

The Half-Life and Obsolescence of the Literature Science Area: a contribution to the understanding the chronology of citations in academic activity.

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Abstract: This paper develops a bibliometric analysis in Literature Science area in order to determinate the Half-Life and Obsolescence of this field of knowledge. They were based on citations that are in the References section and included in dissertation and theses from the Post-Graduate Program in Literature Science of the Belles-lettres School of the Federal University of Rio de Janeiro (UFRJ) Brazil in the periods of 2007/2008 and 2011/2012. It was concluded that the master's degree and doctor's degree students in Literature Science prefer to use books as a source of research. Therefore, books and book chapters were the material selected for the calculation of Half-Life of literature. The results indicate that in Literature Science area the half-life is 14 years, by the citation analysis in theses and dissertations defended in the 2007/2008 period and 15 years for the 2011/2012 period.

Keywords: Citation Analysis. Bibliometrics. Literature Science. xLiterature Half-Life and Obsolescence.

1. 1 Introduction

The use of bibliometric indicators to evaluate an area of knowledge is recognized as an important technique and a device to study, assess and detect determinants phenomena in scientific production activities.

These indicators has appeared in the early twentieth century, in the context of information science, research area called Bibliometrics, area first defined by Alan Pritchard (1969, p. 349) as the "application of mathematical and statistical methods to books and other media of communication."

This work objective to develop a quantitative and descriptive study of the behavior in the field of Literature Science, using the Bibliometric techniques Citation Analysis and Half-Life and obsolescence of Scientific Literature. The

material used are the citation that are in the References section, contained in theses and dissertations submitted to the Post-Graduate Program in Literature Science of the Belles-lettres Scholl of the Federal University of Rio de Janeiro (UFRJ) Brazil, in the periods 2007/2008 and 2011/2012.

The choice of Literature Science area for this research is justified because there was not identified such analysis in this field of knowledge in Portuguese. It was found, however, a bibliometric study by Bronmo in 1979 on the use of Literary Criticism books in the Library of the University of Toronto, mentioned by the author Urbizagástegui Alvarado in 2009.

Several scholars highlight the validity of bibliometric technique of half-life and obsolescence of scientific literature as an indicator that contributes to the knowledge of the study area, offering support to researchers. Thus, the recognition of the half-life and the degree of literature obsolescence produced in the area contributes to the selection of qualitatively important information on research topics related to Science Literature.

On the other hand, the results can also contribute to the management of specialized information units in the studied field, for example, the formation and development of collections, contributing to the decision making with regard to the maintenance of documents in the collection or removing those considered obsolete.

2. Theoretical framework

According to Guedes (2012, p. 101), the "Bibliometrics is a science consisted on statistical laws and empirical principles that contribute to the establishment of the theoretical basis of the area of Information Science." It uses mathematical and statistical methods as a tool to generate different indicators related to productivity journals and authors, the frequency of occurrence of terms to assist in decision-making in the management of information and knowledge.

The term Bibliometrics was introduced by Pritchard (1969), in the article "Statistical bibliography or Bibliometrics?", which notes that the term Statistical Bibliography was first used in 1922 by E. Wyndham Hulme, to denote clarification of scientific and technological processes by document count, but that term was not well accepted by researchers. Thus, Pritchard suggested the term Bibliometrics in the application of mathematical and statistical methods to books and other media.

Urbizagástegui Alvarado (2007) states that the application of statistical methods happened before the introduction of the term by Pritchard. The author lists several studies conducted by researchers as Cole and Eales in 1917; Dresden in 1922; Hulme in 1923; Lotka (1926); Gross and Gross in 1927; Bradford in 1934; Zipf in 1935; Gosnel in 1943; Boig in 1952; Burton and Kebler in 1960 and many others. Le Coadic (2007, p. 219-220) states that some of these works are the first scientific laws in Bibliometry area, which are relatively constant quantitative relations that can be expressed in the form of mathematical functions, are the laws of Lotka, Zipf and Bradford.

Guedes (2012, p 95) adds "other studies and concepts applied to Bibliometrics" as a research and invisible colleges; immediacy or impact factors; bibliographic coupling and co-citation; literature obsolescence and half-life; law of elitism; epidemic theory of Goffman and law of 80/20.

The half-life and literature obsolescence is an indicator that uses citation analysis to investigate the time when the literature in a particular knowledge area becomes rarely used, in other words, they investigate the decline of the use of a particular literature.

