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Research Trends in the Field of Literacy from 1917 To 2020

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Abstract

The aim of the present study was to explore the research trends in the field of “literacy”. From 1917 to June 2020, 3,35,893 documents were found by using “all fields” in Scopus. To explore the overall trend (of the 3,35,893 publications) we selected 9,52,642 keywords for categorization. Later we selected 32, 020 publications which represented the “literacy” word in only titles of the research documents. From these publications 74, 624 words were analyzed and arranged in eight (8) categories i.e., humans and subjects (43%), education (17%), literacy (8%), health (7%), information technology (6%), types of illiteracies (4%) and countries (3%). We calculated the percent relative growth rate (% RGR) and doubling (Dt) of the publications (after 2000). We also performed the detail bibliometric analysis of the two thousand (2000) most cited documents with focus on co-authorship, citations, co-citations, and co-words analysis. The list of top 50 authors, institutes, and countries (after 2000) with maximum number of publications and citations is also provided. The present report may provide a general idea about the trend and development in the field of literacy.

Keywords: Scopus, Literacy and Bibliometrics

1.0 Introduction

In 1983, Callon *et al.*, proposed the co-word maps as a significant analytical tool to study the growth and pattern of a particular field. The content of co-words analysis is one of the most applied and fundamental technique in bibliometric methods. It is mostly used to extract and manipulate data. Infact it provides the detail information about the trends in particular field (1, 2). Its worthy to note that co-word analysis is based on the fundamental assumption that a particular research field could abstract or contain a set of signal-words to present the literature and core contents. The frequency of words occurrence may present the important themes in a field. In other words, the more frequent the co-occurrence of keywords in the literature, the more similar the themes they indicate (3). It is also applied to broadly understand the publishing pattern either geographically, institutionally, or in different subject domains or disciplines like biotechnology, earthquakes, or science or to decode the development of a particular research field over a specific time period (4,5).

Similarly, the co-citation analysis has significant importance in evaluating the contributions of authors, countries, and performance of institutes in research domains. Co-citation expand the field of knowledge and provide opportunity to scientific researchers to focus and explore new fields in research such as journals, industries, and countries. Thus, it can help in evaluating new disciplines (4-6).

Various databases like Web of Science (WoS), Scopus or Google Scholar have made it very easy to perform bibliometric or bibliographic analysis. Similarly, various sophisticated softwares like Scival and InCites, Gephi (Bastian et al.2009), HistCite (Garfield 2009), “Publish or Perish” (Harzing 2010) or Scholarometer can be quantitatively applied to understand the trends and development of a particular field or source (Pellegrino 2011).

2.0 Material and Method

2.1 Source of Information

Scopus (Elsevier BV Company, USA) is the largest database of scientific literature. The data was retrieved between 15th & 20th June, 2020. The data was collected by the authors and downloaded in csv format. Later it was quantitatively and qualitatively analyzed in Microsoft Excel 2013 for access type, year, author name, document type, key words, affiliations and country.

2.2 VOSVeiwier Analysis or Visualization Maps

We used VOSviewer version 1.6.9 for viewing and creating the desired bibliometric maps. The software was developed by Van Eck and Waltman (2010) for constructing and visualizing bibliometric networks. For more information, please see <http://www.vosviewer.com/>. By default, at most 1,000 lines are displayed and represent the 1,000 strongest links between items. The distance between two items in the visualization approximately indicates the relatedness of the items. The results are presented as network visualization maps.

3.0 Results and Discussion

3.1 Part 1

The 1st research document about literacy was published in 1917. In Scopus search bar the word “literacy” was typed and the data in “all fields” options was obtained. From 1917 to 1999, only 25427 and from 2000 to June 2020 total 310466 documents are published. This show approximately 12 times increase in 19 years. After 2000, a significant and regular increase in the number of publications has been observed. The highest documents are published in 2019 (32555), followed by 2018 (29366) and 2017 (26828). While, the lowest number of publications are recorded in 2000 (3124), 2001 (3421) and 2002 (3877). We also calculated the relative growth rate (RGR) and after 2000, the average per year rate was found to be 13.32. Furthermore, the highest rates were observed for the years 2006 (26.02%), 2005 (25.24%) and 2009 (22.13%). The lowest rate was recorded for 2014 (2.01%), 2015 (5.20%) and 2006 (5.87%). In conclusion, total 3,35,893 documents were found (from 1917 to June 2020) as shown in Figure 1.

3.2 Part 2

In this part we retrieved data from scopus which contained the word “literacy” in the title of the publications. Precisely 32020 documents were found from 1917 to June 2020. However most documents (28766) are published from 2000 to 2020. Infact in the last decade (from 2010 to 2020), 20063 documents are indexed. Only 3254 are reported from 1917 to 1999. The data is shown in Figure 2. While, the list of top 50 authors, universities and countries is given in Table 1. Its worthy to note that the names of universities or countries is not associated with authors or does not represent their affiliations.

The highest number of documents are published in 2019 (2773) followed by 2018 (2573) and 2017 (2329). While the highest growth rate was observed for the year 2005 (22.74%) followed by 2007 (21.76%) and 2009 (21.675). We can summarize that approximately 12.33 % per year growth was recorded (from 2000 to 2019). The details of RGR and doubling time (Dt) are given in Tables 2 & 3.

And since the number of publications increased from 1990, therefore in Figure 3, we focused on the details from 1991 to 2010 and from 2010 to 2020 for both parts as mentioned above.

3.3 Keywords Analysis

The co-occurrence of words has been considered as index of concept and their associations. According to Callon, Cour-tial, and Penan (1993) the co-words are “second-order scientometric indicators” which facilitates researchers to compare various text bodies such as scientific articles, conference papers, policy documents etc..[10]. In a similar way, co-word linkages have been suggested as an alternative method to citation and co-citation showing the relation between scientific documents. There is considerable literature which confirms that words co-occurrence cover much broader domain than citations. [11].

The analysis of co-words is based upon the assumption that keywords of any scientific document not only gave adequate elucidation about the content of paper but also link the established problems in documents. Furthermore, it indicates connection of topics, which they refer, between any two papers. The presence of co-occurrence of words around same words in any document indicate affiliation between papers, consequently refers to the research theme. In any specific discipline, co-words reveals trends and patterns among publications of relevant fields [12].

The logical question is what has been covered in the literacy field? For the purpose, we performed the detail keywords analysis. Broadly we explored the trends in two categories.

Part 1

In this section we analyzed the keywords from all fields i.e. from titles to references. From Scopus total 9,52,642 keywords of 3,35,893 published documents were obtained. After critical analysis we divided it in ten (10) categories. Some of the major categories are described below and details are provided in Table. 4 and Figure 4.

By a closer inspection of the per year data, it was observed that most of the documents are published after 2000. Infact 92.43 % documents (310466) are reported after 2000. Therefore we collectively analyzed the keywords of all publications.

3.3.1 Subjects

In this category different words like human, humans , male, female, child, adult, young, parents, infants etc.. were compiled. This was found to be the major category comprising of 3,31,069 words which represented 35% of keywords.

3.3.2 Education

23 % of words (218081) were added in this category. Some of the common words with exact numbers are education (19522), teaching (10652), reading (9759), learning (7239), student (4067), knowledge (3673), writing (3279) and teacher education (2219) etc..

3.3.3 Health

Health was found to be the third major category comprising of health status (2402), health care (2114), patient education (6010), self care (3091), health education (4908), pathophysiology (1916) and clinical trials (2506) etc.. Precisely 17% of keywords were indexed under the “health” title.

3.3.4 Literacy

Different words like literacy (8770), information literacy (4307), computer literacy (2296) and health literacy (10987) were compiled in this category.

3.3.5 Areas or disciplines

We added the words statistics (2600), economics (2559), ethnology (2872) and technology (2850) etc.. in this category which represented 3% of the total keywords.

Part 2

We obtained 74,624 keywords from the titles of 32,020 documents, which were published from 1917 to June 2020. They are compiled in the following major categories and the details are shown in Table 5 and Figure 5.

Similarly, its worthy to note that most of the documents (28766) are published after 2000, therefore for a general description we analyzed all keywords (from 1917-2020).

3.3.6 Humans and subjects

In this category we added the words human (6352), male (3600), female (3936), adult (2943), parents (258), age (313), infants (192) and children (210) etc.. Total 32067 words (43%) were compiled in this category.

3.3.7 Education

The keywords in this group represented the 2nd highest category. Some of the highlighted words include but not limited to education (2210), reading (1577), students (1481), teaching (1085), learning (553), writing (417) and curricula (435).

3.3.8 Literacy

In this category total 6130 words were added. Some of the examples are literacy (3360), critical literacy (199), libraries (249) and language development (255) etc...

3.3.9 Health

Some of the examples in this category are health literacy (4443), health (395), self care (390), controlled study (1263), major clinical study (1409) and health survey 297) etc...

3.3.10 Information technology

This represents an interesting development in the core contents of the literature which covered 6 % of the total keywords. The details are provided in Table 5. Some of examples are e-learning (381), computer literacy (453), information science (431), information literacy (2186), technology (258) and information technology (204). Total 4285 words are added in this category which represents 6 % of the total key words.

