainly used for e-learning literature
4. To identify the growth trend of e-learning research from its inception to date
5. To identify the most productive country, institution and journal which published the highest number of research papers on e-learning
6. To identify the most productive author(s) in e-learning research and their productivity parameters
7. To examine the broad subject areas into which e-learning research falls
8. To identify the citation pattern and the most frequently cited paper on e-learning
9. To investigate the research trend of Sri Lankan researchers on e-learning

Data collection method

Web of Science database was used to study the research trend of e-learning. Web of Science is a database administered by Thomson Reuters – Clarivate Analytics, which maintains the Science Citation Index (SCI), Social Science Citation Index (SSCI), Science Citation Index expanded, Emerging Source Citation Index, Conference Proceedings Citation Index, and the Web of Science core collection.

Data for this study was retrieved in January 2020 by using the Web of Science search function. The research process consisted of two phases: (1) a systematic compilation of the articles identified by the keyword, "e-learning" and (2) an evaluation of the result based on various parameters. Keyword used was "e-learning" and 'topic' was selected as search field because topic searches include title, abstract, author keywords, and keywords plus, at first to identify the research trend globally and then the 'AND' Boolean operator was used to add another keyword "Sri Lanka". Since one of the purposes of the search was to identify the contributions of international publications, especially in the Sri Lankan context, the search criterion included the keyword "Sri Lanka", too. Instead of e-learning the term 'online learning' also was used and found 5267 results. While combining with AND operator with 'Sri Lanka' it retrieved no results. Therefore, the first search results 'e-learning' was used for analysis. H-index was used to identify the most prolific journal and the most prominent researcher in the field. Citation count of each author and the average citations per paper were utilized to study the research productivity.

Results and discussion

Results show the bibliometric data on e-learning in respect of the categories of the publications, publication productivity, countries, institutions, author analysis, journal analysis, language used, average citations per paper, and the most frequently cited paper. A total of 6934 results were retrieved from the database for the keyword 'e-learning'. Only 02 hits were recorded from Web of Science for the search on 'e-learning AND Sri Lanka'.

Term used for search	No. of papers	h-index	Average Citations per item	Number of times cited	Articles Cited
e-learning	6934	116	14.4	99,817 (88,116 without self-citation)	62,892 (59,784 without self-citation)
e-learning AND Sri Lanka	2	2	9.5	19	19

Table 1: Summary of Search Results for 'e-learning' and 'e-learning AND Sri Lanka' from the Web of Science Co-collection

Records retrieved for e-learning search were further analyzed to identify the types of documents, diversity of language, most productive country, most productive institution, most productive author, journal that published highest number of research papers on e-learning, journal that received the most citations, and the most frequently cited paper.

Document type

Among the 6934 papers were 5839 journal articles published in 1823 journals, 520 proceedings papers, 394 meeting abstracts, 243 reviews, and 173 book reviews while the rest were of various other types as depicted in Table 2. These publications have received 88,116 citations till December 2019.

No.	Document type	Number of literary items	Percentage
1	Journal article	5839	84.21
2	Conference proceedings paper	520	7.45
3	Meeting abstract	394	5.68
4	Review	243	3.50
5	Book review	173	2.46
6	Editorial material	169	2.44
7	Letter	54	0.78
8	News item	44	0.64
9	Early Access	43	0.62
10	Correction	14	0.21
11	Book chapter	3	0.04
12	Software Review	3	0.04
13	Note	1	0.01

Table 2: Types of documents available in Web of Science on e-learning

Language of the papers

Though papers have been published in various languages, such as English 6,617 (95.43%), German 123 (1.77%), Spanish 104 (1.5%), French 27 (0.39%), Portuguese 14 (0.20%), Hungarian 10 (0.14), Turkish 9 (0.13), Czech 5 (0.072%), Japanese 4 (0.06%), Korean 3 (0.045), Russian 3 (0.045), Slovenian 3 (0.045), Afrikaans 2 (0.030), Chinese 2 (0.030), Italian 2 (0.030), Croatian 1 (0.015%), Dutch 1 (0.015%), Polish 1 (0.015%), Serbian 1 (0.015%) and Slovak 1 (0.015%). Altogether 20 languages have been utilized. Majority of the literature has been published in English language.

