Mapping of Global Research Performance in E-learning: A Scintometrics Analysis

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Abstract

This study analyze the global research output in the field of E-learning during the period 2000-2011 and the analyses included year wise growth, Exponential growth rate, author wise contribution, share of top scholarly journals, share of international collaborative papers and major collaborative partner countries, global publications' share, and patterns of research communication in most productive journals. It also analyses the characteristics of most productive institutions, authors and high-cited papers. Web of science Citation database was used for retrieving the publications' output in E-learning during 2000-2011, where totally 3070 publications found. After analyses we found that there is need to promote research in developing and underdeveloped nations as the research in E-learning concentrated more in developed world.

Keywords

Literacy, information and communication technology, University Libraries..

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Introduction

Life of knowledge and skill in today's ever growing competitive world is very short. Formal education and degrees are just the beginning of lifelong learning. Various agents are playing vital role in learning process where the E-learning snatched an important position with the capability of reaching every human across the networked globe. Electronic learning (E-learning) is a type of Technology supported education/learning (TSL) where the medium of instruction is computer technology. Scintometrics study is research technique to measure the quantitative as well as qualitative research output in a field. Increasing growth and importance of research in E-learning created enthusiasm to measure its growth quantitatively for which we took this study and analyzed the research output reflected in the web of science database.

Objective

This study to analyze the global research output in the field of E-learning during the period 2000-2011 and the analyses included year wise growth, Exponential growth rate, author wise contribution, share of top scholarly journals, share of international collaborative papers and major collaborative partner countries, global publications' share, and patterns of research communication in most productive journals. It also analyses the characteristics of most productive institutions, authors and high-cited papers.

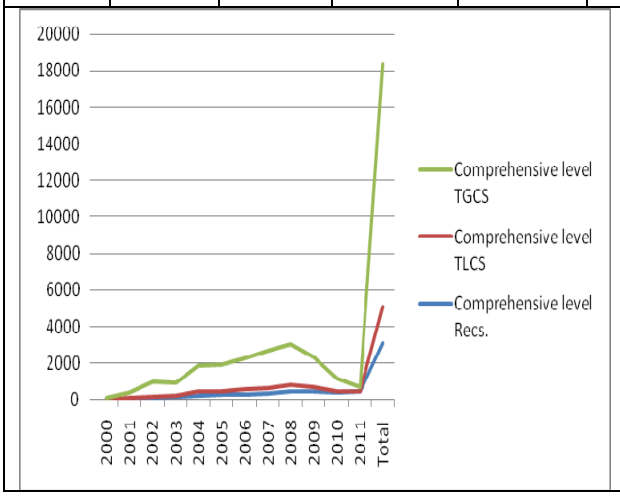
Methodology

Data was collected from the Web of Science (WoS). The WoS is the search platform provided by Thomson Reuters (the former Thomson Scientific emerged from the Institute for Scientific Information (ISI) in Philadelphia). SCI database is one of the very comprehensive databases covering all aspects of science. The study period (2000-2011) is selected as the database is available in machine from since 1982. The search string "E-learning" in the "Basic search**"** field of for the years 2000-2011 to download the records on the subjects 'E-learning'. A total of 3070 records were downloaded and analyzed by using the web of science website application as per the objectives of the study.

Analysis and Discussion

Table: 1Yearly output of Global and National Research Output in E-learning

	Comprehensive level					National Level				
S.No	**Year**	**Recs.**	**TLCS**	**TGCS**		**S.No**	**Year**	**Recs.**	**TLCS**	**TGCS**
1	2000	28	16	66		1	2000	0	0	0
2	2001	54	34	314		2	2001	0	0	0
3	2002	65	99	813		3	2002	0	0	0
4	2003	141	105	707		4	2003	0	0	0
5	2004	222	246	1391		5	2004	1	0	9
6	2005	238	226	1435		6	2005	3	0	2
7	2006	283	288	1709		7	2006	4	0	10
8	2007	309	341	2039		8	2007	6	0	10
9	2008	410	369	2242		9	2008	3	0	6
10	2009	466	199	1649		10	2009	3	0	9
11	2010	397	61	717		11	2010	6	4	13
12	2011	457	23	192		12	2011	3	0	3
	Total	3070	2007	13274			Total	29	4	62



