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### Research on digital and online resources of academic libraries from 1981 to 2020: A bibliometric analysis

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## Research on digital and online resources of academic libraries from 1981 to 2020: A bibliometric analysis

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### Abstract

**Purpose/Rational** - The study has exclusive purpose to find out the literature growth on “Digital and Online Resources of Academic Libraries” within a specific time span 1981 to 2020. Digital resources play an important role in the proliferation of quality research. Plenty of literature has been published on the topic from 1981 to 2020.

**Design/Methodology** - The present study attempts to analyze the literature using the bibliometric technique. Further, the Science Citation Index (SCI) database and Web of Science (Core Collection) has been utilized as a source to extract the available published documents. Furthermore, the investigation utilizes VOS viewer to show the outcomes making a representation picture of the published documents.

**Findings** - The study findings show that the published documents on the topic are “electronic books” and that the articles written reached out better. The study exhibits that the English language has been used the most to write documents and 2011-2015 has been considered the when most articles published. United States is the top country for such publications while Bar Ilan (Israel) is the top publishing university, the highest number of articles has been produced by Huang YM and the most frequent keyword has been used as e-books. The highly cited article is published with the titled, “E-books or textbooks: Students prefer textbooks” with the citation of 249 in total number.

**Value/Originality** - The study provides information in a broad way on digital and electronic resources, published literature through a bibliometric analysis.

**Keywords:** digital resources; academic libraries; online resources; research output; bibliometric analysis

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## **1. Introduction**

Academic libraries in Higher Education Institutions (HEIs) are playing significant role in providing online and digital resources to their users. Academic libraries are trying to improve their services by using digital mediums. Users of HEIs are getting benefits by accessing and utilizing the digital resources subscribed by academic libraries for their research and enhancing the knowledge base. (Soroya & Ameen, 2020). To serve the library users in a better way academic libraries are utilizing every possible way to improve the service quality (Shoaib et al., 2020). The library professionals also accepted the challenge of the digital age and followed the paradigm shift by using new sources, mediums and embraced new technologies in the service landscape. (Lukasiewicz, 2007). Almost all academic libraries in HEIs have completely shifted from manual techniques towards automated systems (Groenendyk, 2013; Huber et al., 2021). Now academic libraries having access to various electronic resources because it is the demand of electronic age and users of this era (Regolini et al., 2013). Indeed, libraries have been affecting from electronic climate and their changes and for providing electronic services, they have to be needed a computer systems (Dhanavandan & Tamizhchelvan, 2012).

Bibliometric analysis is considered a good way for getting the exact and accurate information in a statistical way. A bibliometric examination is a decent method to assess the measurements of any publications and their effect on the concerned people (Siddique et al., 2020). Nowadays, bibliometric is considered as a method to present the research data in a statistical way (Naveed, Ali, et al., 2021). Analysis of the research evaluation using bibliometric interpretation is the best option to see the trends and organization of a particular output in a specific subject area (Montero-Díaz et al., 2018). Along with the ranking of specific indicators bibliometric studies also facilitate in strategic decision making. Bibliometric analysis can also help in framing the conceptual and intellectual boundaries to do concrete analysis of highly specialized patterns and cultural proximities. Mora et al. (2017) indicated that such analysis provides a scientific way of future trends and research pathways of looking into the various facets of publications, persons and citation.

This study aims to measure the number of papers published on this relevant issue (digital and online resources) within the timeframe of 1981 to 2020. The research will feature the author's input on the highlighted topic and the author's contribution will show the significance of the topic (Aslam et al., 2021). The study used a comprehensive analysis of retrospective data and

converted it into useful information which gives a quick glance of the publication trend on researches on the topic of digital resources in academic libraries and hyperlink of all relevant indicators for example the most cited papers, top authors, productive countries and universities (Shoaib et al., 2021). The novelty of the variables selected for the study along with the connected and relevant bibliographic indicators has made this a useful document for the researchers and organizations involved in such scientometric publications (Naveed, Aslam, et al., 2021).