Growth trend of literature

Table 3 summarizes the growth trend of e-learning literature from 1995 to 2019. An exponential growth was noted throughout the years from 1995 to 2009. However, the output of research papers fluctuated after 2009. In 2010 a sudden fall in the number of publications was observed and then the growth trend did not rise every year but remained unsteady. Therefore, e-learning research did not show a definite growth pattern. The highest growth rate was observed for the year 2019, at 531 items (7.66%). Therefore, 2019

turned out to be the most productive year. Average number of publications per year was calculated as 277.36. Based on this result, it can be concluded that though e-learning research does not have a definite pattern of growth, it is evidenced that still it is a significant area for research.

Figure 1: Growth trend of literature on e-learning
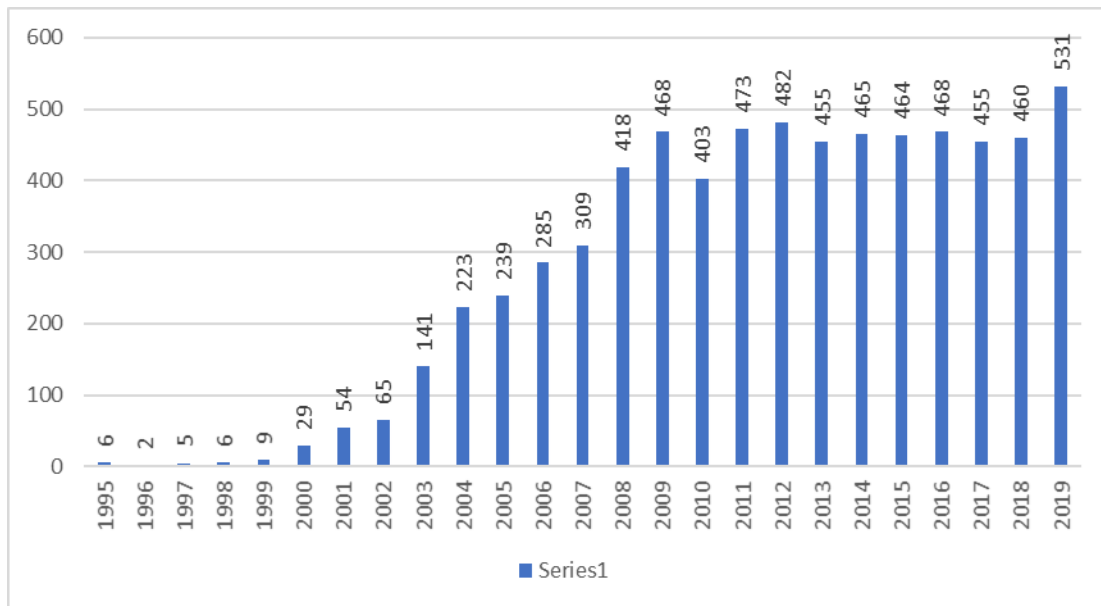
Most productive institution

With respect to the publications on e-learning indexed in the Web of Science databases, 25 institutions have contributed 1245 papers (17.96%) out of the total e-learning literature. University of London has contributed 131 (1.89%) articles, claiming the highest number of publications while the University of Toronto vie for second position with 68 (0.98%) and National Cheng Kung University is at third with 67 (0.97%) papers.

Figure 2: Top 25 Institutions in terms of high productivity in e-learning research

Number of Publications

Institution	Publications
UNIVERSITY OF LONDON	131
University of Toronto	68
NATIONAL CHENG KUNG UNIVERSITY	67
PENNSYLVANIA COMMONWEALTH SYSTEM OF...	61
STATE UNIVERSITY SYSTEM OF FLORIDA	57
UOC UNIVERSITAT OBERTA DE CATALUNYA	54
KINGS COLLEGE LONDON	49
UNIVERSITI MALAYA	48
UNIVERSITY OF CALIFORNIA SYSTEM	47
UNIVERSITY OF HONG KONG	46
UNIVERSITY COLLEGE LONDON	46
UNIVERSITY OF SYDNEY	46
UNIVERSIDAD DE ALCALA	45
GHENT UNIVERSITY	42
University of Amsterdam	42
University of Birmingham	41
University of Pitsburgh	41
NATIONAL TAIWAN NORMAL UNIVERSITY	40
Open UNIVERSITY UK	40
Western University Ontario	40
UNIVERSITY OF Madrid	39
National Central University	39
National Chio Tung University	39
National Taiwan University of Science & Tech	39
Radboud UniversityNijmegan	38