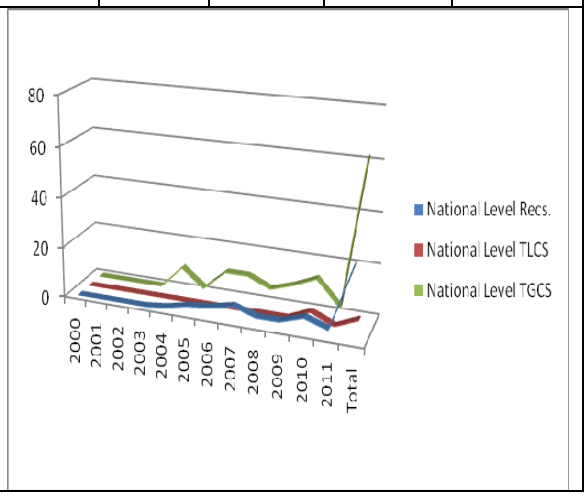


Table 1 reflects the year wise output of the E-learning research there is a linear growth in year wise output and it reached 3070 records in 2011 from only 28 records in the year 2000 which is an indication of increasing importance of E-learning. In case of comprehensive level 2008 stands ahead in TLCS as well as TGCS with 369 and 2242 citations respectively. In national level yearly output history of E-learning research started for in 2004 with 1 record and it was reached to 29 records in the year 2011. As compare to comprehensive level there is no linear growth at national level there is some fluctuations like 2007 and 2010 having 6 records and again it came down to 3 records in 2011. In case of TLCS as well as TGCS also there are fluctuations as there are only 4 citations in national level that too only in the year 2010 in case of TGCS there are 10 citations in each year of 2006 and 2007, 13 in 2010 and again it is 3 in 2011.

Table: 2 Exponential growth rates of E-learning Research Performance

	Comprehensive level				National Level			
S.No	**Year**	**Recs.**	**Growth Rate**		**S.No**	**Year**	**Recs.**	**Growth Rate**
1	2000	28	-		1	2000	0	-
2	2001	54	1.93		2	2001	0	0
3	2002	65	1.20		3	2002	0	0
4	2003	141	2.17		4	2003	0	0
5	2004	222	1.57		5	2004	1	0
6	2005	238	1.07		6	2005	3	3
7	2006	283	1.19		7	2006	4	1.33
8	2007	309	1.09		8	2007	6	1.5
9	2008	410	1.33		9	2008	3	0.5
10	2009	466	1.14		10	2009	3	1.0
11	2010	397	0.85		11	2010	6	**2**
12	2011	457	1.15		12	2011	3	0.5
	Total	3070	14.69(1.22)				29	9.83(0.82)

The Table 2 reveals that the Exponential growth rate of publications in E-learning research output at comprehensive and national level. An exponential growth in number of publication was observed during 20000 to 2011, average growth rate at comprehensive level is 1.22 and 0.82 at national level. The highest growth rate at comprehensive level is 2.17 during 2003 and 3 during. The total exponential growth rate value is 14.69 at comprehensive level and 9.83 at national level. With this data we can say observe the linear increasing growth at comprehensive level except the year 2010 where the contribution is less than 2009. In case of national level growth there are fluctuations with very less contribution to global output which is a major concern.