Its worthy to note that various categories for example humans and subjects, educations, health, literacy and areas or types of studies and countries remained constant from 1917 to 2020 with quantitatively a significant alteration is noticed.

For further detail analysis, we selected another category which can be termed as computer era or information technology etc...From 1917 to 1999, this set of keywords contained a common “computer” word. While from 2000 onwards, different words like, internet, technology, social media, social status and information technology etc.. can be observed. For comparison the details with numbers are given in Table. 6

The same tendency can be observed for the titles of the manuscripts, we retrieved the following keywords reflecting the computer science or information technology area as shown in [Table 7](#).

3.4 Co-authorships network for authors

Co-authorship analysis is a fundamental tool in bibliometrics analysis. It gives direct information about the research collaboration and status of a particular field. (7)

Its worthy to note that in 2000 publications 4738 authors have contributed. Precisely, 112 authors have atleast 5 publications or 23 authors have contributed in 10 publications with 200 citations. The cooperation or collaboration network of the authors in the stated field (literacy) is mapped in Figure 6. Its worthy to note that 23 authors are grouped in eight (8) clusters, where cluster 1 has 6 items and cluster 2, 3 and 4 have 4 items merged together. The figure represents the co-authorship network of 23 authors. The size of the nodes represents the number of publications with the word literacy in their titles. In the case of co-authorship links, the higher the value, the higher the number of publications the two researchers have co-authored. Numerically the data is presented in Table 8, with number of publications, citations and total link strength of the top 20 authors. Wolf M.S. has the highest number of publications (46), followed by Baker D.W (31) and Davis T.C (24).

Institutional and country co-authorship analysis can reflect the degree of communication between influential institutes or broadly the countries. In institutional category, more than one thousand (1000) affiliations were recorded. More than 1200 are more United States. 27 of them have atleast 5 publications with atleast 200 citations. University Of Michigan, United States has the highest number of publications (15), followed by Division of General Internal Medicine, Feinberg School Of Medicine, Northwestern University, Chicago, Il, United States (12) and Harvard Graduate School of Education, United States with 11 publications. The detailed list of the top 20 institutions is given in Table 9. Apart from University of Sheffield, United Kingdom and Centre for Mental Health Research, Australian National University, Canberra, Act 0200, Australia, Eighteen (18) institutes are from United States.

While in countries category, twenty four (24) countries have contributed atleast 10 publications with four hundred (400) citations. Based on total publications (1253), citations (119294) and total link

strengths (129) USA was found to be the top ranked country followed by United Kingdom and Australia. The details of the top countries are given in Table 10. While, the data about their co-authorship network, representing the link strength is given in Figure 7.

3.5 Citation and Co-citation Analysis

3.5.1 Citation and Co-citation Analysis of top 20 documents

Citation analysis can be carried out using four different units in bibliometric analysis such as documents, authors, countries, and institution of affiliation. The major objective was, to identify the most influential papers in total publications, on the basis of citations.

427 publications were found with atleast 100 citations, or 130 documents showed atleast 200 citations, or 69 with 300 or 46 with 400 or 33 with 500 or 25 with 600 or 19 with 700 or 13 with 800 citations are recorded. The details of the top 20 documents are described in Table 11.

The appearance of two or more references or authors in same bibliography is term as co-citation. Co-citation analysis is a form of quantitative bibliometrics. This technique is used to analyse the structures of scientific research (8). It also determines the similarity of content among authors and references and shows proximity of content in any two publications. Co-citation is a reliable indicator in terms of subject similarity as it reflects the opinion of many authors. Co-citation analysis has the potential for detecting evolutionary pattern. Its worthy to note that co-citation of documents may also confirm the relevance and growth of a particular field (9, 10). The list of top 20 most co-cited documents with citations and total link strength is given in Table 12.

3.5.2 Citations and Co-Citations Analysis of Journals

We also performed the citation analysis of the sources or journal in 2000 publications. The details are provided in Table 13. Total 695 sources were cited in all documents. 32 sources were found to have atleast 10 publications with 1000 citations. Interestingly the names of the sources or journals may reflect the relevant research domains dealing with literacy. The examples are, American Educational Research Journal, American Journal Of Health Behavior, BMC Public Health, Child Development, College And Research Libraries and Computers And Education etc..

The co-citations analysis of sources is also performed. In this category total 31439 sources were identified. 86 of them have published atleast 100 documents or 31 sources published 200 documents. The list of the co-citation sources with number of citations and total link strength is depicted in table 14 . Some of the highest co-cited sources are Journal Of Educational Psychology, Reading Research Quarterly, Child Development, Developmental Psychology, Early Childhood Research Quarterly, Journal Of General Internal Medicine, Journal Of Research In Science Teaching and Journal Of Experimental Child Psychology (11-13).

3.6 Co-words Analysis of Titles, Abstract and Keywords of 2000 Research Documents

3.6.1 Titles

Total 4340 words are found in the titles of 2000 research documents. 109 of them repeated at least 10 times. The map is described in Figure 8. Some of the highlighted words are literacy (560), health literacy (286), child (147), study (116), effect (114), language (105), development (100), information literacy (96), patient (88), education (81), relationship (72), literacy skill (70), knowledge (69) and literacy development (62).

3.6.2 Abstract

While, in abstracts, total 27895 words were noted. 71 of them repeated at least 100 times. Some of the words are study (1020), literacy (987), child (506), analysis (505), skill (490), level (488), knowledge (453), research (428), development (423), education (421), health literacy (419), information (375) and practice (359) Figure 9.

3.6.3 Keywords

It is worthy to note that the keywords were analyzed both manually and by Vosviewer. In manual analysis, total 4466 keywords were retrieved from scopus and categorized in six major categories i.e. literacy (37%), education (24%), social life (9%), subjects (8%), technology (8%) and health (4%). The details are presented in Figure 10.

However to find the co-occurrence network, we also analyzed it by Vosviewer. Total 5116 are recorded in 2000 documents. 35 words repeated at least 100 times. Human, male, female, adult, health, health literacy, aged, education, child etc... repeated regularly. The detailed network is depicted in Figure 11.

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- Figure 1: The publications from 1917 to 2020 in “All” categories. All” is a search option in scopus.
- Figure 2: The publications from 1917 to 2020 in “titles”. In scopus search options, we restricted it to Only “titles”
- Figure 3: The number of publications after 1991 to 2010 and from 2011 to 2020 in;
A=“All” categories. All” is a search option in scopus.
B= “Titles”, In scopus search options, we restricted it to Only “titles”
- Figure 4: Categorization of keyword in “All” documents. All” is a search option in scopus.
- Figure 5: Categorization of keyword in “titles” of the documents.
- Figure 6: The co-authorship network in the top 2000 most cited documents.
- Figure 7: The Co-authorship network describing the countries in the top 2000 most cited documents.
- Figure 8: Collection of different words in the titles of the top 2000 cited documents
- Figure 9: Collection of different words in the abstract of the top 2000 cited documents
- Figure 10: Collection of different words in the keywords of the top 2000 cited documents
- Figure 11: Categorization of all keywords obtained from the top 2000 cited documents

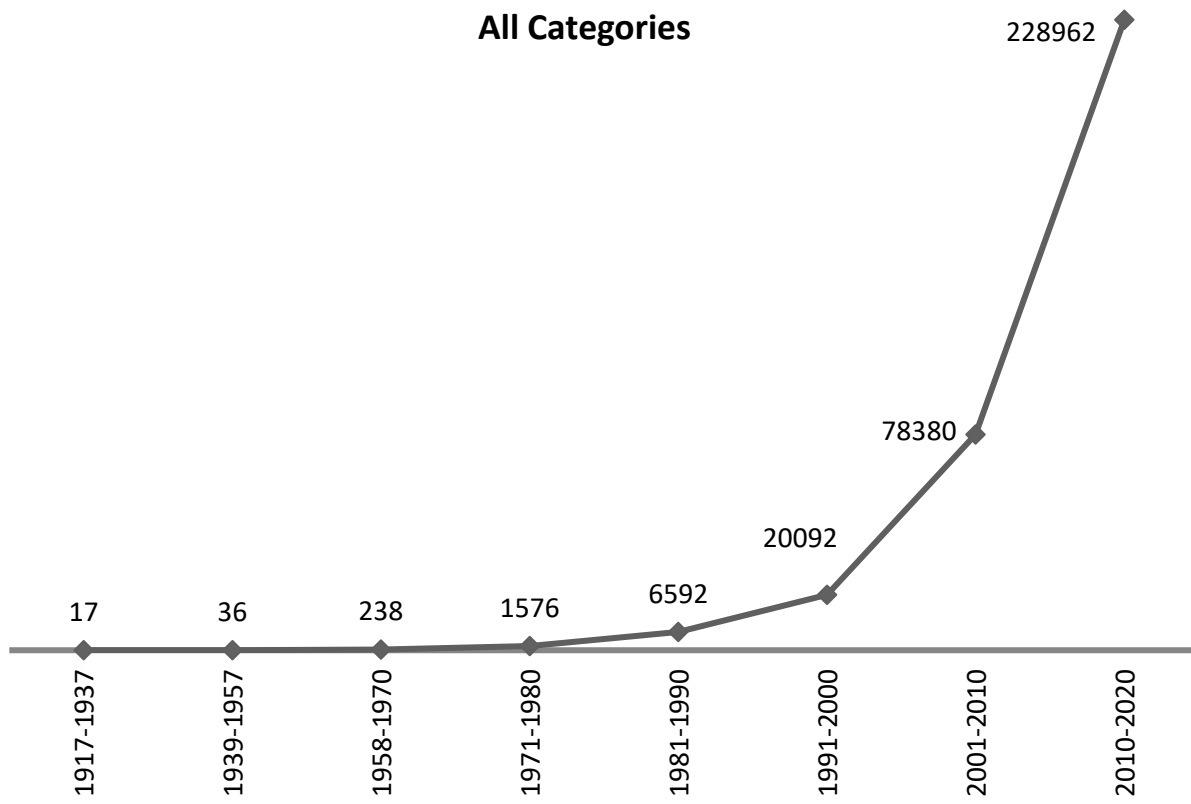


Figure 1: The publications from 1917 to 2020 in “All” categories. All” is a search option in scopus.