Journals that publish e-learning research papers

The journal "Computers & Education" has published the highest number of papers, at 264 (3.81%) on e-learning. "Lecture Notes in Computer Science" has published the second highest number at 262 (3.78%), while "Educational Technology Society" has published the third highest number of papers at 205 (2.96%). These 25 journals together have contributed a considerable quantity of items, numbering 2411 (34.77%) to e-learning literature.

Source Title	No. of Papers Published	Percentage
Computers & Education	264	3.81
Lecture Notes in Computer Science	262	3.78
Educational Technology Society	205	2.96
British Journal of Educational Technology	193	2.78
Computers in Human Behaviour	143	2.06
International Review of Research in Open and Distributed Learning	102	1.47
International Journal of Engineering Education	96	1.38
BMC Medical Education	91	1.32
Interactive Learning Environments	88	1.27
Expert Systems with Applications	81	1.17
Medical Teacher	80	1.15
Computer Applications in Engineering Education	80	1.15
Journal of Universal Computer Science	71	1.02
Nurse Education Today	71	1.02
Journal of Computer Assisted Learning	71	1.02
IEEE Transactions on Learning Technologies	64	0.92
International Review of Research in Open and Distance Learning	53	0.72
Anatomical Sciences Education	50	0.71
IEEE Transactions on Education	49	0.68
Australasian Journal of Educational Technology	47	0.67
ETRD - Educational Technology Research and Development	46	0.66
Training Development	45	0.65
Lecture Notes in Artificial Intelligence	42	0.61
Innovations in Education and Teaching International	40	0.58
Multimedia Tools and Applications	39	0.56
Electronic Library	38	0.55
Total	2411	34.77%

Table 3: Top 25 journals that published e-learning research articles

Authors with the highest number of published articles and their research productivity

The study further analyzed the authors, their affiliations and their productivity in terms of the number of publications and the number of citations received. Table 4 depicts the results of the top ten authors. Huang, Yong-Ming from Southern Taiwan University of Science & Technology, Taiwan is first in the top ten, as he has published 19 papers and received 300 citations with 19.53 as the average citation per paper. The same number of papers was also published by Tsai, Chia-Wen from Ming Chun University, Taiwan, who received 202 citations at a rate of 12.37 per paper. Chen, Chih Ming from National Hualien Teachers College, Taiwan has the highest value of H-index (13) and has received the highest number of citations (1001) with an average of 55.61 citations per item. His research papers have had the highest impacts.

| Author's Name	Institution	No. of papers	h-index	Average Citations per item	Citations Received without self-citing
Huang, Yong-Ming	Southern Taiwan University of Science & Technology	19	11	19.53	351
Tsai, Chia-Wen	Ming Chun University, Taiwan	19	08	12.37	202
Chen, Chih Ming	National Hualien Teachers College, Taiwan	18	13	56.83	1001
Fernandez-Manjon B.	University Compultense Madrid, Spain	16	9	14.5	218
Kinshuk	Athabasca University, Canada	15	10	27.2	406
Chen, Nian Shing	National Sun Yat Sen University, Taiwan	14	10	23.14	323
Shen, Rumin	Shangai, Jiao Tong University, China	14	7	20.21	280
Fischer, Martin, R.	Hospital of Ludwig Maxmilians University, Germany	13	6	13.54	169
Kim, J. Jungloo	Korea University, South Korea	13	9	28.85	374
Tseng, Shian-Shyong	National Chiao Tung University, Taiwan	13	7	14	173
De Marcos, L.		13	6	57.31	725

Table 4: Top ten Authors and their productivity

Broad subject area of e-learning research

Considering the broad subject area, 1843 papers (26.58%) of the publications fall into Educational research and the rest are categorized as Educational Science, Multidisciplinary, Computer Science, Information System, Electrical and Electronic Engineering, Library and Information Science, Psychology, Medicine

and Dentistry, etc.