Table: 3 Top 10 Authors Productivity in E-learning Research

S.No	**Author**	**Records**	**TLCS**	**TGCS**
1	[Anonymous]	35	0	0
2	Chen CM	14	67	234
3	Huang YM	14	31	112
4	Shen RM	13	5	49
5	Tseng SS	13	20	82
6	Fernandez-Manjon B	11	6	44
7	Harden RM	11	42	151
8	Kinshuk	9	7	32
9	Koper R	9	2	54
10	Gaeta M	8	4	41

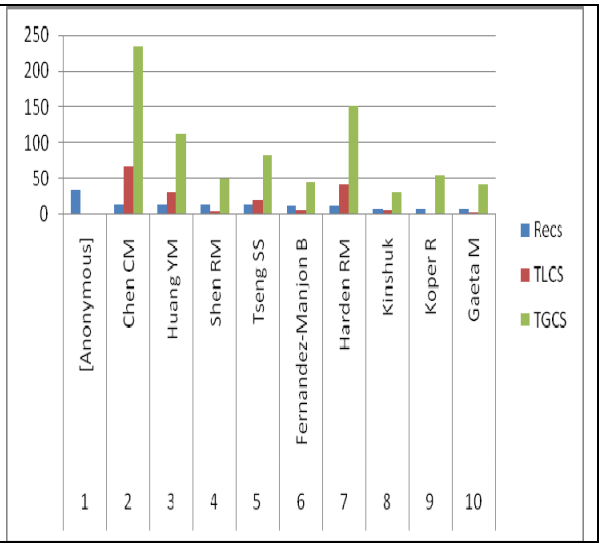


Table: 4 reflect the contribution of top 10 most productive authors in E-learning. Chen CM and Huang Y M tops the list with the contribution of 14 documents each, but in case of total global citation and total local citation Chen C M stands far ahead of Huang Y M which finally places Chen C M on top of the most productive contributors list. Remaining authors in the list have contributed with less difference but with greater difference in total global citation and total local citation.

Table: 4 Collaboration Pattern of Authorship in E-learning Research

No of Authors	No of Article	Percentage
1	741	24.14
2	755	24.60
3	686	22.35
4	420	13.68
5	194	6.30
6	106	3.45
7	56	1.82
8	38	1.24
9	23	0.75
10	10	0.33
Above 10	41	1.34
Total	3070	100

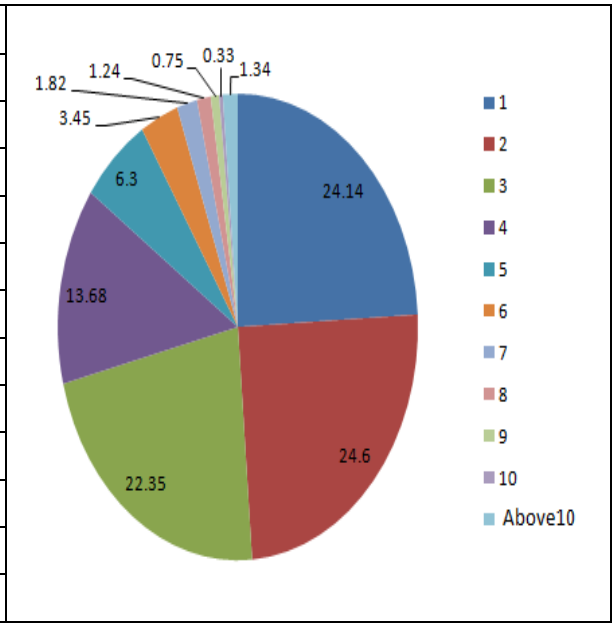
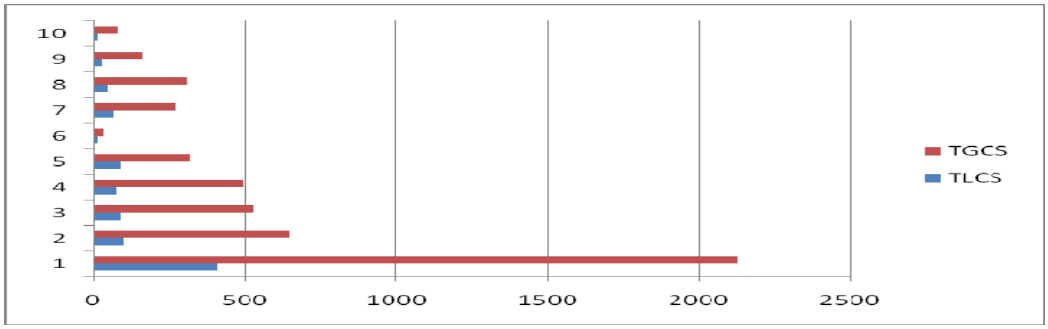