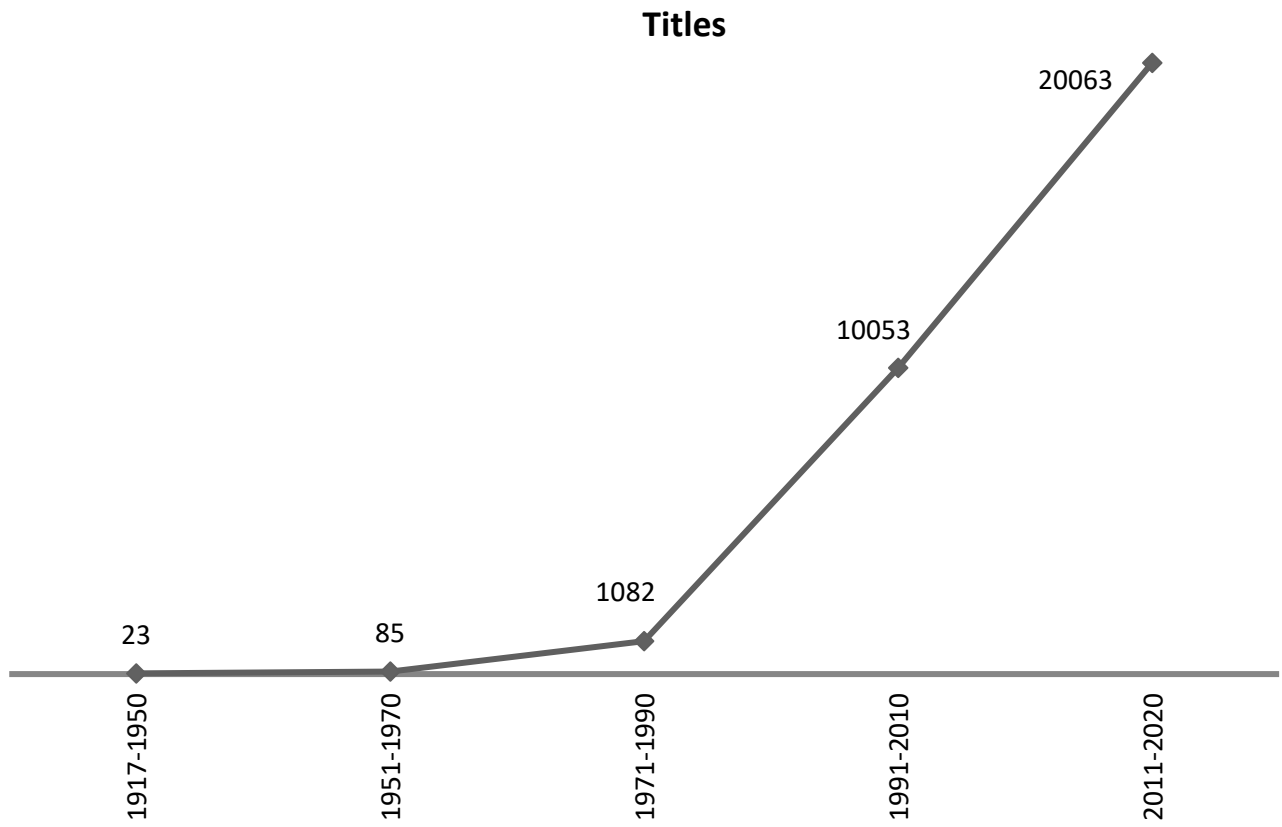


Figure 2: The publications from 1917 to 2020 in “titles”. In scopus search options, we restricted it to Only “titles”

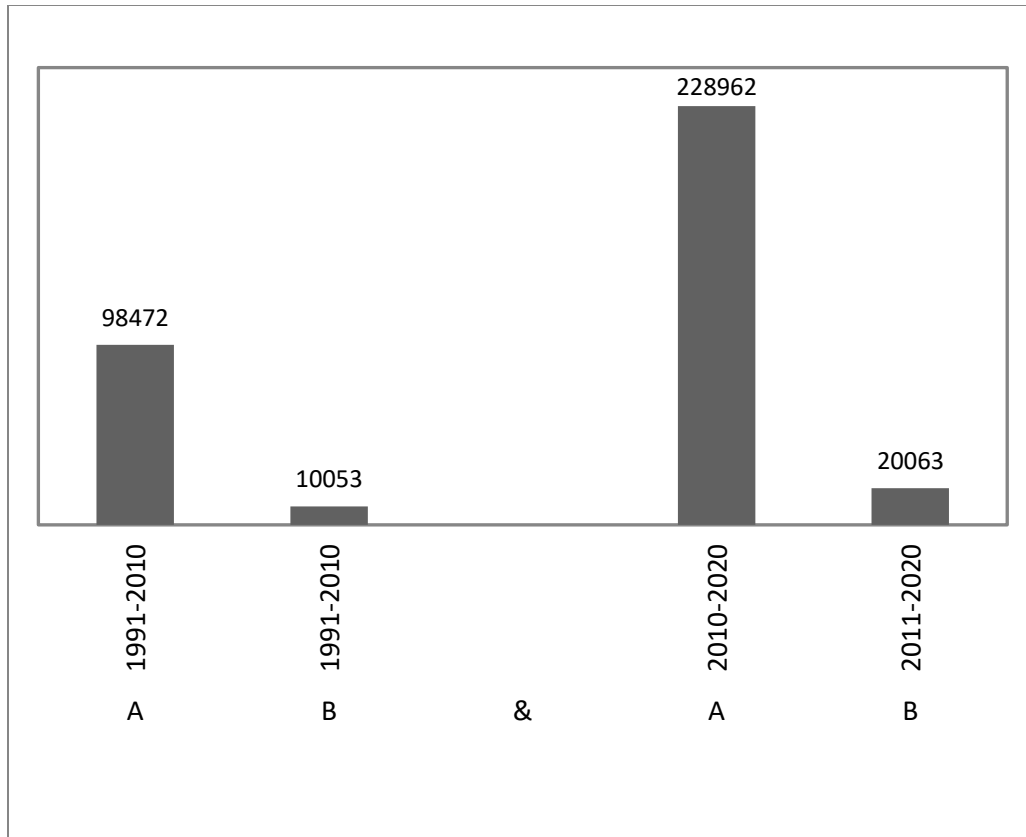


Figure 3: The number of publications after 1991 to 2010 and from 2011 to 2020 in; A=“All” categories. All” is a search option in scopus.
 B= “Titles”, In scopus search options, we restricted it to Only “titles”