**Figure 3: Broad disciplines covered by the e-learning research papers**
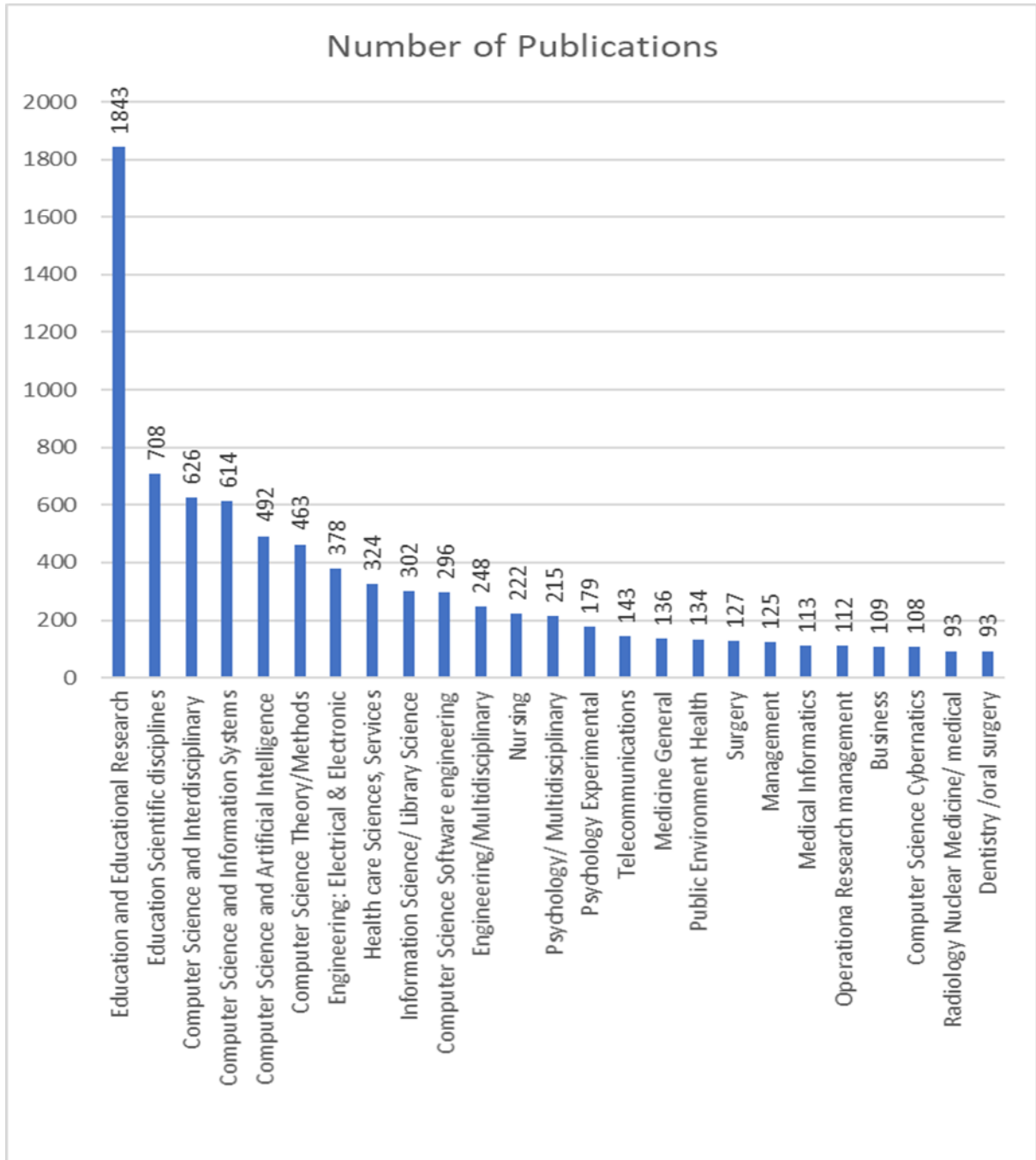
Geographical distribution