Table 4 reflects the collaboration pattern of authorship. Out of 3070 records 741 are contributed by single authors which are 24.14 percent of total output. 755 records are contributed by double authors which are 24.60 percent of total and which tops percentage wise contribution. Contribution by single author and double authors together stands around 50 percent and remaining 50 percent contribution came from three and more than three authors with the major contribution of three authors. Analysis of this collaborative pattern in though quite good in collaboration but as compare to other areas of research it demands still more collaboration.

Table: 5. Most productive Journals (Core Journals)

S.No	Journal	Records	Percentage	TLCS	TGCS
1	Computers & Education	155	14.99	410	2127
2	Educational Technology & Society	132	12.77	99	648
3	British Journal of Educational Technology	120	11.61	91	532
4	Expert Systems with Applications	58	5.61	80	493
5	Medical Teacher	49	4.74	90	321
6	Training & Development	44	4.26	12	33
7	Computers in Human Behavior	43	4.16	68	272
8	Journal of Computer Assisted Learning	38	3.68	48	312
9	IEEE Transactions on Education	37	3.58	29	167
10	Journal of Universal Computer Science	37	3.58	12	84



These top 10 most productive Journals have contributed 713 papers, with an average contribution of 71.3 papers per Journal publications output of 2000-2011. Among the top 10 most productive journals, only three journals have published higher number of papers than the group's average. These are Computers & Education (155), Educational Technology & Society (132), and British Journal of Educational Technology (120). In case of total local citation and total global citation Computers & Education Journal dominates the list by having 43.66 and 42.63 percent of citations respectively which indicates the dominated usage of Computers & Education journal followed by Educational Technology & Society

Table: 6 Top 10 Institutions Contributed to E-learning Research

S.No	Institution	Records	TLCS	TGCS
1	Unknown	175	34	131
2	National Cheng Kung University (Taiwan)	42	59	243
3	Open University	42	21	220
4	National Chiao Tung University (Taiwan)	28	27	231
5	National Cent University	25	66	271
6	University of Sheffield	22	16	158
7	Tamkang University	20	10	43
8	University of Vigo	20	4	53
9	University of Manchester	19	12	77
10	City University Hong Kong	18	6	60

Citation Pattern

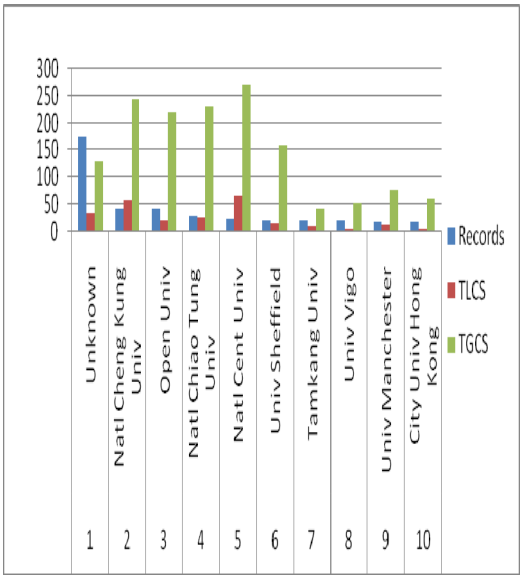
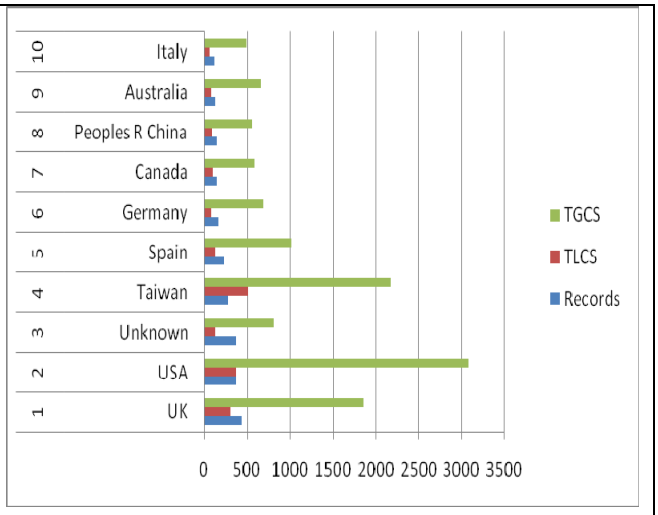