After a thorough research, it is demonstrated that there is no exhaustive study on the bibliometric research that includes the digital and online resources of academic libraries. This bibliometric study appears to be appropriate to highlight the current status of researches.

## **2. Literature Review**

Bibliometric studies have become a standard tool for research in many fields of study (Ahmad et al., 2018; Dees, 2015; Qayyum & Naseer, 2013; Singh et al., 2007). Many known institutions heavily rely on scientometrics, webometrics and other research analytics for the compilation of various ranking metrics. Especially, in the last two decades many national and international organizations are involved in doing bibliometrics to measure the rank of academic and research institutions. Bibliometrics consists of structural and dynamic models for the systematic evaluation of multifaceted techniques along with the scientific requirement of the citation process (Glanzel, 2003). The foundations of bibliometric study were laid down by Pritchard in 1969 by using mathematical and statistical techniques for examining bibliographic entities.

Bibliometric studies were conducted to identify the patterns of growth in the area of digital library resources. The study conducted by Kollé et al. (2018) on e-books concluded that literature in the form of e-books has tremendous growth in the previous decade, most of the articles on the topic were contributed by a single author and the top sourced countries were USA and UK. The coverage of the study was limited to e-books only, while the information seeking patterns show that the articles and thesis are the most widely used sources (Schaffer, 2004). The bibliometric study on the usage of online theses conducted by Mishra et al. (2014) shows that books are the highest sources of information through digital medium. The study was limited to only one university which cannot represent the global practice (Ali, Aslam, et al., 2021). In the research on electronic resources in academic libraries conducted by Chhatwal (2018) revealed

that 56.8% publication were journal articles and medical institutions were highly productive in the field, university of Toronto was ranked at the first number and the USA yielded the most results. In the study MS Excel was used for analysis trends. Lohar and Roopashree (2006), concluded that most of the scientific community uses online journals during their research. Mora et al. (2017) in his bibliometric study found that historians fulfill their information needs from online books available in central libraries, even if they do not cite them in their research (Dees, 2015). The study also found that it is not their preferred source due to some of their concerns like perception of colleagues to respect print resources over digital resources. Bibliographic study by Shihab and Devarajan (2017) explored that lion's share 97% in the use of electronic resources are journal articles. More than half of researchers (54.5%) use e-journals. He used LISA, Emerald, Google Scholar and DOAJ to extract data for the study. The study used mix sources of open access and subscribed databases. Majority papers included in the study were authored from developed countries. In a bibliographic study in the field of Library and Information Science, the usage of e-resources was studied by (Nazir, 2015). The study concluded that 90.1% professionals use e-journals and 38.53% articles have hyperlink in their references. The study only used open access sources to fetch the data for study. Study also concluded that the trend of using open access sources is increasing rapidly among researchers (Ali & Naveed, 2020). The Top 25 most productive journals were analyzed in a bibliographic study by Gupta and Dhawan (2019) which revealed that the most cited papers are only 0.81% while e-books were ranked at the top followed by e-journals, and theses and dissertations. The study period was from 1994-2017.

The review of literature showed that the trend of research analytics in bibliometric method is gaining appreciation and is a preferred technique to study various patterns of research and publications (Shonhe, 2020). The present study is distinguished in a sense that it used latest data and unique set of variables to make different analysis. The source used for the study is highly valued in the world of research and combination of variables was rarely used in the previous studies (Ali, Shoaib, et al., 2021). The global data was extracted and authors, productive years, countries, organizations and keywords pattern that were most cited were studied. The study presents a holistic understanding and would be beneficial for research in this area.

