How Has E-Book Research Evolved? A Bibliometric Comparison of International Journal Publications (2000-2019)

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Abstract

This study is a longitudinal observation of e-book research. Through a series of keyword searches, a total of 579 articles with 7,554 citations were obtained and collected from the Web of Science database. This study spanned the period 2000-2019, and research data retrieval was completed on June 24th, 2020. Through a bibliometric analysis, the top ten most frequently cited articles in each of the two decades that were covered were identified and compared. The findings were two-fold. First, the main research topics across the two decades included a performance comparison between e-books and the printed versions (e.g., in terms of vocabulary, comprehension, and reading rates) as well as e-book acceptance and usage in the academic library context. Second, in the previous decade, as opposed to the one prior, e-book research has seen more diverse research themes as the main foci; some emergent research topics, such as joint parent-child reading, the e-book's interactive learning system, and the theoretical model of e-book adoption were identified. It is also interesting to note that e-book research has expanded its territory beyond education and libraries to both the business and communication fields. Further discussion is provided.

Keywords: E-book, Bibliometric analysis, Highly-cited research, International publication patterns

1 Introduction

Recently, amidst the new coronary pneumonia (also known as COVID-19) pandemic, many schools have been forced to make an abrupt switch to online teaching, necessitating online/electronic teaching and learning resources. In response, many publishing houses have released textbook resources in electronic format to facilitate higher-education students' online learning. This also increases students' intent to utilize as well as their preference for using electronic learning resources, such as electronic books (e-books) (Hendal, 2020) [1].

Indeed, e-books have not only been used for the school education, such as through e-textbooks [2-3], e-book technology has also been used for informal learning [4] that includes digital magazines, picture books, and storybooks [5].

According to the Web of Science (WoS) search results, international e-book publications have grown rapidly. The growth of published articles and the number of authors from the earlier decade (2000-2009) that this study covers to the recently-passed one (2010-2019) reached increases of 2.1 and 2.8 times, respectively. From the perspective of academic research, numerous of successful publications also provide researchers with great opportunities for literature review.

Most of the previous review studies of e-book have focused on interviews [6], narrative review [7], status reports (e-lending [8], library acquisitions [9], and the use of academic libraries [10]). However, this study adopted a series of bibliometric indicators to analyze the international publication patterns in e-book research, providing a complementary viewpoint for the development of the literature. More specifically, this study aimed to conduct a bibliometric analysis to systematically review the research development of e-book. Bibliometric indicators (e.g., the *h*-index and the *g*-index) were used to identify the most influential research articles and journal publications, as well as the countries that have been the most productive in the e-book research field.

In brief, this study's two main objectives were as follows. The first aim was to profile the publication patterns in international e-book research. To achieve this, a bibliometric analysis was conducted to identify some publication attributes in e-book research, such as the number of articles and the number of active authors. The second goal was to analyze and compare the development of e-book research over the two specified decades (the earlier decade, 2000-2009, and the recently-passed decade, 2010-2019), based on the most frequently cited articles.

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2 Methods

This section introduces a systematic procedure for research data collection. To achieve the main research purpose of exploring the research dynamics of e-books, two analyses, from different angles, were used in this study, namely bibliometric analysis and content analysis.

2.1 Data

In this study, the research data were collected from a longitudinal observation of quality journal articles that were searched for in the WoS database, which is a reputed source that incorporates the majority of high-quality research on e-books, such as in the categories of information science and library science.

Following previous research (Kumbhar, 2012) [11], a series of often-used terms in e-book literature, including "electronic book(s)," "e-book(s)," and "digital book(s)," were entered as keywords in the WoS search. In order to include as many related publications as possible, all research articles from the Science Citation Index (SCI) and Social Sciences Citation Index (SSCI) databases were considered. The timespan of the search was set to 2000 (which marks the emergent stage of e-book technology, for example, e-ink technology) to the recent year of 2019; this period (2000-2019) covers the development of e-book research over the last 20 years. The search returned 652 articles in total. After screening the irrelevant articles, indexed by KeyWords Plus®, a total of 579 articles with 1,194 authors were identified as the significant community of e-book research, as shown in Figure 1.