Table 10 reflects the research profile of the most productive institutions in E-learning research. The top 10 most productive institutions involved in research in E-learning are identified out of these two universities in case of records and citation are National Cheng Kung University and National Chiao Tung University which are from Taiwan which shows the importance of E-learning research in Taiwan**.** Here the focusing point is that E-learning research is concentrated in universities and it demands specific research centres for E-learning research which can further boost the E-learning research.

Table: 7 Contribution of Top 10 Countries in E-learning Research

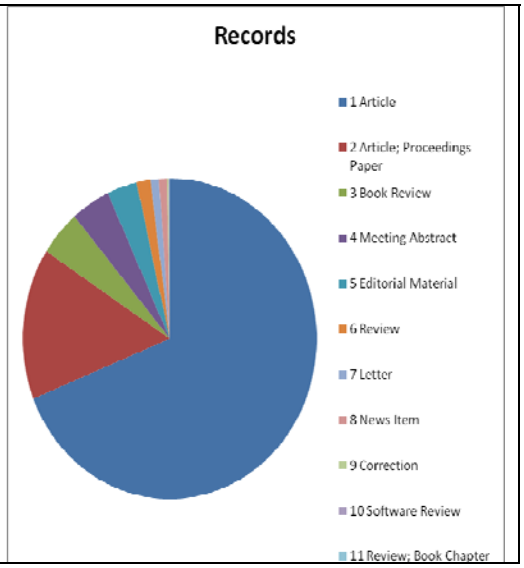
S.No	Country	Records	TLCS	TGCS
1	UK	445	302	1854
2	USA	376	378	3089
3	Unknown	373	129	819
4	Taiwan	275	515	2187
5	Spain	233	125	1026
6	Germany	170	75	693
7	Canada	147	96	587
8	Peoples R China	145	85	556
9	Australia	123	79	657
10	Italy	119	64	493



The global publication shares of the top 10 most productive countries in E-learning research during 2000-2011 varied between 119 and 445 records. United Kingdom (UK) topped the list, with global publication (3070) share of 445 records during 2000-2011. United States of America ranked 2nd with the contribution of 376 records, followed by, Taiwan, Spain, Germany, Canada, Peoples R China and Australia. In case of TGCS and TLCS there is a little variation.USA topped the TGCS followed by Taiwan and UK. Taiwan topped the TLCS list followed by USA and UK. The citation analysis shows that USA and Taiwan though with fewer records than UK managed to get more citation which is a healthy sign of quality research in USA and Taiwan. Here the concern is that the research is concentrated in developed world and it need to promote in developing world including India and under developed world.