### **Objectives of the Study**

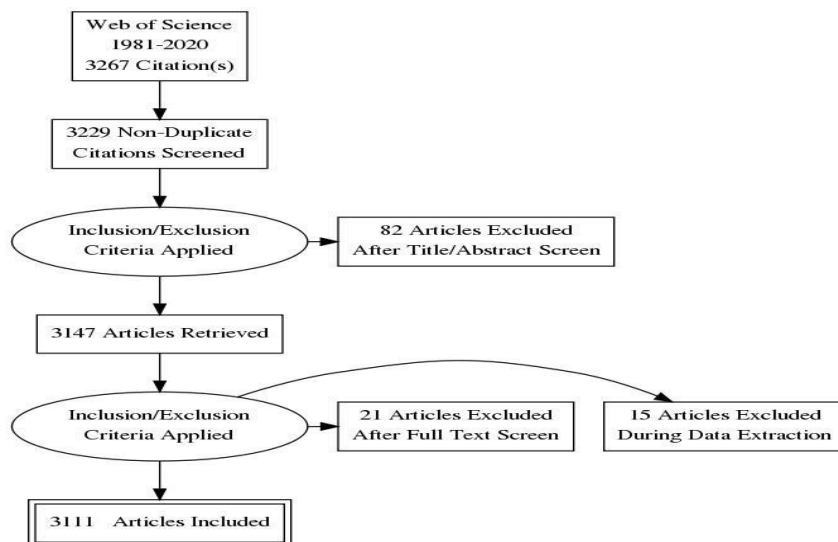
Following research objectives are to be explored:

- 1) To find out the topics of published documents and the types of publications related to online resources
- 2) To identify the language of the published documents and productive years of publications
- 3) To study the patterns of the top productive organizations and countries
- 4) To study the most productive authors and sources
- 5) To calculate the top co-occurrences of keywords and top cited articles

### **3. Methodology**

Bibliometric method was used to conduct this study. Mapping of publications using metadata is an easy and scientific method to derive useful information on the basis of different indicators e.g. area, university, person or documents to get insight to meet the objective. Developing the linkage between and among the bibliographic variables is an excellent and quick approach to derive useful results (Russell & Rousseau, 2010). Mathematical and statistical techniques also help to get results from scattered documents (Ellegaard & Wallin, 2015). The current technology can also be supportive to draw patterns and trends in future research.

For the bibliometric analysis, data was extracted from the Science Citation Index database, Web of Science (Core Collection), dated April 29, 2021, Time: 02:55 AM, PST. Searched Queries from web of science were following: : TI=(“E Journal\*” OR “Electronic Journal\*”) OR TI=(“Database\*” AND Library) OR TI=(“Electronic Book\*” OR “E-Book\*”) OR TI=(“Online Resource\*” AND Library) OR TI=(“Digital Resource\*” AND Library) OR TI=(“E-thes\*s” OR “Electronic thes\*s” OR “dissertation\*” AND Library). Total 3267 publications were found relevant such as articles, proceeding papers, book review, editorial material, meeting abstract, news items, letters and reviews within a specific time frame from 1981 to 2020 (figure 1). After screening 38 duplications were found, further 82 articles were excluded after the screening of abstracts. Remaining 3147 articles were reviewed; further 21 articles were excluded after full text screening and 15 during data extraction. Total 3111 publications were included after the screening process in this bibliometric study. Biblioshiny, ScientoPy, VOSviewer, MS Excel software were used for data analysis.



**Fig 1.** Data extraction process

#### 4. Data Analysis

After examining the gathered information, the researchers have endeavored to introduce the findings under various headings. The definite consequences of the investigation of Digital and Online Resources of Academic Libraries in HEIs from 1981 to 2020 are portrayed as under.

##### 4.1. Documents Published by Topics

The data (Table 1) shows the documents types published between the years 1981-2020. The total numbers of publications are 3111. Around 1488 publications were published on the topic of electronic Books. The second most published topic is Electronic Journals with 836 total publications. The topic E-Databases is third most published topic with 538 total publications and the least published topic was Online Resources published only 23 total publications. It is apparent that the authors have more interest in publishing documents on the topic Electronic Books.