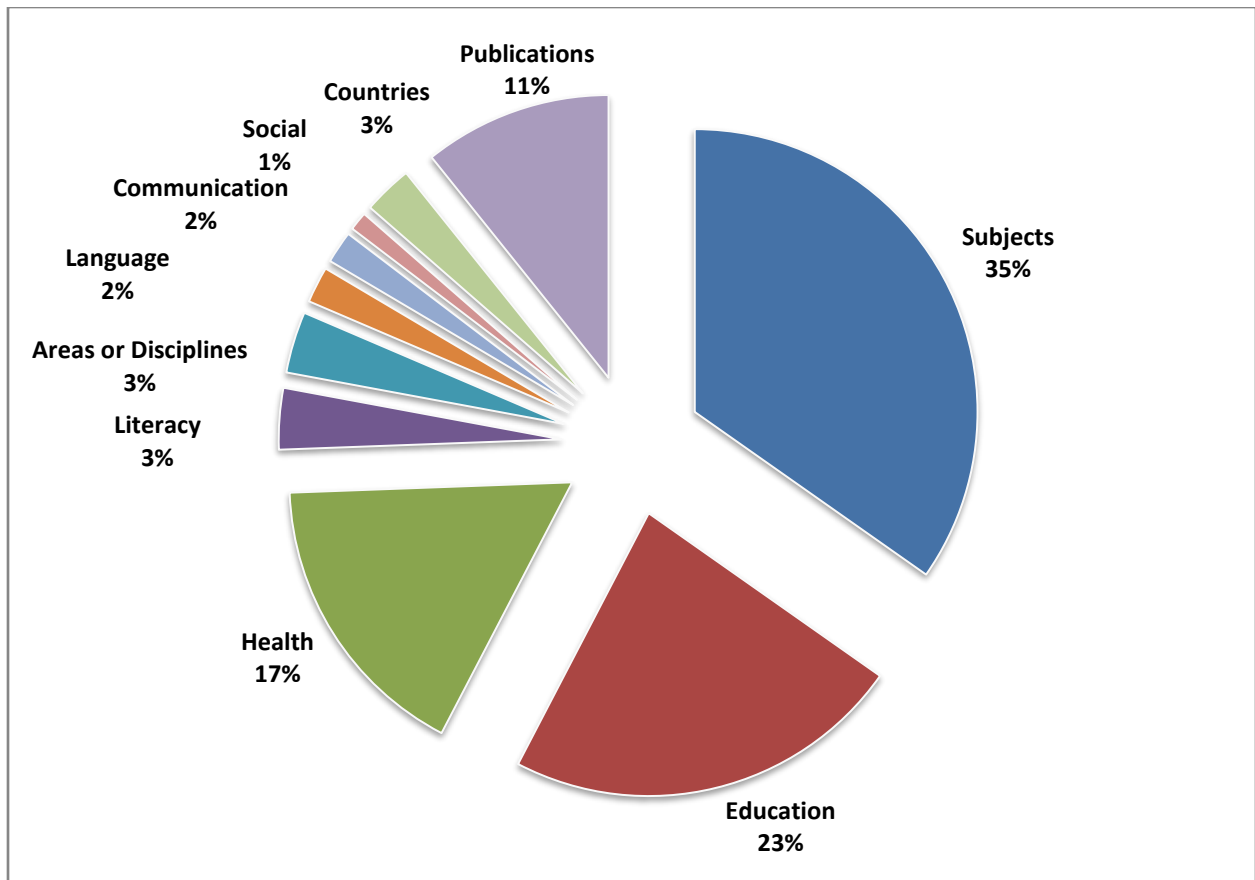


Figure 4: Categorization of keyword in “All” documents. All” is a search option in scopus.

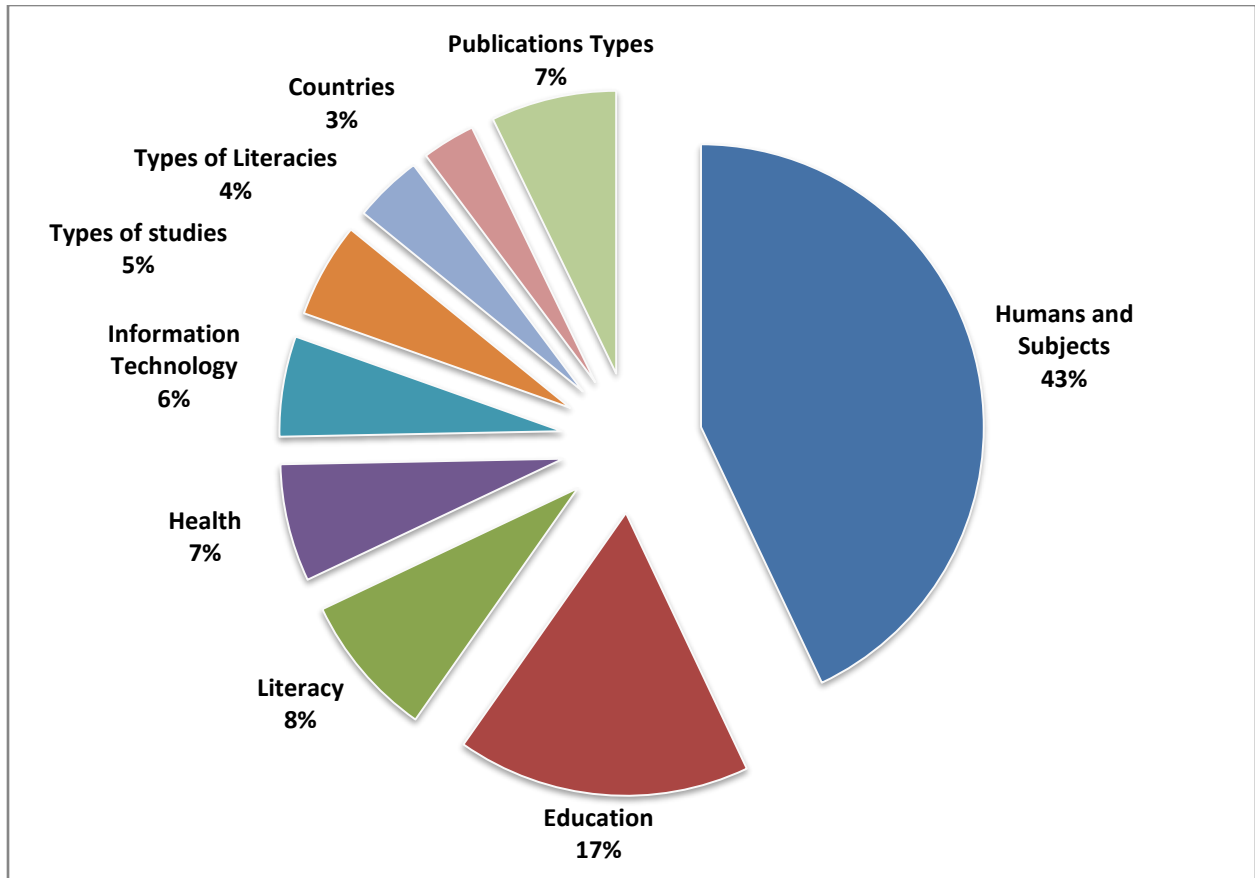


Figure 5: Categorization of keyword in “titles” of the documents.

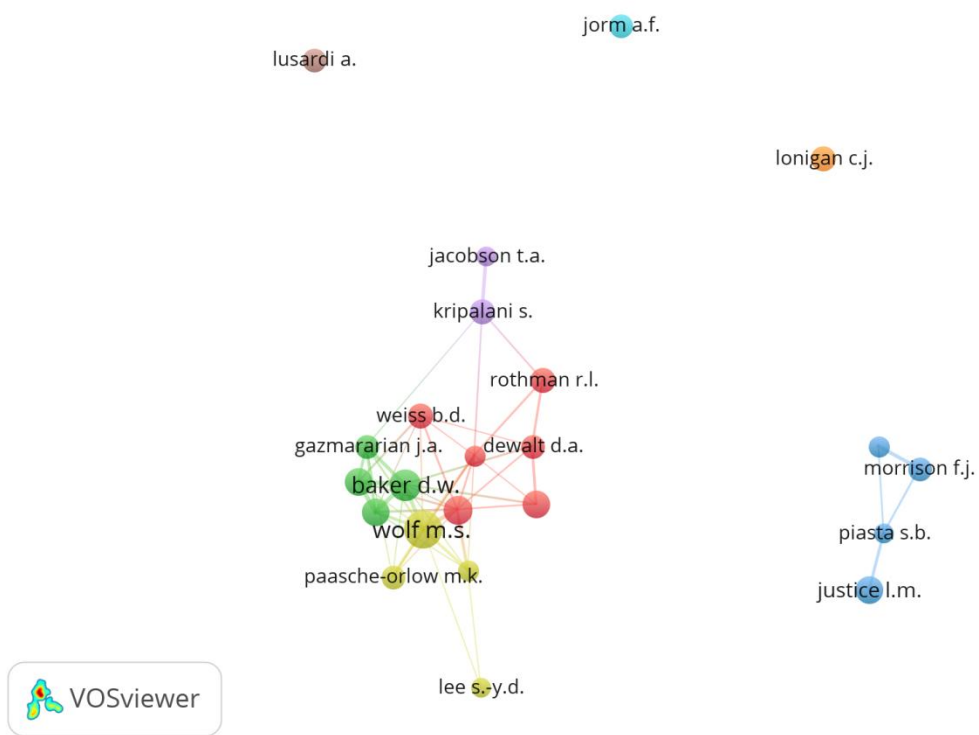


Figure 6: The co-authorship network in the top 2000 most cited documents.