Table: 8 Document Wise Distribution of E-learning Research Output

S.No	Document Type	Records	%	TLCS	TGCS
1	Article	2115	68.89	1654	10995
2	Article; Proceedings Paper	469	15.28	220	1601
3	Book Review	142	4.63	3	7
4	Meeting Abstract	132	4.30	1	2
5	Editorial Material	101	3.29	43	178
6	Review	47	1.53	79	463
7	Letter	28	0.91	4	18
8	News Item	27	0.88	3	6
9	Correction	5	0.16	0	0
10	Software Review	3	0.10	0	0



11	Review; Book Chapter	1	0.03	0	4	

E-learning research communicated in various types of documents. Articles with the contribution of 2115 (68.89) dominates the list which is common phenomena in most of the research communication. Articles in proceedings ranked second followed by book reviews, meeting abstracts, and editorial material and reviews. In case of local citation and global citation pattern article dominates the list followed by proceeding papers. Here interesting fact is that reviews stands sixth at contribution and in case of citation it stands 3rd which shows the importance of reviews in usage. The analysis says that there is a need of communicating research in letters, news items and book chapters which are easily accessible.

Historiograph of E-learning research

An attempt have been made to trace the evolution of E-learning research by constructing historiographs using HistCite software (developed by Garfield and colleagues) in conjunction with Web of Science. All 3070 papers have been considered. All the references quoted in these 3070 papers have been included. All the papers that have cited these 3070 papers as well as all the references quoted in those citing papers have been added. The resulting aggregate is called the E-learning Global Collection. The collection is exported to HistCite to obtain cited references along with their local and global citation scores (LCS and GCS).

Figure 1: Historiograph of E-learning research based on local citation scores LCS

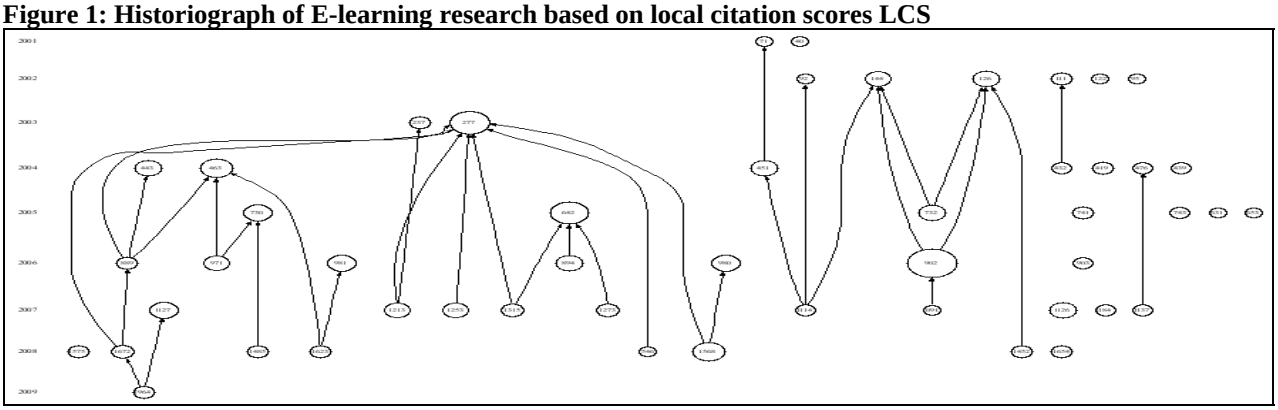


Figure 1-Nodes: 50, Links: 34 LCS, top 50; Min: 7, Max: 52 (LCS scaled)

S.No	Record No	Authors	LCS	GCS
1.	40	Cloete E, 2001, COMPUT EDUC, V36, P171	8	24
2.	71	Davis MH, 2001, MED TEACH, V23, P441	8	13
3.	92	Merrill MD, 2002, ETR&D-EDUC TECH RES, V50, P43	8	147
4.	95	Wild RH, 2002, IND MANAGE DATA SYST, V102, P371	7	30
5.	111	Forman D, 2002, NURS EDUC TODAY, V22, P76	10	17
6.	122	Coppola NW, 2002, J MANAGE INFORM SYST, V18, P169	8	57
7.	126	Harden RM, 2002, MED TEACH, V24, P261	17	58
8.	144	Clark D, 2002, MED TEACH, V24, P598	14	35
9.	237	Zhang DS, 2003, INFORM SYST FRONT, V5, P207	11	41
10.	277	Wang YS, 2003, INFORM MANAGE-AMSTER, V41, P75	34	96

Figure 1 is the Historiograph of E-learning research of world based on the 10 most highly cited papers in the E-learning Global Collection based on their LCS. It covers the period from 2000 to 2011. In this historiographs, the story begins with a paper by Cloete E in Journal computer education published in 2001. In this paper no.40 (2001), of Cloete E from Department of Computer Science and Information Systems, UNISA, South Africa has studied the influence of various technologies in learning. This paper has received 32 citations so far.