**Table 1.** Documents Published by Topics

Topic	Total Publications	Percentage
Electronic Books	1488	47.83
Electronic Journals	836	26.87
E-Databases	538	17.29
Theses & Dissertations	159	5.11
Digital Resources	67	2.16
Online Resources	23	0.74
Total	3111	100

#### 4.2. Documents Published by Types

Table 2 identifies the documents types published in time span 1981-2020. The table categorized the documents in sixteen various forms that are published during 40 years and the highest frequency of publication type is research article 1666 (53.55%). Similarly 604 (19.41%) proceedings papers have been published. Book Reviews 283 (9.1%) were the third most published document type and the last category of published documents are the discussion and hardware review with 1 (0.03%) document each. It is evident that the most preferred document type is the article that the researcher published.

**Table 2.** Documents Published by Types

Document Type	Publications	Percentage	Document Type	Publications	Percentage
Article	1666	53.55	Note	13	0.42
Proceedings Paper	604	19.41	Correction	10	0.32
Book Review	283	9.10	Software Review	9	0.29
Editorial Material	222	7.15	Database Review	5	0.16
Meeting Abstract	113	3.63	Bibliography	3	0.10
News Item	75	2.41	Biographical- Item	2	0.06
Letter	61	1.96	Discussion	1	0.03
Review	43	1.38	Hardware Review	1	0.03

#### 4.3. Documents Published in their Languages

The results in table 3 examined the total publications with their language type. The most 2858 (91.87%) publications were published in English language far ahead of other language publications followed by Spanish language 82 (2.64%) total publications. Similarly German language received 46 publications and Czech, Norwegian and Ukrainian received only single publication. It is quite obvious that English language is the most preferred language of choice for publication of research work.



**Table 3.** Documents Published in their Languages

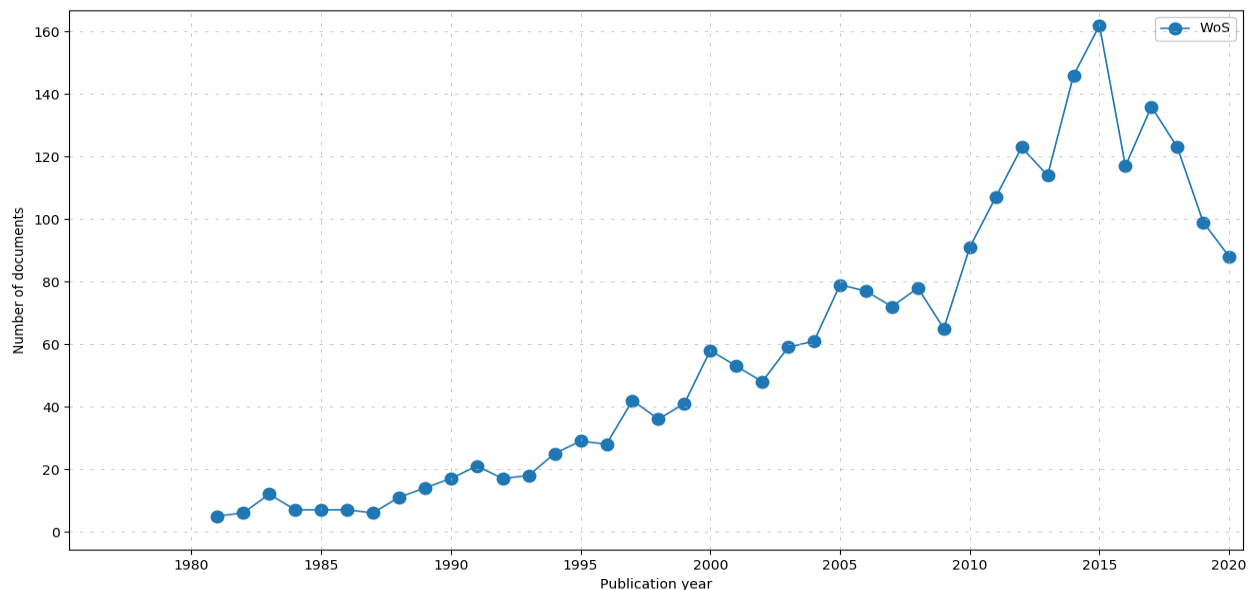
Languages	TP*	Percentage	Languages	TP*	Percentage
English	2858	91.868	Japanese	7	0.225
Spanish	82	2.636	Polish	5	0.161
German	46	1.479	Chinese	4	0.129
Portuguese	29	0.932	Croatian	3	0.096
Russian	27	0.868	Arabic	2	0.064
French	17	0.546	Czech	1	0.032
Catalan	12	0.386	Norwegian	1	0.032
Italian	8	0.257	Ukrainian	1	0.032
Turkish	8	0.257	TP* = Total Publications		