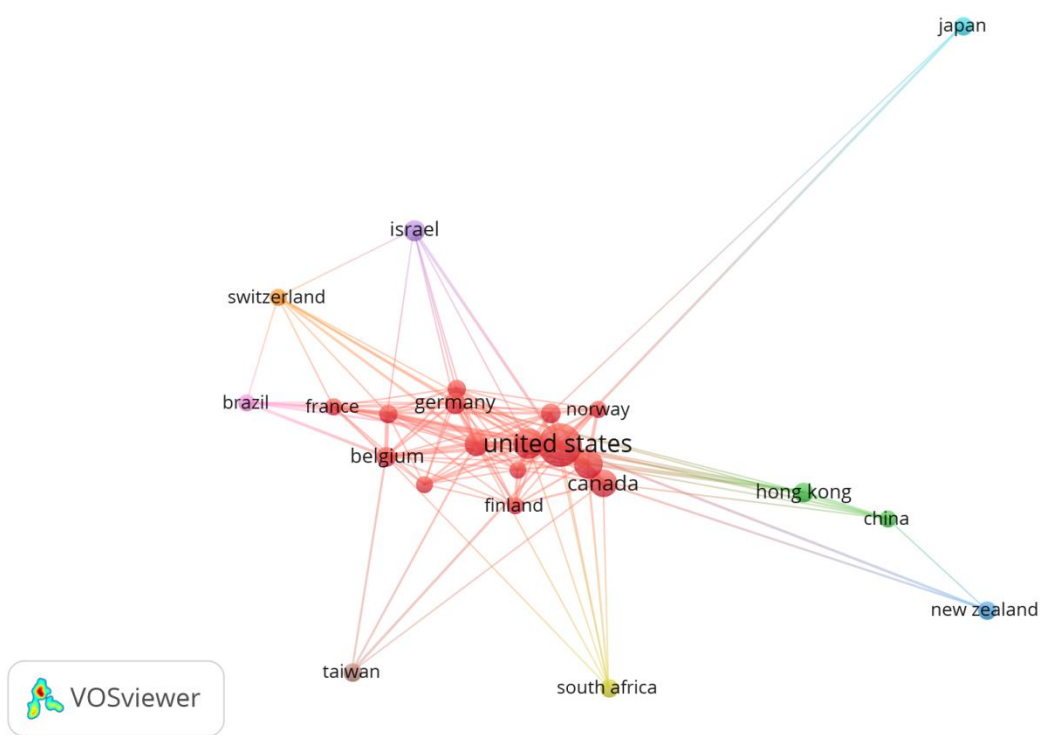


Figure 7: The co-authorship network describing the countries in the top 2000 most cited documents.

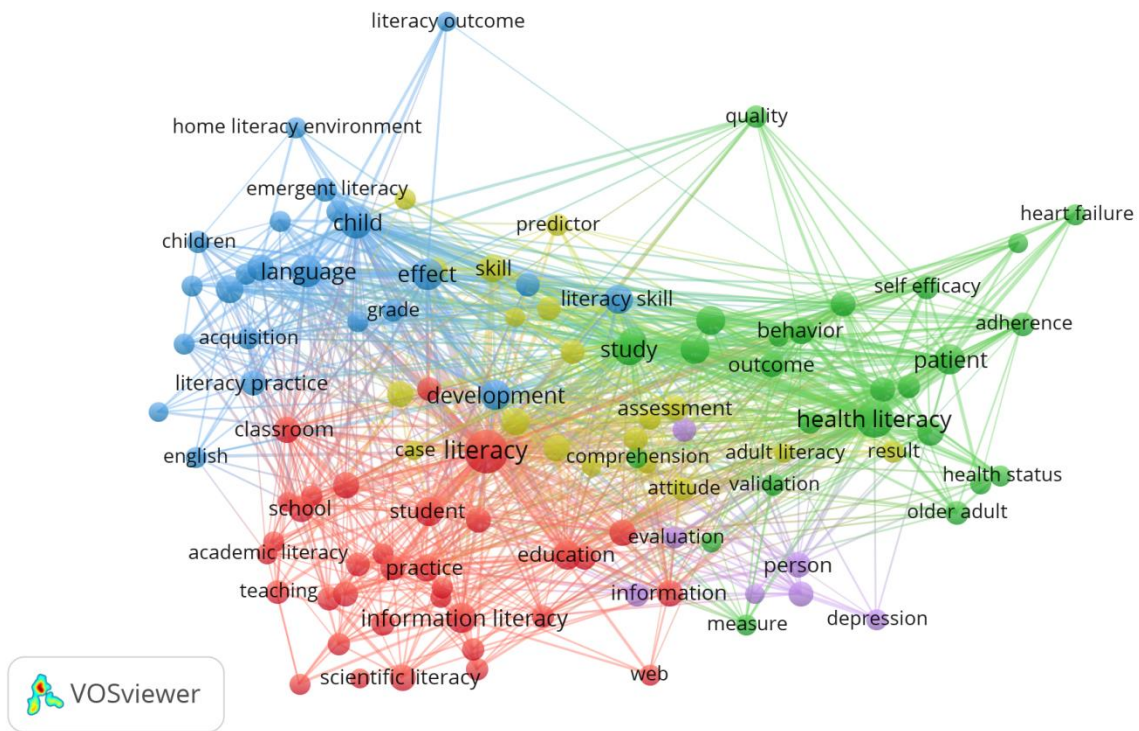


Figure 8: Collection of different words in the titles of the top 2000 cited documents

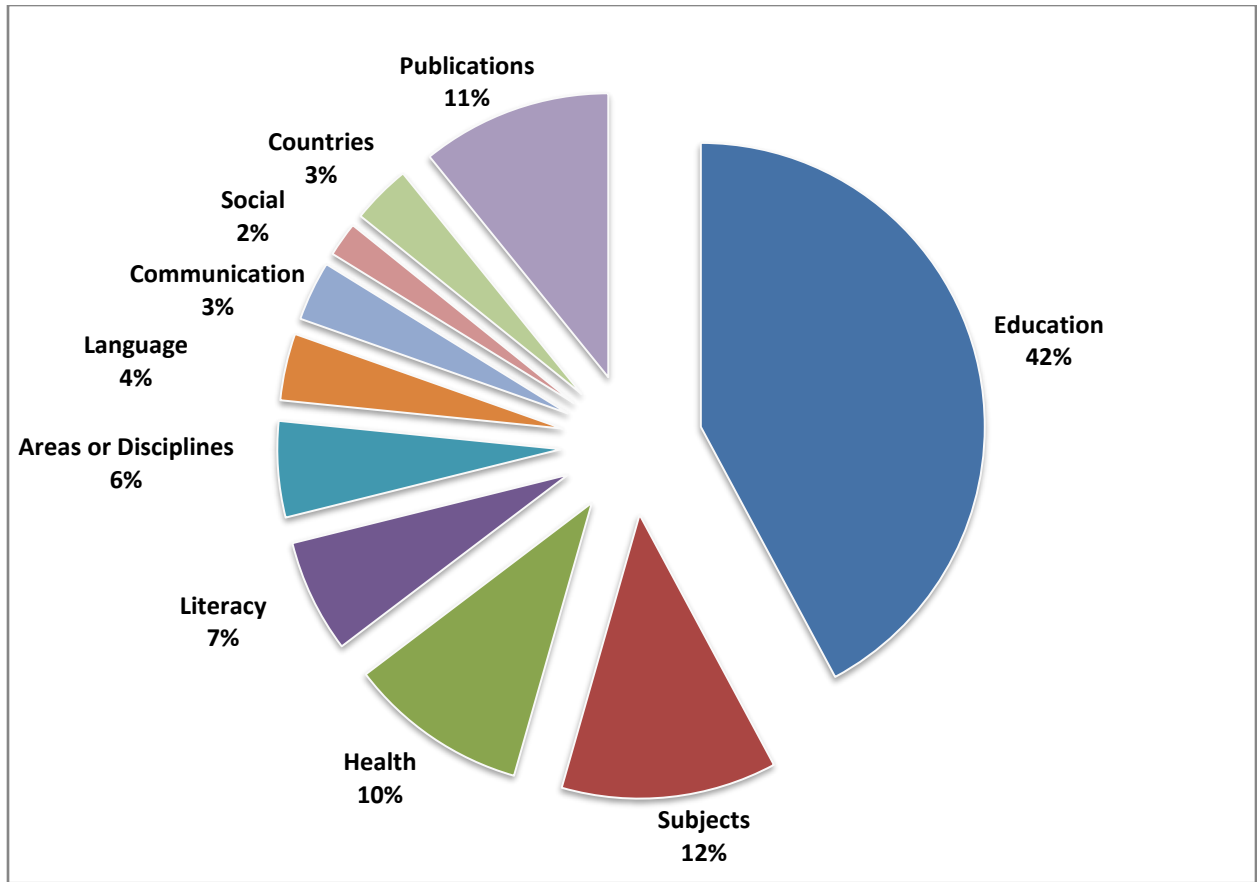


Figure 11: Categorization of all keywords obtained from the top 2000 cited documents

Table 1:	The list of top fifty (50) authors, institutes and countries involved in publications. The names of universities and countries does not describe affiliations of the authors
Table 2:	The relative growth rate (RGR) of publications after 2000
Table 3:	The doubling time (Dt) of publications after 2000
Table 4:	The list of the categories and key words with the number of times of appearance. The data covers the publication record of “All” documents. “All” is a search option in scopus.
Table 5:	The list of the categories and key words with the number of times of appearance. The data covers the publication record of documents which covered the “titles”. In scopus search options, we restricted it to Only “titles”
Table 6:	Comparison of different keywords categorized under the title “technology” from 1917 to 1999 and from 2000 to 2020. The data covers the publication record of “All” documents. “All” is a search option in scopus.
Table 7:	Comparison of different keywords categorized under the title “technology” from 1917 to 1999 and from 2000 to 2020. The data covers the publication record of “titles” documents. In scopus search options, we restricted it to Only “titles”
Table 8:	The list of top 20 authors with number of publications, citations and total link strength
Table 9:	The list of top 20 institutes with number of publications, citations and total link strength
Table 10:	The list of top 20 countries with number of publications, citations and total link strength
Table 11:	The list of top 20 most cited documents with number of citations and links
Table 12:	The list of top 20 most co-cited references with number of citations and links
Table 13:	The list of top 20 most cited sources
Table 14:	The list of top 20 most co-cited sources