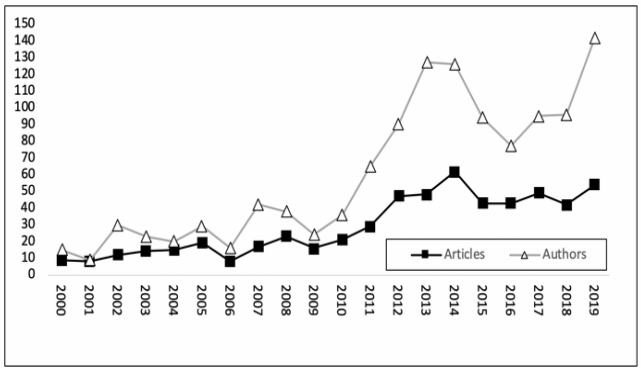

Figure 1. The growth trend of e-book research: articles and authors from 2000 to 2019

Observing the trend of publications in e-book research, we divided the research period into two stages for the upcoming analysis. In the earlier decade (2000-2009), which experienced stagnant growth, a total of 141 articles were published, and 246 authors were involved in the research. However, compared to the earlier decade, the recent decade (2000-2019) saw a significant growth trend, whereby the amount of articles grew by 2.1 times (up to 438 articles), and the number of authors increased by more than 2.8 times (948 authors). This result shows a significant growth trend in e-book research, especially in the recent decade (2010-2019). The gap in publication patterns that is shown in the map (Figure 1) points to the need for further investigation of e-book research development between the two abovementioned decades.

2.2 Bibliometric Analysis

This study treated bibliometric analysis as the primary approach by using scientific indicators to capture the overall publication patterns in e-book research. Following previous studies [12], the citations (including the total and average number of citations), the *h*-index, and the *g*-index were used to measure performance among the journals. Sorting was done according to the number of citations that were received; the *h*-index counted how many times (at least *h* times) a single article has been cited, while the *g*-index was used to calculate the total number of citations at least g^2 times a group of articles received. In this study, we used the three indices to identify the most influential journal publications and the most productive in the field. Moreover, the publication periods were divided into the two previously-mentioned decades (the earlier decade, 2000-2009, and the recent one, 2010-2019) to allow for further observation and comparison of the changes in e-book research.

2.3 Content Analysis

In this study, we also used content analysis to investigate published articles' main ideas over the past 20 years, including the article types and research topics of the most frequently cited e-book research. The content analysis' strength lies in its ability to provide researchers with a research classification, which is the foundation of scientific research. Hence, through content analysis, researchers can identify the mainstream as well as some potential changes in e-book research. Furthermore, the category of research (indexed by the WoS) was provided to compare the e-book's research domain over the past 20 years.

3 Results

The main research results were provided in line with the two research objectives. First, an investigation into the domain(s) of journals featuring e-book research across the two decades was presented, with some bibliometric results. Second, highly-cited articles on e-books were content-analyzed. Some discussion will be provided in the upcoming sections.

3.1 Bibliometric Results for E-book Research

3.1.1 The Most Influential Journals in the Earlier Decade (2000-2009)

The bibliometric analysis revealed that most of the e-book research in the earlier decade (2000-2009, n = 141) has been published in library journals, such as *Electronic Library*. As shown in Table 1, *Electronic Library* is the most-cited journal in the field, with the highest total number of citations (n = 385), the highest total number of published papers (n = 24), and the most significant bibliometric impact in terms of the h-index (n = 12) and the g-index (n = 19). This means that the e-book-related articles that were published in *Electronic Library* have been cited at least 12 times, and the 19 top-cited articles have received 19^2 (which is equivalent to 361) citations in total. The period during which 24 e-book research articles were published in the journal was 2000-2009 (the full range of the first decade), showing that the journal is top-rated among e-book researchers. *Library Collections Acquisitions & Technical Services* (with 326 total citations and eight papers on e-books) and *ASLIB Proceedings* (with 210 citations and four published papers) were also library journals.

Table 1. The top-ranked journals that published e-book research in the earlier of the two studied decades (2000-2009)

#	Journal	Total citations (average)	Total papers	h-index	g-index	Active years
1	*Electronic Library*	385 (16)	24	12	19	2000-2009
2	*Library Collections Acquisitions & Technical Services*	326 (40)	8	7	8	2003-2009
3	*ASLIB Proceedings*	210 (52)	4	4	4	2005-2009
4	*Journal of Computer Assisted Learning*	205 (68)	3	3	3	2003-2007
5	*Library Hi Tech*	186 (46)	4	4	4	2007-2009
6	*Electronic Library and Information Systems*	159 (17)	9	7	9	2002-2007
7	*Journal of Academic Librarianship*	142 (35)	4	4	4	2006-2008
8	*Computers & Education*	132 (66)	2	2	2	2008-2008
9	*British Journal of Educational Technology*	112 (56)	2	2	2	2006-2007
10	*Journal of Educational Computing Research*	102 (51)	2	2	2	2009-2009