#### 4.4. Documents Published by Years

Table 4 and figure 1 revealed the frequency distribution of year wise total published documents. The frequency distribution 2011-2015 was the remarkable period of top 822 (26.42%) total publications (TP). The period 2016-2020 was the second most productive period with 661 (21.25%) TP. The period 2006-2010 was the third most productive period of publications with 521 TP. The least productive period was 1981-1985 received 56 TP. It is evident that the authors are now more interested in publishing their documents on digital and online resources of academic libraries.

**Table 4.** Documents Published by Years

Publication Years	Publications	Percentage	Publication Years	Publications	Percentage
1981-1985	56	1.8	2001-2005	418	13.44
1986-1990	90	2.89	2006-2010	521	16.75
1991-1995	183	5.88	2011-2015	822	26.42
1996-2000	360	11.57	2016-2020	661	21.25



**Fig 2.** Distribution of Document by Years (1981-2020)

#### 4.5. Top Productive Organizations

Table 5 and figure 2 highlight the top ten organizations with their total publications. Total 2008 organizations were found but data for top twenty organizations has been compiled. The organization Bar Ilan Univ., Israel was the highest organization with highest publications that were 23 and 11 h-index. The Natl. Cheng Kung Univ., Taiwan published the second highest number of documents 22 TP and 7 h-index. The third most productive organization was Natl. Taiwan Univ. Sci. & Tech., Taiwan with 16 TP and 5 h-index. The Natl. Cent Univ., Taiwan had published the least documents, 10 total publications and 4 h-index.

**Table 5.** Top Productive Organizations

Organizations	Publications	h-index
Bar Ilan Univ., Israel	23	11
Natl. Cheng Kung Univ., Taiwan	22	7
Natl. Taiwan Univ. Sci. & Tech., Taiwan	16	5
Natl. Yunlin Univ. Sci. & Tech., Taiwan	16	4
Dept. Info. Sci., United Kingdom	13	8
Univ. Lib., United States	13	5
Univ. Salamanca, Spain	13	4
Kyushu Univ., Japan	11	3
Univ. Malaya, Malaysia	11	7
Natl. Cent Univ., Taiwan	10	4