There were 6934 publications on e-learning that had originated from 106 countries. Despite the large number of results for e-learning overall, there were only 02 results that addressed the Sri Lankan situation. This clearly shows that e-learning is an area to which Sri Lankan researchers have given very little attention

and therefore it is very important to correct this situation by doing more research in the Sri Lankan context. Regarding the geographic scope, the articles were from 106 countries of which 25 countries have made substantial contributions, such as USA 1003, England 828, Spain 671, Taiwan 564, Germany 434, Australia 384, Canada 375, China 370 , Italy 264 , Netherlands 260, South Korea 180, France 164, Greece 147, Japan 146, Switzerland 139, Turkey 132, India 143, Scotland 120, Belgium 114 , Ireland 113 , Malaysia 108 , Serbia 102, Austria 102 , Sweden 92 and Portugal 87, which demonstrate the depth and diversity of the research done in this field. The vast majority of studies were from USA, with 1003 papers (14.45%) and England, with 828 papers (11.94%).

**Figure 4: Geographical Distribution of Publications**
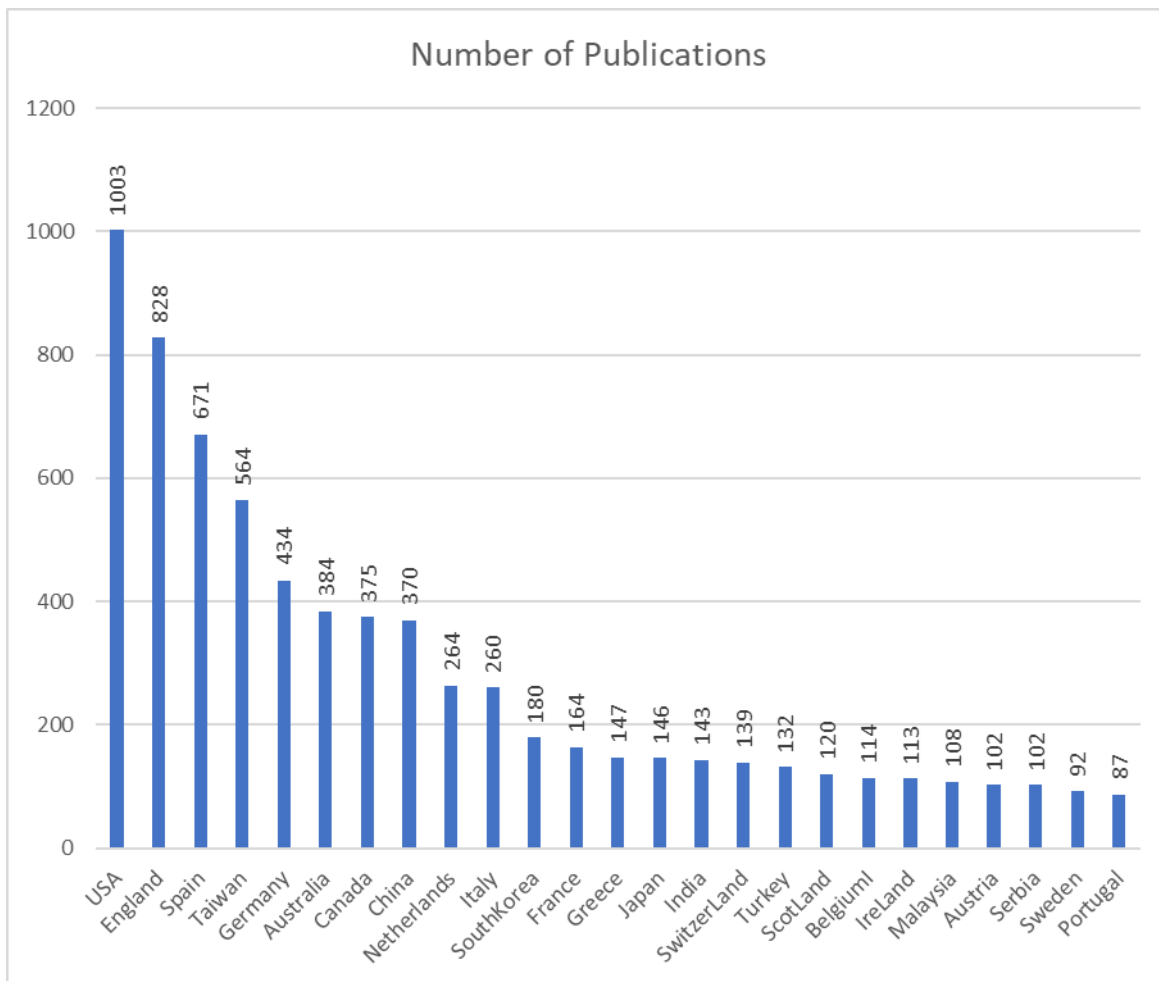
Research impact and citation pattern