S#	Author name	#	Affiliation	#	Country	#
1.	Wolf, M.S.	99	The Ohio State University	305	United States	14439
2.	Justice, L.M.	73	University of Toronto	250	United Kingdom	2813
3.	Paasche-Orlow, M.K.	67	The University of North Carolina at Chapel Hill	250	Australia	2402
4.	Parker, R.M.	53	University of Michigan, Ann Arbor	227	Canada	1717
5.	Kripalani, S.	52	The University of Texas at Austin	224	Indonesia	655
6.	Osborne, R.H.	51	The University of British Columbia	222	Germany	626
7.	Schillinger, D.	49	The University of Georgia	218	South Africa	528
8.	Baker, D.W.	43	Michigan State University	210	China	511
9.	Pinto, M.	42	University of Illinois at Urbana-Champaign	205	Spain	505
10.	Rowlands, G.	42	Northwestern University	204	Brazil	498
11.	Weiss, B.D.	42	Queensland University of Technology QUT	204	Netherlands	437
12.	Comber, B.	41	University of Melbourne	200	Taiwan	396
13.	Davis, T.C.	41	Columbia University in the City of New York	194	Turkey	395
14.	Rothman, R.L.	40	Monash University	192	New Zealand	361
15.	Schulz, P.J.	39	Deakin University	184	India	344
16.	Lonigan, C.J.	38	The University of Sydney	183	Japan	303
17.	Nutbeam, D.	38	University of Pennsylvania	181	Sweden	300
18.	Jorm, A.F.	37	University of Wisconsin-Madison	181	Hong Kong	292
19.	SÃrensen, K.	36	Florida State University	179	Malaysia	289
20.	Verhoeven, L.	36	Arizona State University	172	Israel	277
21.	Rudd, R.E.	33	Purdue University	170	Norway	260
22.	DeWalt, D.A.	31	University of Maryland	164	Italy	257
23.	Lloyd, A.	31	Griffith University	156	South Korea	252
24.	Marsh, J.	31	The University of Arizona	154	Finland	231
25.	Piasta, S.B.	31	University of Illinois at Chicago	154	Portugal	229
26.	Rowsell, J.	31	City University of New York	153	Iran	225
27.	Luke, A.	30	University of California, Los Angeles	149	France	221
28.	Alvermann, D.E.	29	University of Sheffield	148	Singapore	212
29.	Aram, D.	29	University of California, Berkeley	148	Switzerland	197

30.	Korat, O.	29	Northwestern University Feinberg School of Medicine	140	Belgium	192
31.	Lusardi, A.	29	University of Minnesota Twin Cities	136	Denmark	178
32.	Yin, H.S.	28	Vanderbilt University	135	Ireland	173
33.	Furnham, A.	27	Universitas Pendidikan Indonesia	134	Nigeria	162
34.	Hamilton, M.	27	University of Washington, Seattle	133	Mexico	148
35.	Morrison, F.J.	27	The University of Queensland	133	Croatia	138
36.	Burnett, C.	26	University of London	130	Greece	135
37.	Julien, H.	26	Georgia State University	129	Thailand	123
38.	Moje, E.B.	26	UCL	129	Russian Federation	110
39.	Saracho, O.N.	26	University of Alberta	129	Austria	108
40.	Buchbinder, R.	25	The University of Hong Kong	128	Czech Republic	102
41.	Connor, C.M.D.	25	University of South Australia	127	Colombia	89
42.	Hobbs, R.	25	University of Florida	126	Pakistan	85
43.	Kaphingst, K.A.	25	University of Virginia	123	Chile	84
44.	Bruce, C.	24	UCL Institute of Education	121	Poland	80
45.	Dreyer, B.P.	24	Texas A&M University	120	Slovakia	75
46.	Majid, S.	24	University of Colorado Boulder	116	Slovenia	74
47.	Neumann, M.M.	24	Nanyang Technological University	115	United Arab Emirates	71
48.	Bailey, S.C.	23	Indiana University Bloomington	114	Saudi Arabia	57
49.	Gazmararian, J.A.	23	Emory University	112	Hungary	54
50.	Mackert, M.	23	University of Victoria	112	Ghana	45

Table 1: The list of top fifty (50) authors, institutes and countries involved in publications. The names of universities and countries does not describe affiliations of the authors

Year	#	%age	RGR	% Growth
2000	375	42.28		
2001	391	44.08	0.04	4.27
2002	464	52.31	0.19	18.67
2003	564	63.59	0.22	21.55
2004	686	77.34	0.22	21.63
2005	842	94.93	0.23	22.74
2006	772	87.03	-0.08	-8.31
2007	940	105.98	0.22	21.76
2008	1043	117.59	0.11	10.96
2009	1269	143.07	0.22	21.67
2010	1357	152.99	0.07	6.93
2011	1517	171.03	0.12	11.79
2012	1643	185.23	0.08	8.31
2013	1980	223.22	0.21	20.51
2014	1830	206.31	-0.08	-7.58
2015	1949	219.73	0.07	6.50
2016	2210	249.15	0.13	13.39
2017	2329	262.57	0.05	5.38
2018	2573	290.08	0.10	10.48
2019	2773	312.63	0.08	7.77
2020	1259	141.94	-0.55	-54.60

Table 2: The relative growth rate (RGR) of publications after 2000

Years	Numbers	Cumulative	W1	W2	R(a) W2- W1	Mean R(a)(1-2)	Doubling Time Dt(a)	Mean Dt(a)(1-2)
2000	375	375	0.0	5.9	0.0		0.0	
2001	391	766	5.9	6.6	0.7		1.0	
2002	464	1230	6.6	7.1	0.5		1.5	
2003	564	1794	7.1	7.5	0.4		1.8	
2004	686	2480	7.5	7.8	0.3		2.1	
2005	842	3322	7.8	8.1	0.3		2.4	
2006	772	4094	8.1	8.3	0.2		3.3	
2007	940	5034	8.3	8.5	0.2		3.4	
2008	1043	6077	8.5	8.7	0.2		3.7	
2009	1269	7346	8.7	8.9	0.2	0.2	3.7	4.4
2010	1357	8703	8.9	9.1	0.2		4.1	
2011	1517	10220	9.1	9.2	0.2		4.3	
2012	1643	11863	9.2	9.4	0.1		4.6	
2013	1980	13843	9.4	9.5	0.2		4.5	
2014	1830	15673	9.5	9.7	0.1		5.6	
2015	1949	17622	9.7	9.8	0.1		5.9	
2016	2210	19832	9.8	9.9	0.1		5.9	
2017	2329	22161	9.9	10.0	0.1		6.2	
2018	2573	24734	10.0	10.1	0.1		6.3	
2019	2773	27507	10.1	10.2	0.1		6.5	
2020	1259	28766	10.2	10.3	0.0		15.5	

Table 3: The doubling time (Dt) of publications after 2000

Education		Health		Subjects	
Education	19522	Major Clinical Study	14489	Human	67921
Teaching	10652	Attitude To Health	7435	Humans	50568
Reading	9759	Health Knowledge, Attitudes, Practice	6218	Female	42509
Learning	7239	Health Promotion	3837	Male	38639
Educational Status	6545	Patient Education As Topic	3582	Adult	29033
Preschool Child	6102	Health Care Delivery	3491	Child	15522
child,preschool	5701	Patient Care	3281	Adolescent	12656
Health Education	4908	Mental Health	3134	Young Adult	8635
E-learning	4085	Health Care Personnel	2883	Parents	2118
Student	4067	Patient Compliance	2877	Human Experiment	6904
Questionnaires	3858	Patient Attitude	2806	Children	3029
Interview	3707	Health	2756	Infant	3217
Knowledge	3673	Health Care Quality	2649	Child Development	2213
Engineering Education	3607	Public Health	2603	Gender	3379
Curricula	3359	Health Status	2402	Sex Difference	2427
Higher Education	3282	Doctor Patient Relation	2342		288770
Writing	3279	Health Service	2303	Diseases	
Information Processing	3272	Health Care	2114	Diabetes Mellitus	2156
Assessment	2754	Patient Satisfaction	1989	Depression	3576
Longitudinal Study	2474	Health Services Accessibility	1895	Dyslexia	3128
Vocabulary	2420	Pregnancy	2032		8860
Teacher Education	2219	Health Behavior	3042	Literacy	
School Child	2209	Clinical Trial	2506	Health Literacy	10987
Professional Development	2141	Clinical Article	4362	Literacy	8770
Learning Systems	2111	Treatment Outcome	2492	Information Literacy	4309
School	2100	Patient Education	6010	Computer Literacy	2296
Medical Education	2068	Risk Factor	4785	Human Computer Interaction	3771
Information Technology	2036	Risk Factors	3625	Information Processing	3272
Education Computing	2018	Risk Assessment	2832		33405