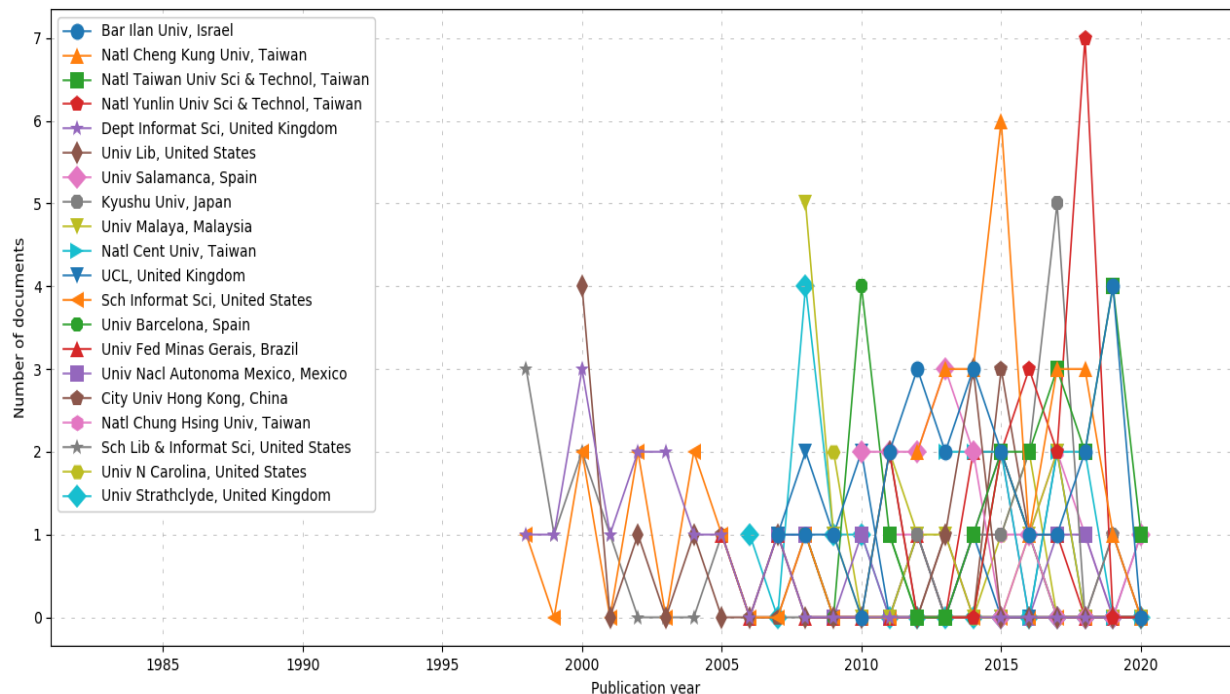


Fig 3. Top Productive Organizations (1981-2020)

#### 4.6. Top Productive Countries

Table 6 highlights the top ten productive countries out of 89. The USA was the top productive country in terms of 975 total publications. The second productive country was China with 257 TP and United Kingdom was the third productive country with 239 TP. The least productive country was Brazil with 41 TP. It is recognizable that the USA is producing remarkable development in the field of research.

Table 6. Top Productive Countries

Country	Publication	Freq.	SCP*	MCP*	MCP*_Ratio
USA	975	0.378788	945	30	0.0308
China	257	0.099845	237	20	0.0778
United Kingdom	239	0.092852	223	16	0.0669
Spain	97	0.037685	86	11	0.1134
India	90	0.034965	88	2	0.0222
Canada	83	0.032246	74	9	0.1084
Japan	65	0.025253	62	3	0.0462
Germany	51	0.019814	44	7	0.1373
Australia	44	0.017094	41	3	0.0682
Brazil	41	0.015929	37	4	0.0976

SCP\* = Single Country Publications, MCP\* = Multiple Country Publications

#### 4.7. Top Productive Authors

Table 7 identifies the top ten productive authors during the time span of 1981-2020. The author Huang YM was on top in the list with highest 20 publications, 278 citations and 6 h-index. The Shamir A was second highest author with 18 publications, 525 citations and 12 h-index. The third highest level author was Korat O with 17 publications, 567 citations and 11 h-index. The least 9 publications and 146 citation and 4 h-index is from the author Su YN.

**Table 7.** Top Productive Authors

Author	Publication	Citations	h-index	g-index	m-index	Publication Year
Huang YM	20	278	6	16	0.60	2012
Shamir A	18	525	12	18	0.70	2004
Korat O	17	567	11	17	0.61	2004
Tenopir C	17	367	7	17	0.21	1989
Ogata H	14	51	5	7	0.00	2016
Wu TT	14	33	3	5	0.30	2012
Barker P	11	39	3	6	0.09	1990
Mcknight C	11	171	7	11	0.24	1993
Nicholas D	9	330	8	9	0.40	2002
Su YN	9	146	4	9	0.40	2012

#### 4.8. Top Co-Occurrences Keywords

Table 8 and figure 3 signify the detail of keywords. The most occurred keyword E-Books was occurred 211 times with total link strength (TLS) 742. The second most keyword “E-Book” occurred 201 with 463 TLS. The third most appearances 189 and, 759 TLS of the keyword “Electronic Books”. The least 53 keywords were University.