Ranked as the fourth most impactful journal, *Journal of Computer Assisted Learning* published three e-book research articles between 2003 and 2007. These articles have been cited 205 times in total, and in terms of performance, they constitute the research with the highest average number of citations (n = 68.3) in the field. Note that the WoS indexes the journal's domain as belonging to the education category. The following three education journals that published e-book research in the first decade were ranked eighth to tenth: *Computers & Education*, *British Journal of Educational Technology*, and *Journal of Educational Computing Research*. In addition, these three journals all published two papers each in the late years of the first decade (2006-2009), evidencing increasing interest in e-book research from an educational perspective.

3.1.2 The Most Influential Journals in the Recent Decade (2010-2019)

Structurally, the most influential journals that published e-book research in the recent decade (2010-2019) have changed. As shown in Table 2, the top-ranked journal in the field is *Computers & Education*, which has received a total of 852 citations and has published 17 e-book research articles (h-index = 13; g-index = 17). Moreover, each e-book research article that has been published in this journal has been cited 50 times on average. The figure representing high-impact citations may imply that e-book-related issues have attracted much attention from education researchers. Furthermore, the research period for papers published in *Computers & Education* covered the full time span of the recent decade, suggesting that the journal has always welcomed education-focused e-book research.

Ranked from second to fifth place, *Electronic Library*, *Journal of Academic Librarianship*, *College & Research Libraries*, and *Library Hi Tech* were library journals. Three out of the four journals have been cited more than 200 times in total. Note that the following journals had diverse research domains. While *International Journal of Electronic Commerce* (ranked 7th) published e-book research from a business perspective, *Computers in Human Behavior* (ranked 8th) and *New Media & Society* (ranked 9th) focused on interactive aspects such as the human-computer and media-society dyads. In brief, the results for the most influential journals that have published e-book-related

Table 2. The top-ranked journals that published e-book research in the recent decade (2010-2019)

#	Journal	Total citations (average)	Total papers	*h*-index	*g*-index	Active years
1	*Computers & Education*	852 (50)	17	13	17	2010-2019
2	*Electronic Library*	251 (8)	30	8	14	2010-2019
3	*Journal of Academic Librarianship*	229 (15)	15	8	15	2010-2019
4	*College & Research Libraries*	212 (12)	17	9	14	2011-2018
5	*Library Hi Tech*	171 (11)	15	9	13	2010-2019
6	*International Journal of Electronic Commerce*	158 (79)	2	2	2	2011-2017
7	*Educational Technology & Society*	152 (16)	9	6	9	2013-2018
8	*Computers in Human Behavior*	148 (24)	6	4	6	2011-2019
9	*New Media & Society*	142 (47)	3	3	3	2011-2016
10	*Reading Teacher*	129 (21)	6	4	6	2010-2019

research have highlighted that the main research streams have shifted from the library to the education domain. However, in recent years (2010-2019), e-book researchers have become more diversified, compared to researchers in earlier years (2000-2009). This result also echoes the increasing multi-industry popularity of e-book applications.

3.2 The Most Productive Country in Terms of E-book Research

Many reviews of research publications trends [12-14] have considered a country's productivity in order to highlight the most influential country in terms of the scientific impact it exerts in specific areas. Following previous research, this study conducted an international comparison of e-book researchers' productivity at the country level.

Using bibliometric information for all 579 e-book articles that were collected from the WoS, the first author's affiliate country was counted. The first author was used instead of full authorship in order to highlight the first author's contribution to the research. Among all 579 e-book articles, international researchers from 54 countries were identified. As shown in Figure 2, researchers from the top ten most productive countries have contributed 477 publications, while others, from 44 countries, can be credited for publishing the remaining 102 e-book research articles. The top three most influential countries were the United States (US), Taiwan, and the United Kingdom (UK), followed by China (4th), Israel (5th), Canada (6th), Spain (7th), South Korea (8th), Australia (9th), and India (10th). Note that UK researchers published the most e-book articles (n = 47, 33.3%) in the first decade (2000-2009). However, American (n = 152) and Taiwanese researchers (n = 70) contributed more than half the e-book research articles (n = 222, 50.7%) that were published in the recent decade (2010-2019).