A total of 1823 journals have published research papers on e-learning, which have received 88,116 citations excluding self-citations in 59,786 documents. The citation pattern of the e-learning research papers exhibits

an exponential growth. This provides ample evidence of the significance of this area of research globally.

Figure 5: Citation pattern of e-learning research papers over the years
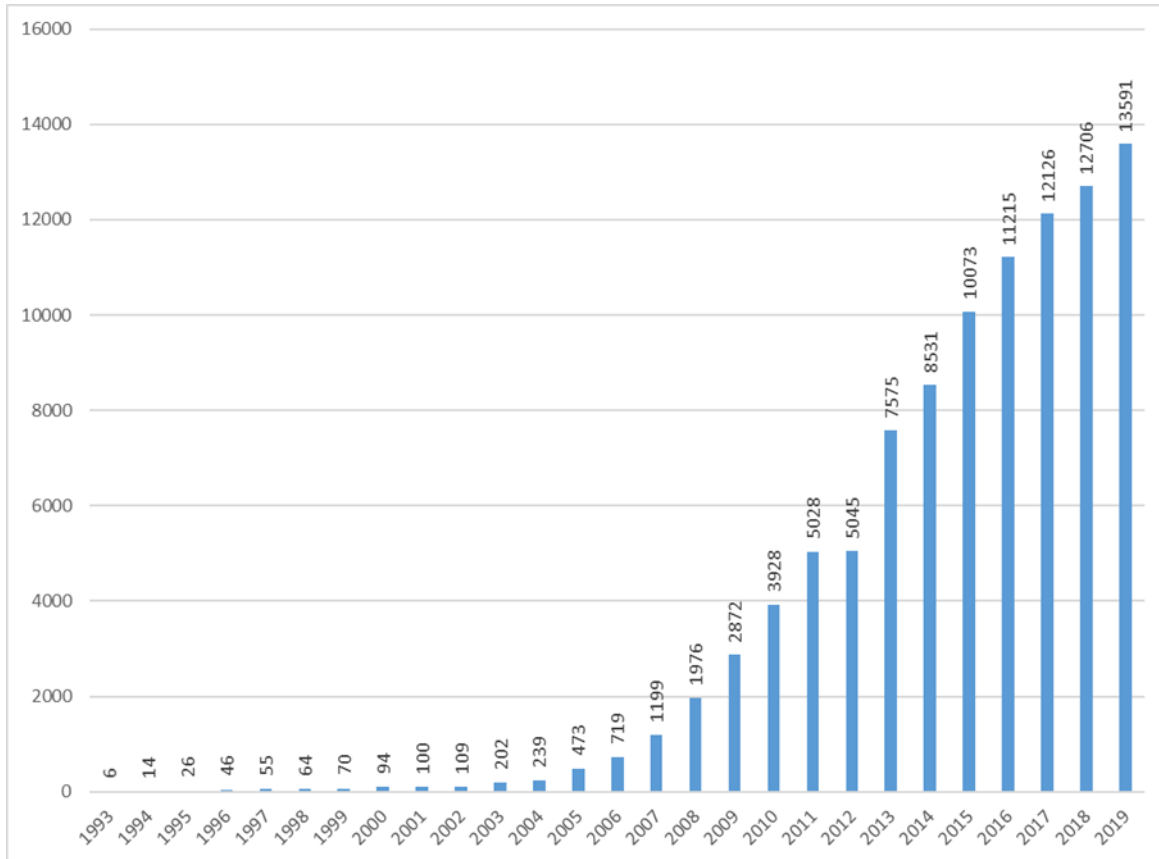
The top 25 papers that received the highest number of citations accounted for 9610 citations. The article "*What drives a successful e-Learning program? An empirical investigation of the critical factors influencing learner satisfaction*" authored by Sun, Pei-Chen; Tsai, Ray J.; Finger, Glenn *et al.,* published in Computers & Education, Volume 50, Issue 4 in May 2008 has received the highest number of citations at 810, averaging 81 per year. The top 10 papers that earned the highest number of citations are listed in Table 5.