Academic achievement	2016	Randomized Controlled Trial	3862		
Cross-sectional Study	6319	Medical Information	3649	Countries	
Cross-Sectional Studies	5133	Self Care	3091	United Kingdom	2016
Outcome Assessment	3456	Health Survey	3117	China	2014
Comprehension	4763	Health Education	4908	India	2382
Controlled Study	15283	Pathophysiology	1916	Australia	2936
Cognition	4414		127315	African American	2176
Comparative Study	3316			United States	9680
Methodology	4794	Areas or Disciplines		Developing Countries	2218
Problem Solving	1979	Statistics	2600	Demography	3407
Self Report	2101	Economics	2559		26829
Practice Guideline	2237	Statistics And Numerical Data	4678		
Skill	2406	Ethnology	2872	Language	
Standards	2733	Technology	2850	Language	6542
Perception	3504	Physiology	3735	Language Development	2978
Motivation	3584	Psychology	10116	Phonetics	2624
Organization And Manag.	3959	Psychological Aspect	4030	Culture	2285
Decision Making	5124		33440	Hispanic	2174
Follow Up	3490			Linguistics	3141
Awareness	2921	Social			19744
Quality Of Life	3382	Social Support	2473	Age	
	218081	Self Concept	2512	Middle Aged	15891
Publications		Social Media	2572	Aged	13352
Priority Journal	15347	Social Status	2644	Age	3828
Review	7437		10201	Very Elderly	2909
Socioeconomics	4700	communication		Age Factors	2396
Socioeconomic Factors	4379	Communication	4734	Aged, 80 And Over	3923
Procedures	7397	Interpersonal Communication	4048		42299
Systematic Review	2526	Computer Aided Instruction	1924		
Surveys	2364	Internet	6873		

Cohort Analysis	2300		17579		
Qualitative Research	4041				
Research	2550				
Article	44837				
Surveys And Questionnaires	4645				
	102523				

Table 4: The list of the categories and key words with the number of times of appearance. The data covers the publication record of “All” documents. “All” is a search option in scopus.

Humans and Subjects		Health		Information Technology	
Human	6352	Health		Information Literacy	2186
Humans	4815	Health Literacy	4443	Priority Journal	1228
Female	3936	Major Clinical Study	1409	Information Science	431
Male	3600	Controlled Study	1263	Interpersonal Communication	460
Human Experiment	734	Health Knowledge, Attitudes, Practice	1136	Internet	584
Middle Aged	1804	Attitude To Health	1117	Statistics And Numerical Data	580
Adult	2943	Patient Education	868	Digital Literacy	489
Aged	1576	Psychology	770	Computer Literacy	453
Adolescent	1108	Medical Information	684	E-learning	381
Child	1078	Health Promotion	617	Human Computer Interaction	318
Young Adult	831	Patient Education As Topic	510	Digital Literacies	307
Aged, 80 And Over	468	Health Behavior	446	Technology	258
Preschool Child	423	Health Status	433	Education Computing	239
Child, Preschool	411	Health	395	Computers	236
Very Elderly	334	Self Care	390	Information Processing	236
Age	313	Mental Health	367	Information Technology	204
Parents	258	Psychological Aspect	333		4285
Gender	274	Public Health	314		
Age Factors	219	Health Survey	297		
Sex Difference	188	Surveys	295		
Infant	192	Cognition	291	Financial Literacy	
Children	210	Depression	282	Financial Literacy	603
	32067	Health Care Personnel	276	Socioeconomics	448
		Quality Of Life	269	Socioeconomic Factors	398
		Doctor Patient Relation	267	Statistics	328
Education		Health Care Delivery	245	Poverty	205
Education	2210	Mental Health Literacy	243	Statistical Model	188
Reading	1577	Follow Up	256		2170
Educational Status	1500	Chronic Disease	219		
Students	1481				

Questionnaire	1423	Health Care	219	Publications Types	
Teaching	1085	Health Service	218	Article	4028
Health Education	978	Patient Attitude	217	Review	530
Cross-sectional Study	885	Patient Care	217	Systematic Review	188
Learning	553	Psychometry	216	Research	232
Curriculum	551	Clinical Article	232	Pilot Study	192
Engineering Education	485	Consumer Health Information	228	Editorial	188
Student	420	Psychometrics	226		5358
Writing	417	Medical Education	222		
Curricula	435	Diabetes Mellitus	211	Media Literacy	398
Higher Education	365	Clinical Trial	209		
Educational Measurement	227	Dyslexia	199	Scientific Literacy	355
Professional Development	227	Health Care System	192	Countries	
Teacher Education	222	Physician-Patient Relations	186	United States	1100
School	199	Emergent Literacy	255	Demography	300
Scoring System	202		5022	Australia	284
Phonetics	189			China	191
Vocabulary	186			African American	201
Academic Libraries	208			Hispanic	193
Awareness	279				2269
	12517				
Types of studies		Literacy			
Cross-Sectional Studies	696	Language Development	255		
Surveys And Questionnaires	692	Ethnology	249		
Language	685	Libraries	249		
Comprehension	676	Literacy	3360		
Procedures	671	Standards	311		
Communication	504	Self Concept	276		
Methodology	501	Early Literacy	275		

Questionnaires	450	Patient Compliance	274		
Decision Making	385	Critical Literacy	199		
Knowledge	383	Risk Factors	225		
Interview	318	Motivation	223		
Randomized Controlled Trial	323	Self Report	234		
Outcome Assessment	350		6130		
Assessment	340				
Qualitative Research	298				
Reproducibility	278				
Organization And Management	371				
Skill	365				
Risk Factor	327				
Reproducibility Of Results	315				
	4053				

Table 5: The list of the categories and key words with the number of times of appearance. The data covers the publication record of documents which covered the “titles”. In scopus search options, we restricted it to only “titles”

From 1917-1999 for all	No. Of Words	Total words	%age
Computer Literacy	622	48203	1.290376
Computers	167	48203	0.346451
Computer	158	48203	0.32778
Information Processing	151	48203	0.313259
Computer Program	134	48203	0.277991
COMPUTER LITERACY	122	48203	0.253096
Attitude To Computers	128	48203	0.265544
Internet	117	48203	0.242723
Computer User Training	110	48203	0.228202
Computer-Assisted Instruction	108	48203	0.224052
Technology	105	48203	0.217829
Information Services	105	48203	0.217829
Total words	2027	48203	4.205132
From 2000-2020 for all	No. Of Words	Total words	%age
Internet	6760	919079	0.735519
Information Literacy	4294	919079	0.467207
E-learning	4090	919079	0.445011
Human Computer Interaction	3366	919079	0.366236
Information Processing	3124	919079	0.339905
Technology	2749	919079	0.299104
Social Media	2588	919079	0.281586
Social Status	2313	919079	0.251665
Learning Systems	2085	919079	0.226858
Education Computing	1987	919079	0.216195
Information Technology	1953	919079	0.212495
Academic Achievement	1965	919079	0.213801
Total words	37274	919079	4.055582

Table 6: Comparison of different keywords categorized under the title “technology” from 1917 to 1999 and from 2000 to 2020. The data covers the publication record of “All” documents. “All” is a search option in scopus.

This is for 1917-1999 titles	No. Of Words	Total words	%age
Computer Literacy	97	5209	1.862162
COMPUTER LITERACY	54	5209	1.036667
Computer	34	5209	0.652716
Human Computer Interaction	33	5209	0.633519
COMPUTERS	28	5209	0.537531
Computer Analysis	25	5209	0.479939
Technology	20	5209	0.383951
Computer User Training	14	5209	0.268766
Information Technology	14	5209	0.268766
Computer Program	13	5209	0.249568
Technological Literacy	12	5209	0.230371
Computer Aided Instruction	10	5209	0.191975
COMPUTER SOFTWARE	9	5209	0.172778
Total	363	5209	6.968708
These are for titles 2000 to 2020	No. Of words	Total words	%age
Internet	577	100948	0.571581
Digital Literacy	489	100948	0.484408
Information Science	419	100948	0.415065
E-learning	382	100948	0.378413
Computer Literacy	356	100948	0.352657
Digital Literacies	307	100948	0.304117
Information Technology	191	100948	0.189206
Computer Science	178	100948	0.176328
Total	2899	100948	2.871776

Table 7: Comparison of different keywords categorized under the title “technology” from 1917 to 1999 and from 2000 to 2020. The data covers the publication record of “titles” documents. In scopus search options, we restricted it to Only “titles”

S#	Author	Documents	Citations
1.	wolf m.s.	46	5199
2.	baker d.w.	31	9019
3.	davis t.c.	24	4598
4.	parker r.m.	22	7603
5.	schillinger d.	22	4445
6.	justice l.m.	21	1839
7.	williams m.v.	21	6857
8.	lonigan c.j.	17	3088
9.	weiss b.d.	17	3043
10.	kripalani s.	16	1432
11.	rothman r.l.	16	1818
12.	dewalt d.a.	15	2588
13.	lusardi a.	15	4044
14.	paasche-orlow m.k.	15	1648
15.	gazmararian j.a.	14	3725
16.	jorm a.f.	14	2662
17.	morrison f.j.	14	2089
18.	connor c.m.	12	1668
19.	bennett c.l.	11	1711
20.	osborn c.y.	11	1130