#	Country	Total	2000-2009	2010-2019	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	United States	197	45	152	6	3	4	4	3	6	4	6	4	5	8	8	20	15	17	21	14	19	12	18
2	Taiwan	75	5	70	-	-	-	2	-	1	1	1	-	-	3	2	5	10	5	8	12	9	8	8
3	United Kingdom	70	47	23	2	3	3	4	5	7	1	7	11	4	2	3	4	2	4	1	1	2	3	1
4	China	27	4	23	-	-	-	1	1	2	-	-	-	-	-	4	-	1	3	2	1	3	5	4
5	Israel	26	7	19	-	-	-	-	2	-	-	1	3	1	3	1	2	2	3	1	1	1	1	4
6	Canada	19	3	16	-	1	-	1	-	-	-	-	1	-	1	1	1	4	2	-	1	3	2	1
7	Spain	19	6	13	1	-	2	-	1	-	-	-	1	1	1	1	2	1	4	2	-	1	1	-
8	South Korea	18	1	17	-	-	1	-	-	-	-	-	-	-	1	2	3	3	4	1	2	-	-	1
9	Australia	16	0	16	-	-	-	-	-	-	-	-	-	-	-	-	1	2	5	-	2	1	-	5
10	India	10	6	4	-	1	-	-	1	1	2	-	1	-	1	-	-	1	-	-	1	-	1	-
	Others	102	17	85	-	-	2	2	2	2	-	2	2	5	1	7	9	7	15	7	8	10	9	12

Figure 2. The most productive countries in terms of e-book research

3.3 The Top-cited E-book Articles Across the Two Decades

Since the academic citations indicated that the earlier-published papers were related to the later-published papers, which cited them, the most frequently cited e-book articles endorsed by various research efforts can be considered the researchers' main focus in the e-book area. Therefore, all highly-

cited articles identified in this study were divided between the two aforementioned decades to explore the development of e-book research.

3.3.1 Highly-cited E-book Research (2000-2009)

The top ten most highly-cited articles were identified, based on each article's per annum citations. While the articles that were published during the period 2000-2009 were grouped into the earlier decade, the papers that were published in recent years, from 2010 to 2019, were grouped into the recent decade's research. Table 3 shows the details and the main ideas of the high-impact e-book articles from the first decade.

Table 3. A summary of the top ten most influential e-book articles published in the earlier decade (2000-2009)

#	Author	Main Idea	Citations (average)	Research Category
1	Woody, WD; Daniel, DB; Baker, CA [24]	Pedagogical issues; Post-secondary education; Human-computer interface	188 (21)	Education & Educational Research
2	Daniel, DB; Woody, WD [25]	E-text; Print text; Textbook; Student learning; College students	90 (15)	Education & Educational Research
3	Amblee, N; Bui, T [26]	Digital microproducts; electronic word of mouth; social proofs	116 (15)	Business
4	Parish-Morris, J; Mahajan, N; Hirsh-Pasek, K; Golinkoff, RM; Collins, MF [27]	Parent-child; dialogic reading; preschooler;	72 (12)	Education & Educational Research
5	Huang, YM; Liang, TH; Su, YN; Chen, NS [28]	Personalized learning; Usability; Functionality; Elementary school	77 (11)	Education & Educational Research
6	Korat, O [29]	e-storybook; Vocabulary; Word reading; Comprehension; Kindergarten children; First graders	83 (9)	Education & Educational Research
7	Krcmar, M; Cingel, DP [30]	Parent-child; preschool; cognitive	40 (8)	Communication
8	Shin, DH [31]	Affective factor; Diffusion theory; Expectation confirmation theory; Uses and gratification	61 (8)	Communication
9	Huang, YM; Liang, TH [32]	Elementary school; racking; reading rate; reading behaviors	30 (8)	Education & Educational Research
10	Walters, WH [33]	Academic library; licensing; acquisition	44 (7)	Information Science & Library Science

Based on content, the top ten most frequently cited papers have mainly been attributed to three research categories: education and educational research [7, 15-16-17, 23]; computer science [18-19] and library science [20-22]. With regard to research type, most of the highly-cited papers were empirical research, including experimental design [15-18, 23] and survey [19-21]. The other two were qualitative research, such as review research [7] and content analysis [22].

Regarding research topics, the primary concern in the earlier decade was whether e-books can enhance children's (mostly kindergartners') emergent literacy. Therefore, the main research interests here were to evaluate e-reading performance [7, 17] and compare the effects of e-books versus paper-based (or printed) books [15-16, 18, 23]. In their study, the measurement of emergent literacy included vocabulary, word recognition, and phonological awareness [17]. Three remaining studies focused on the academic library, and a general survey was performed to determine library visitors' (mostly consisting of university students and staff) usage, acceptance, and preference with respect to e-books [19-21].