The term "obsolescence", according Urbizagástegui Alvarado (2009), was first used in the work of Gross and Gross in 1927, when analyzing the references of the journal *Chemical Literature*, when they observed that the number of references fell by half after 15 years of the publication. Subsequently, Gosnell (1934) studied nineteen different areas and postulated the hypothesis that the value of older books generally are lower than those newer; and the causes of obsolescence of books can be from pure trend to the extent of scientific knowledge, technological changes and fundamental changes in our civilization (URBIZAGÁSTEGUI ALVARADO, 2009, unpagged).

Burton and Kebler (1960) state that the term half-life was evident since the meeting International Conference on Scientific Information, held in Washington in 1958 and since then it has begun to be used by librarians and documentalists. This term is an analogy to the familiar term for physical and nuclear engineers who use it to describe the time that radioactive substances come into decay. Documentalists use the term half-life to set the time to obsolescence for half of the currently published literature (BURTON; Kebler, 1960, p. 19). In literature, it does not decompose, it simply becomes unused; however, does not become useless, but obsolete.

3. Material and Methodology

The Post-Graduate Program in Literature Science of the Belles-lettres School of the Federal University of Rio de Janeiro was created in 1970 and it is divided into three areas: Literary Theory, Comparative and Poetics Literature. Those areas multiply in seven lines of research and expand in eleven major centers of research (Post-Graduate Program in Literature Science, UFRJ, 2014).

The literature is the overall product of human labor, that is, the culture of a people's achievements in sciences and arts. The word literature was formed from the word Latin *littera*, letter or character of scripture and translates a Greek word meaning the art with respect to letters, the art of writing and reading (CASTRO, 1985, p. 33). "Science of Literature" was the label used to represent the literary studies, development of literature, comparative literature and literary foundations of culture (SOARES, 1985, p. 92)

For achieving the purposes, in the first stage, citation were collected in "References" section of theses and dissertations in diachronic period 2007/2008 and 2011/2012, which consisted in computing the amount of work completed in the period, the number of citations per paper; identify and classify the types of media used (book, chapter book, journal etc.); identify and classify the year of publication of the document; narrow the study of life extension only to reference

books and chapter books that were identified during collectas the document type most used by the community. In the second stage, the data was organized in tables and, in the last step, the half-life was calculated following the orientations of Burton and Keblerr (1960)

4. Results

During the study period, 77 dissertations and 41 theses were completed, amounting 118 works, which were cited in 5.682 and 8.708 respectively documents, totaling 14.390 citations. These numbers show that the amount of dissertations and theses represent 34.7% and 65.3% of the total work completed, while in number of citations represent 39.5% in dissertations and 60.5% in the total of citations theses.

Table 1 below shows the documentary types and the number of citations in the analyzed periods.

Table 1 Documentary typologies - Number of citations

TYOLOGY	2007	2008	N1	Σ N1	2011	2012	N2	Σ N2	N1+N2
Book	3.053	1.776	4.829	4.829	2.529	2.237	4.766	4.766	9.595
Ebook	13	3	16	4.845	18	15	33	4.799	49
Book chapter	384	327	711	5.556	292	472	764	5.563	1.475
Book chapter web	5	0	5	5.561	7	4	11	5.574	16
Journal	522	100	622	6.183	227	185	412	5.986	1.034
Journal in web	21	16	37	6.220	65	43	108	6.094	145
These/dissertation	25	20	45	6.265	28	47	75	6.169	120
These/dissert. web	1	0	1	6.266	5	2	7	6.176	8
CongressComun	13	15	28	6.294	14	12	26	6.202	54
CongressCom web	2	3	5	6.299	4	1	5	6.207	10
Websites	103	77	180	6.479	113	103	216	6.423	396
Newspaper	693	12	705	7.184	21	27	48	6.471	753
Newspaperwe	15	3	18	7.2	2	216	218	6.6	236

b				02				89	
Manuscript	24	4	28	7.2	9	27	36	6.7	64
				30				25	
CD/music	24	9	33	7.2	54	36	90	6.8	123
				63				15	
Movie/DVD	32	12	44	7.3	99	151	250	7.0	294
				07				65	
Painting/engraving	2	15	17	7.3	1	0	1	7.0	18
				24				66	
Total	4.9	2.3	7.3	7.3	3.4	3.5	7.0	7.0	14.39
	32	92	24	24	88	78	66	66	0

N1: number of citations in the period 2007/2008

N2: number of citations in the period 2011/2012

The Table 1 shows that, in the analyzed period, there are 14.390 citations classified in eleven documentary types, according to their similarities. It was observed that more than 75% of the citations are to books and book chapter, both in the first and the second analysis period. Therefore, we opted for the realization of the calculation of half-life from the realization of citations of books and book chapters, as methodological innovation relative to what is often suggested in the literature on Bibliometrics, which investigates the half-life of literature by citation analysis to journal papers.