Table 8: The list of top 20 authors with number of publications, citations

S#	Organization	Documents	Citations
1.	UNIVERSITY OF MICHIGAN, UNITED STATES	15	1475
2.	DIVISION OF GENERAL INTERNAL MEDICINE, FEINBERG SCHOOL OF MEDICINE, NORTHWESTERN UNIVERSITY, CHICAGO, IL, UNITED STATES	12	1199
3.	HARVARD GRADUATE SCHOOL OF EDUCATION, UNITED STATES	11	1276
4.	VANDERBILT UNIVERSITY, NASHVILLE, TN, UNITED STATES	9	614
5.	EMORY UNIVERSITY SCHOOL OF MEDICINE, ATLANTA, GA, UNITED STATES	8	1043
6.	FLORIDA STATE UNIVERSITY, UNITED STATES	8	2110
7.	MICHIGAN STATE UNIVERSITY, UNITED STATES	7	425
8.	UNIVERSITY OF CALIFORNIA, BERKELEY, UNITED STATES	7	978
9.	RUTGERS UNIVERSITY, UNITED STATES	6	381
10.	TEMPLE UNIVERSITY, UNITED STATES	6	394
11.	UNIVERSITY OF CALIFORNIA, LOS ANGELES, UNITED STATES	6	1104
12.	UNIVERSITY OF SHEFFIELD, UNITED KINGDOM	6	281
13.	UNIVERSITY OF VIRGINIA, UNITED STATES	6	504
14.	CENTRE FOR MENTAL HEALTH RESEARCH, AUSTRALIAN NATIONAL UNIVERSITY, CANBERRA, ACT 0200, AUSTRALIA	5	652
15.	DEPARTMENT OF BIostatISTICS, VANDERBILT UNIVERSITY MEDICAL CENTER, NASHVILLE, TN, UNITED STATES	5	919
16.	DEPARTMENT OF LEARNING SCIENCES, SCHOOL OF EDUCATION AND SOCIAL POLICY, NORTHWESTERN UNIVERSITY, EVANSTON, IL, UNITED STATES	5	356
17.	DEPARTMENT OF MEDICINE, EMORY UNIVERSITY SCHOOL OF MEDICINE, ATLANTA, GA, UNITED STATES	5	1378
18.	FEINBERG SCHOOL OF MEDICINE, NORTHWESTERN UNIVERSITY, CHICAGO, IL, UNITED STATES	5	345
19.	INSTITUTE FOR HEALTHCARE STUDIES, FEINBERG SCHOOL OF MEDICINE, NORTHWESTERN UNIVERSITY, CHICAGO, IL, UNITED STATES	5	1048
20.	RUTGERS UNIVERSITY, NEW BRUNSWICK, NJ, UNITED STATES	5	265

Table 9:

The list of top 20 institutes with number of publications, citations

S#	Country	Documents	Citations
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1.	United states	1253	119294
2.	United kingdom	219	20273
3.	Australia	158	14963
4.	Canada	116	9435
5.	Netherlands	54	6932
6.	Germany	31	3489
7.	Israel	30	2281
8.	Sweden	25	2588
9.	Hong kong	23	1490
10.	Belgium	22	3297
11.	New zealand	18	1326
12.	Spain	18	2907
13.	Taiwan	18	961
14.	Japan	17	993
15.	South africa	16	1001
16.	Portugal	15	2450
17.	Finland	14	1947
18.	Italy	14	2138
19.	Norway	12	1090
20.	Switzerland	12	803

Table 10: The list of top 20 countries with number of publications, citations

S#	Document	citations
1.	Nutbeam d. (2000)	1638
2.	Blair c. (2007)	1480
3.	Whitehurst g.j. (1998)	1251
4.	Seymour p.h.k. (2003)	1207
5.	Parker r.m. (1995)	1188
6.	Davis t.c. (1993)	1142
7.	Schillinger d. (2002)	1128
8.	Bus a.g. (1995)	1097
9.	Weiss b.d. (2005)	1038
10.	Nutbeam d. (2008)	989
11.	Jorm a.f. (1997)	975
12.	Bresolin l.b. (1999)	898
13.	Chew l.d. (2004)	859
14.	Kahan d.m. (2012)	797
15.	Lea m.r. (1998)	783
16.	Williams m.v. (1995)	782
17.	Schillinger d. (2003)	775
18.	Williams m.v. (1998)	752
19.	Mcclelland m.m. (2007)	729
20.	Lusardi a. (2007)	646

Table 11: The list of top 20 most cited documents with number of citations

S#	Cited reference	Citations
1.	adams, m.j., (1990) beginning to read: thinking and learning about print, , cambridge, ma: mit press	50
2.	baker, d.w., gazmararian, j.a., williams, m.v., functional health literacy and the risk of hospital admission among medicare managed care enrollees (2002) am j public health, 92, pp. 1278-1283	24
3.	baker, d.w., parker, r.m., williams, m.v., clark, w.s., health literacy and the risk of hospital admission (1998) j gen intern med, 13, pp. 791-798	33
4.	baker, d.w., parker, r.m., williams, m.v., clark, w.s., nurss, j., the relationship of patient reading ability to self-reported health and use of health services (1997) am j public health, 87, pp. 1027-1030	27
5.	baker, d.w., williams, m.v., parker, r.m., gazmararian, j.a., nurss, j., development of a brief test to measure functional health literacy (1999) patient educ couns, 38, pp. 33-42	42
6.	bus, a.g., van ijendoorn, m.h., pellegrini, a.d., joint book reading makes for success in learning to read: a meta-analysis on intergenerational transmission of literacy (1995) review of educational research, 65, pp. 1-21	30
7.	davis, t.c., long, s.w., jackson, r.h., rapid estimate of adult literacy in medicine: a shortened screening instrument (1993) fam med, 25, pp. 391-395	41
8.	dewalt, d.a., berkman, n.d., sheridan, s., lohr, k.n., pignone, m.p., literacy and health outcomes: a systematic review of the literature (2004) j gen intern med, 19, pp. 1228-1239	28
9.	gazmararian, j.a., baker, d.w., williams, m.v., health literacy among medicare enrollees in a managed care organization (1999) jama, 281, pp. 545-551	30
10.	gazmararian, j.a., williams, m.v., peel, j., baker, d.w., health literacy and knowledge of chronic disease (2003) patient educ couns, 51, pp. 267-275	22
11.	health literacy: report of the council on scientific affairs (1999) jama, 281, pp. 552-557	24
12.	juel, c., learning to read and write: a longitudinal study of 54 children from first through fourth grades (1988) journal of educational psychology, 80, pp. 437-447	29
13.	kalichman, s.c., ramachandran, b., catz, s., adherence to combination antiretroviral therapies in hiv patients of low health literacy (1999) j gen intern med, 14, pp. 267-273	28
14.	parker, r.m., baker, d.w., williams, m.v., nurss, j.r., the test of functional health literacy in adults: a new instrument for measuring patients' literacy skills (1995) j gen intern med, 10, pp. 537-541	43
15.	scarborough, h.s., dobrich, w., on the efficacy of reading to preschoolers (1994) developmental review, 14, pp. 245-302	46

16.	schillinger, d., grumbach, k., piette, j., association of health literacy with diabetes outcomes (2002) jama, 288, pp. 475-482	33
17.	scribner, s., cole, m., (1981) the psychology of literacy, , cambridge, ma: harvard university press	25
18.	snow, c.e., burns, m.s., griffin, p., (1998) preventing reading difficulties in young children, , washington, dc: national academy press	21
19.	stanovich, k.e., matthew effects in reading: some consequences of individual differences in the acquisition of literacy (1986) reading research quarterly, 21, pp. 360-407	25
20.	storch, s.a., whitehurst, g.j., oral language and code-related precursors to reading: evidence from a longitudinal structural model (2002) developmental psychology, 38, pp. 934-947	36

Table 12: The list of top 20 most co-cited references with number of citations

S#	Source	Documents	Citations
1.	Journal of general internal medicine	46	7187
2.	Child development	13	4176
3.	Journal of educational psychology	34	4088
4.	Early childhood research quarterly	33	2922
5.	Journal of academic librarianship	31	2053
6.	Journal of health communication	32	2042
7.	Journal of literacy research	23	1879
8.	Computers and education	27	1734
9.	American journal of health behavior	12	1626
10.	Bmc public health	20	1572
11.	Journal of adolescent and adult literacy	23	1415
12.	Journal of consumer affairs	12	1396
13.	Journal of documentation	14	1371
14.	Journal of child psychology and psychiatry and allied disciplines	10	1323
15.	International journal of science education	12	1190
16.	Elementary school journal	15	1127
17.	Journal of early childhood literacy	18	1076
18.	College and research libraries	13	1057
19.	American educational research journal	13	1046
20.	Journal of experimental child psychology	11	1019

Table 13: The list of top 20 most cited sources

S#	Source	Citations
1.	Journal of educational psychology	1397
2.	Reading research quarterly	1330
3.	J gen intern med	930
4.	Child development	804
5.	Developmental psychology	727
6.	Jama	621
7.	Patient educ couns	517
8.	Early childhood research quarterly	497
9.	Journal of general internal medicine	435
10.	Journal of research in science teaching	365
11.	Journal of experimental child psychology	349
12.	Review of educational research	340
13.	Pediatrics	319
14.	Harvard educational review	313
15.	Scientific studies of reading	309
16.	Journal of learning disabilities	301
17.	Arch intern med	300
18.	Applied psycholinguistics	289
19.	American educational research journal	286
20.	Science education	276

Table 14: The list of top 20 most co-cited sources