Title of the papers	Author/s	Publication	Citations
What drives a successful e-Learning program? An empirical investigation of the critical factors influencing learner satisfaction	Sun, Pei-Chen; Tsai, Ray J.; Finger, Glenn; Chen, Yueh-Yang; Yeh, Dowming	Computers & Education, Volume 50, Issue 4	810
The impact of e-learning in medical education	Ruiz, JG; Mintzer, MJ; Leipzig, RM	Academic Medicine, Vol 81, issue 3	801
Contrasting mechanisms of impaired attentional set-shifting in patients with Frontal Lobe damage or Parkinson's Disease	Owen, AM; Roberts, AC; Hodges, JR; Summers, BA; Polkey, CE; Robbins, TW	Brain, Volume 116	525
Evaluating intertwined effects in e-learning programs: A novel hybrid MCDM model based on factor analysis and DEMATEL	Gwo-Hshiung Tzeng; Cheng-Hsin Chiang; Chung-Wei Li	Expert Systems with Applications, Volume 32, Issue 4	524
First principles of instruction	Merrill, MD	ETR&D-Educational Technology Research And Development, Volume 50, Issue 3	510
Understanding e-learning continuance intention: An extension of the TAM	Roca, Juan Carlos; Chiu, Chao-Min; Martinez, Francisco Jose	International Journal of Human-Computer Studies, Volume 64, Issue 8	485
Gamifying learning experiences: Practical implications and outcomes	Dominguez, Adrian; Saenz-de-Navarrete, Joseba *et al*.	Computers & Education, Volume, 63	449
Data mining in course management systems: Moodle case study and tutorial	Romero, Cristobal; Ventura, Sebastian; Garcia, Enrique	Computers & Education, Volume, 51	406
An Analysis of the Technology Acceptance Model in Understanding University Students' Behavioural Intention to Use e-Learning	Park, Sung Youl	Educational Technology & Society, Volume 12, Issue 3	405
Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness	Zhang, DS; Zhou, LN; Briggs, RO; Nunamaker, JF	Information & Management, Volume 43, Issue 1	372

Table 5: Research papers and their impact in terms of number of citations

Research trend on e-learning in Sri Lanka

Search results of the Web of Science database for 'e-learning AND Sri Lanka' returned only 02 hits whilst

'online learning AND Sri Lanka' returned no hits. These two records are journal articles, published under

the broad headings of Library Science and Information Science in 2010 and 2011, respectively. This is a collaborative effort of Sri Lanka, Sweden and USA. These two papers have together received 19 citations at a rate of 9.5 each, and have 2 *h-index*. Lack of literature in this area indicates that there is a gap in E-L research studies published in high impact journals, in Sri Lanka. As such, this is an area that must be studied at present. It is important to make academics and administrators aware of the issues and challenges relating to existing E-L facilities and the challenges relating to its usage. Enhancing e-learning system usage in the higher education sector of Sri Lanka to provide quality teaching and learning for formal and distant education would be highly appreciated by various stakeholders. Therefore, research studies in this area should be encouraged.