3.3.2 The Characteristics of Highly-cited E-book Research (2010-2019)

Following the analysis of highly-cited articles, e-book research in the recent decade (2010-2019) has become more diversified in terms of journal publications and research themes (Table 4). First, on the subject of research category, four categories can be identified. Most e-book studies were published in education journals [24-25, 27-29, 32], followed by the communication field [30-31]. The other two articles were found in the business area [26] and library science [33]. In terms of research types, most e-book articles were empirical research, which replicates the previous decade's pattern. The main research methods used are experimental design [25, 27, 29-30, 32] and surveys [24, 26, 28, 31].

However, compared to the previous decade, the recent e-book research themes have been more diverse in terms of focusing on education-related topics, including general e-books, parent-child dialogue reading, an interactive e-book learning system, e-textbooks, e-book modeling, and academic libraries.

Table 4. A summary of the top ten most influential e-book articles in the recent decade (2010-2019)

#	Author	Main Idea	Citations (average)	Research Category
1	Shelburne, WA [20]	Academic library; acceptance, attitude	101 (10)	Information Science & Library Science
2	Zucker, TA; Moody, AK; McKenna, MC [7]	Pre-kindergarten; elementary; literacy development	72 (7)	Education & Educational Research
3	Kang, YY; Wang, MJJ; Lin, RT [18]	Reading performance; Eye fatigue	69 (7)	Computer Science, Hardware & Architecture
4	Korat, O; Shamir, A [15]	E-storybook; Emergent literacy; kindergarteners; Socioeconomic status (SES)	81 (7.)	Education & Educational Research
5	de Jong, MT; Bus, AG [16]	Book-reading; experiment	114 (7)	Psychology, Educational
6	Korat, O; Shamir, A [17]	Emergent literacy; SES; kindergarteners	73 (7)	Education & Educational Research
7	de Jong, MT; Bus, AG [23]	Within-subjects design; efficacy; kindergarten	93 (6)	Education & Educational Research
8	Levine-Clark, M [21]	Awareness; convenience; search	78 (6)	Information Science & Library Science
9	Rowlands, I; Nicholas, D; Jamali, HR; Huntington, P [19]	Academic staff; Students	70 (6)	Computer Science, Information Systems
10	Vassiliou, M; Rowley, J [22]	Digital libraries; Electronic publishing	62 (6)	Information Science & Library Science

Continuing the last decade's prevalent research topic, Korat (2010) examined e-storybooks' effect on vocabulary and story comprehension by comparing kindergartners and first-grade students [29]. Other researchers found that focusing on parent-child dialogic reading is another approach for examining whether e-books can enhance children's story comprehension [27, 30]. They found that distractions occurred when electronic features were present (e.g., when reading an e-book on an iPad). Focusing on a more specific type of e-book, that is, e-textbooks, researchers compared students' preferences for e-textbooks versus the printed versions [24-25] and found that even with the e-textbooks' easy-to-search function, students still preferred traditional textbooks. In addition to examining e-books' performance, an interactive e-book learning system was adopted to track elementary students' performance in terms of reading behaviors [28, 32]. Finally, two studies tested the theoretical model of e-books [14, 19]. While Amblee and Bui (2013) investigated the effect of electronic word of mouth (eWOM) on e-book sales from a business viewpoint [26], Shin (2011) explored the factors influencing e-book reading habits from a communication perspective [31]. Note that Walters (2013) conducted a state-of-the-art review articulating the challenges of adopting e-books in academic libraries due to a lack of uniformity with respect to license terms, access restrictions, and librarians' expectations [33].

4 Conclusion

This paper focuses on the development of e-book research. Growth trends in international e-book publication patterns were confirmed. We also identified highly-cited research across two research periods. The results showed that most studies consisted of empirical research. Moreover, the main camps in terms of research themes are (1) a performance comparison between e-books and traditional books (e.g., in terms of vocabulary, comprehension, and reading rates) and (2) e-books' acceptance and usage in academic libraries. However, the trend diversified in the recent decade. Joint parent-child reading, interactive e-book learning systems, and e-book modeling are emergent research topics. In addition, e-book research has attracted researchers from outside the education and library science fields, such as those from the business and communication fields.

For future studies, more advanced methods (e.g., citation-based network analysis) can be considered to conduct a more in-depth investigation of the developmental paths in e-book literature in order to complement this study's content-based finding. Additionally, more extensive research data can be further analyzed to confirm the main themes of highly-cited articles in e-book research. Bearing this in mind, this study has contributed a brief but critical understanding of the development of e-books.

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