**Table 8.** Top Co-Occurrences Keywords

Keyword	Occurrences	Total Link Strength	Keyword	Occurrences	Total Link Strength
E-Books	211	742	Students	85	447
E-Book	201	463	Usage	67	369
Electronic Books	189	759	Internet	57	227
Electronic Journals	118	327	Libraries	55	204
Academic Libraries	89	340	University	53	283

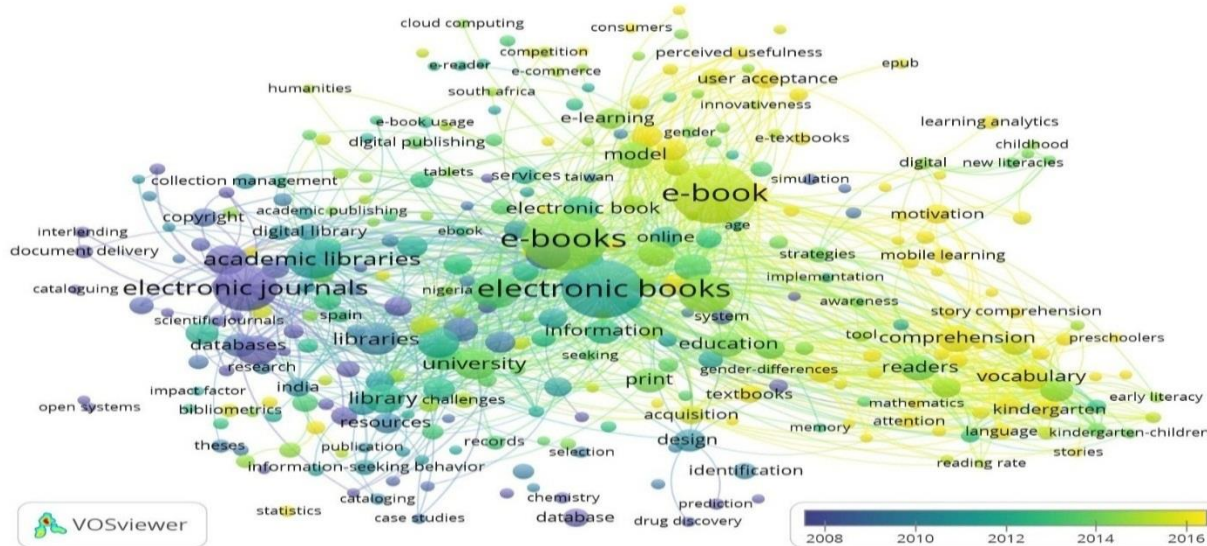


Fig 4. Co-occurrences of Keywords

#### 4.9. Top Productive Sources

Table 9 produced the top ten highly published sources. The Journal “Electronic Library” is the most published source with 107 total publications (TP) and far ahead of the other sources. College & Research Libraries were the second highest source with 57 TP. The Journal of Academic Librarianship was the third source with 56 TP. The least published source was “Serials Librarian” who received 39 TP. It is obvious that the researchers most preferably choose the source Electronic Library for publication of their research work.

Table 9. Top Productive Sources

Source	TP*	TC*	h-index	g-index	m-index	PY*
Electronic Library	107	719	14	21	0.38	1985
College & Research Libraries	57	765	19	25	0.46	1981
Journal of Academic Librarianship	56	641	16	24	0.44	1986
Program-Electronic Library and Information Systems	52	321	11	17	0.39	1994
Abstracts of Papers of The American Chemical Society	48	1	1	1	0.03	1990
Library Collections Acquisitions & Technical Services	43	432	11	20	0.48	1999
Library Resources & Technical Services	40	338	10	17	0.31	1990
Library Journal	39	53	4	6	0.10	1983
Learned Publishing	35	152	7	11	0.25	1994
Serials Librarian	35	60	4	6	0.10	1983

TP\* = Total Publication, TC\* = Total Citations, PY\* = Publication Year

#### 4.10. Top Cited Articles

Table 10 data highlights the top ten highly cited articles published in time span 1981 to 2020. The article “E-books or textbooks: Students prefer textbooks” was the most cited article with 249 total citations (TC) count followed by “Electronic journals and changes in scholarly article seeking and reading patterns” being the second with 121 TC and third most cited article was “E-book usage in an academic library: User attitudes and behaviors” received 118 TC. The least cited article is “A circulation analysis of print books and e-books in an academic research library” received only 88 citations.