CONCLUSIONS

This study determined that a total of 6934 papers were published on e-learning from 1989 to 2019 July. These papers have received altogether 88,116 citations at a rate of 14.4 per paper. Average number of publications per year is 346.7. The main language of the publications is English as 6,617 papers were in this language, accounting for 95.43% of the total literature on e-learning. Maximum growth occurred in 2019 and there was no definite growth pattern. Altogether 106 countries have contributed to e-learning research, with the topmost contributor being USA, with 1003 (14.45%) papers and England following behind with 828 (11.94%) papers. The most productive Institutions was the University of London, which has 131 publications, led the rest. The most prominent authors who published 19 papers each on e-learning were Huang, Yong-Ming and Tsai, Chia- Wen. However, in terms of the citations received and h-index value, Chen, Chih Ming from National Hualien Teachers College, Taiwan was the best author. Top journal was '*Computers and Education',* which published the highest number of papers at 264 (3.81%). Altogether, the top 25 journals have contributed 2411 papers, accounting for 34.77% of the total research output. The most highly cited paper was, "What drives a successful e-Learning program? An empirical investigation of the critical factors influencing learner satisfaction" published in 'Computers & Education', Volume 50, Issue 4, 2008. The top 10 papers that received the highest number of citations obtained altogether 5287 citations. Sri Lanka had only 02 papers on e-learning, both being of a collaborative nature, which together obtained 18 citations. This study concludes that around the world 106 countries have engaged in e-learning research

and that Sri Lanka has made only a very small contribution. As such, there is vast room for improvement in the country's engagement in this topic. Therefore, Sri Lankan University academics and researchers need to give much greater attention to e-learning research as well as concern on high impact journals which are indexed in Science Citation Index, Science Citation Index Expanded, Social Science Citation Index, and Arts and Humanities Citation Index to make visible their research papers in WoS database.

REFERENCES

Atan, T. (2015). Distant education: from deep disappointment to new optimism. *The Online Journal of Distance Education and e-Learning*, 3(4), Retrieved from http://www.tojdel.net/pdf/v03i04/tojdel-volume03-i04-03.pdf.

Gupta, B.M. & Dhawan, S.M. (2019). Global research studies on Electronic resources in Libraries: A scientometric assessment during 1994-2017. COLLNET journal of Scientometric Information and Information Management, 13(1), 167-181, DOI 10.1080/093737766.2019.1583836

Khrawbok, N. & Bikika, L. (2016). Bibliometric study of Biochemistry literature Bibliography in North Eastern Hill University during 2000 to 2010. COLLNET Journal of Scientometric and Information Management, 10 (2), 197-207, DOI 10 1080/09737766.2016.1213964

Malkeet Singh (2015). Literature published in Web 2.0 Technologies in Libraries: A bibliometric study, COLLNET Journal of Scientometric and Information and Information Management, 9(2), 251-262, DOI 10.1080/093737766.2015.1069963

Mbengo, P. (2014). E-learning adoption by lecturers in selected Zimbabwe State Universities: An application of technology acceptance model. *Journal of Business Administration and Education, 6*(1), 15-33.

OECD. (2005). *E-learning in tertiary education. .* Retrieved from OECD Observer: http://www.oecd.org/dataoecd/55/25/35961132.pdf

Rajkumar Bhardwaj & Jain, P.K. (2015). Research trends in mobile learning: A global perspective, COLLNET journal of Scientometric and Information and Information Management, 9(2), 205-224, DOI 10.1080/093737766.2015.1069960

Rajkumar Bhardwaj (2017). Mapping of global research literature in the field of cloud computing: COLLNET journal of Scientometric and Information and Information Management, 11(2), 173-191, DOI 10.1080/093737766.2017.1284727

Ravichandra Rao, I.K., Raghavan, K.S. & Bhargav, K.N. (2017). Quantitative analysis of scientific literature in forensic science, COLLNET journal of Scientometric and Information and Information Management, 11(1), 59-72, DOI, 10.1080/093737766.2016.1251561

Vog, et al.(2018), Psychology: a bibliometric analysis of psychological literature in the online media, Scientometrics, 115, 1253-1269 https://doi.org/10.1007/s11192-018-2727-5