Figure 2: Historiograph of E-learning research based on local citation scores GCS

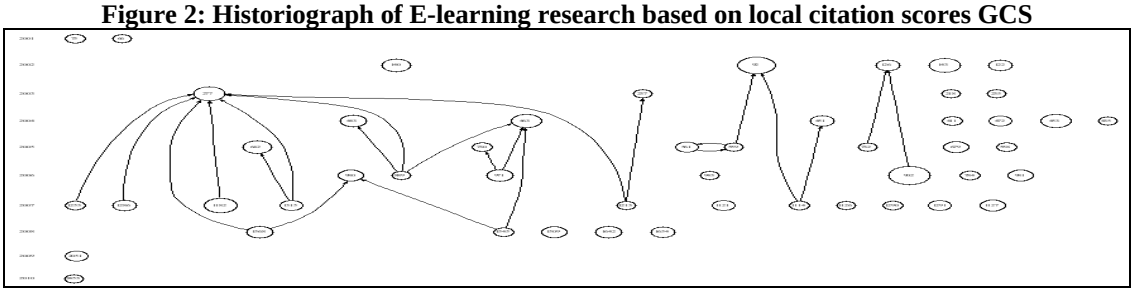


Figure 2 -Nodes: 50, Links: 23 GCS, top 50; Min: 37, Max: 162 (GCS scaled)

S.No	Record No	Authors	LCS	GCS
1.	66	Moore D, 2001, J INSECT PHYSIOL, V47, P843	0	39
2.	75	Amat J, 2001, BRAIN RES, V917, P118	0	47
3.	92	Merrill MD, 2002, ETR&D-EDUC TECH RES, V50, P43	8	147
4.	122	Coppola NW, 2002, J MANAGE INFORM SYST, V18, P169	8	57
5.	126	Harden RM, 2002, MED TEACH, V24, P261	17	58
6.	140	Vilalta R, 2002, ARTIF INTELL REV, V18, P77	0	83
7.	143	Riess P, 2002, NEUROSURGERY, V51, P1043	0	100
8.	218	De Laat M, 2003, INSTR SCI, V31, P7	0	37
9.	235	Shute V, 2003, EDUC PSYCHOL, V38, P105	6	38
10.	237	Zhang DS, 2003, INFORM SYST FRONT, V5, P207	11	41

Figure 2 is a similar Historiograph but based on the GCS. It includes period from 2000 to 2011. In this historiographs, the story begins with a paper by Moore D. In this paper no.66 (2001), Moore D Department of Biological Sciences, East Tennessee State University, USA has studied various learning mechanisms to understand the behavior of honey bee. This paper has received 39 citations so far.

Conclusion

As E-learning opened a new world for learning, from 1990s to till date there is a curios development in the area of E-learning research which is realized by this study. This study reflects the linear growth in the research as well as usage of the output. Collaboration pattern found in the E-learning research is really interesting and optimistic that we can understand by authorship pattern and histogram as there is huge network between researchers. Major portion of the research output communicated in journal papers followed by proceedings here there is a need of communicating research output in letters, news and other medias which can easily accessible. In case of countrywide output it is somewhat disappointing as it is concentrated in developed world and there is a need of huge initiation in developing and underdeveloped world. In case of India it is really unsatisfactory because being a IT hub of the world failed to place at least in the top ten position in E-learning research so there is a need of greater initiation to make use of Indian expertise to improve the performance in E-learning research.

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