**Table 10.** Top Cited Articles

TC*	Title	Authors	Vol./Issue	PY*
249	E-books or textbooks: Students prefer textbooks	Woody, William Douglas; Daniel, David B.; Baker, Crystal A.	55(3)	2010
121	Electronic journals and changes in scholarly article seeking and reading patterns	Tenopir, Carol; King, Donald W.; Edwards, Sheri; Wu, Lei	61(1)	2009
118	E-book usage in an academic library: User attitudes and behaviors	Shelburne, Wendy Allen	33(2-3)	2009
112	Reasons for the use and non-use of electronic journals and databases - A domain analytic study in four scholarly disciplines	Talja, S; Maula, H	59(6)	2003
111	Reading electronic books as a support for vocabulary, story comprehension and word reading in kindergarten and first grade	Korat, Ofra	55(1)	2010
103	Indexing and access for digital libraries and the Internet: Human, database, and domain factors	Bates, MJ	49(13)	1998
93	Usability evaluation of E-books	Kang, Yen-Yu; Wang, Mao-Jiun J.; Lin, Rungtai	30(2)	2009
90	Electronic book usage: A survey at the University of Denver	Levine-Clark, Michael	6(3)	2006
89	Progressing the definition of e-book	Vassiliou, Magda; Rowley, Jennifer	26(3)	2008
88	A circulation analysis of print books and e-books in an academic research library	Littman, J; Connaway, LS	48(4)	2004

TC\* = Total Citations, PY\* = Publication Year

## **5. Discussion and Findings**

The result of the investigation experiences the exploration of the goals and highlights the publications on digital and online resources of academic libraries in Higher Education Institutions from 1981 to 2020. It is observed that 3111 documents have been published in sixteen various types of publications such as articles, proceeding papers, book reviews, editorial material, meeting abstract, news item, letter, review, note, correction, software review, database review, bibliography, biographical item, discussion and hardware review.

Many facets have been discussed in this study which provided the basis for the bibliometric analysis such as: documents published on this topic during this time span, which variety of documents published?, publication's language analysis, which year was the most productive?, to find out the organization's publications, countries contribution in publication, top most productive authors, co-occurrences keywords, most productive source, and highly cited articles.

This exploration provides facility to scholars to get all important information about the relevant topic "digital and online resources of academic libraries in HEIs on one stage. This paper assists the scholars with seeing the trend of publications from 1980 to 2021.

This bibliometric study meets the objectives and provides information in a statistical form. The findings highlight the aim of this research:

- Documents were mostly published in electronic books form and the highest type of publications sum up the "articles". Outcomes show the interest of researchers to cite the articles written was high as compared to other types of research.
- Seventeen languages were found in these documents but the most common or preferred language was "English". Year wise analysis highlighted that the highest publication years were found 2011-2015.
- Most productive organization "Bar Ilan Universty Israel" was involved in publications and the most productive country was USA with highest TP in this race of publications.
- The highest ranking in top twenty authors was "Huang YM "with the most number of publications and the top source of publication was found to be the "electronic library".
- The findings of keyword interpret the result that "E Books" keywords were used with highest occurrences (211) in this time frame. And in top twenty cited articles the most cited article

was “E-books or textbooks: Students prefer textbooks” by Woody, William Douglas; Daniel, David B.; Baker, Crystal A with 249 citations.

The details about digital and online resources of academic libraries in HEIs from 1981 to 2020 will facilitate the researchers who want to get exact statistical information about the publications of the discussed issue. Digital and online resources have great impact on library services, so this type of bibliometric analysis will highlight the significance of these sources.

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