In Table 1, it was also identified that the area of Literature Science uses few documents available on the web, however, from one period to another, there was a considerable increase, 3.6% to 8%.

The table below shows the calculation of the half-life of theses and dissertations in the field of Literature Science, analyzed in 2007/2008.

Table 2 Calculation of half-life (2008 – 2009)

ANOS	N	Σ N	%	Σ %
2008	19	19	0,34%	0,34%
2007	50	69	0,90%	1,24%
2006	132	201	2,37%	3,61%
2005	223	424	4,01%	7,62%
2004	247	671	4,44%	12,07%
2003	244	915	4,39%	16,45%
2002	270	1.185	4,86%	21,31%
2001	223	1.408	4,01%	25,32%
2000	249	1.657	4,48%	29,80%
1999	236	1.893	4,24%	34,04%
1998	211	2.104	3,79%	37,83%
1997	235	2.339	4,23%	42,06%
1996	205	2.544	3,69%	45,75%
1995	194	2.738	3,49%	49,24%

$$\frac{14 \text{ years} \times 5.561}{2} = 2.780,5$$

1994	181	2.919	3,25%	52,49%
1993	153	3.072	2,75%	55,24%
1992	138	3.210	2,48%	57,72%
1991	149	3.359	2,68%	60,40%
1990	123	3.482	2,21%	62,61%
1989	143	3.625	2,57%	65,19%
1988	122	3.747	2,19%	67,38%
1987	109	3.856	1,96%	69,34%
1986	101	3.957	1,82%	71,16%
1985	119	4.076	2,14%	73,30%
1984	78	4.154	1,40%	74,70%
1983	82	4.236	1,47%	76,17%
1982	82	4.318	1,47%	77,65%
1981	66	4.384	1,19%	78,83%
1980	71	4.455	1,28%	80,11%
***	***	***	***	***
1841	1	5.561	0,02%	100%

Among the 7.324 citations (2007/2008, see Table 1) computed in eleven documentary typologies were selected 5.561 citations of books and book chapters representing approximately 75% of the analyzed citations, an amount that justifies the choice of such material in this study.

It appears in Table 2 that the 5.561 documents cited were published in the period between 1841 to 2008, references going back 167 years. It can be seen that the highest number of citations (270) refers to documents published

in 2002.

To calculate the half-life, we divided the 5.561 citations analyzed by two, resulting in 2.780 that represent 50% of the literature cited. Then nearest number was located in the table in the column of the sum of citations (ΣN), which is represented by the value 2.738. Added up the years listed above, resulting 14 years, which means that the half-life of Literature Science area calculated in the period 2007-2008 is 14 years.

In the table below, shows the calculation of the half-life in the biennium 2010/2012.

Table 3 Calculation of half-life (2011-2012)

ANOS	N	Σ N	%	Σ %
2012	13	13	0,23%	0,23%
2011	67	80	1,20%	1,44%
2010	161	241	2,89%	4,32%
2009	198	439	3,55%	7,88%
2008	224	663	4,02%	11,89%
2007	221	884	3,96%	15,86%
2006	240	1.124	4,31%	20,17%
2005	242	1.366	4,34%	24,51%
2004	217	1.583	3,89%	28,40%
2003	239	1.822	4,29%	32,69%
2002	220	2.042	3,95%	36,63%
2001	204	2.246	3,66%	40,29%

15 years

$$\frac{5.574}{2} = 2.787$$

2000	189	2.435	3,39%	43,68%
1999	180	2.616	3,23%	46,93%
1998	144	2.760	2,58%	49,52%
1997	123	2.883	2,21%	51,72%
1996	147	3.030	2,64%	54,36%
1995	119	3.149	2,13%	56,49%
1994	132	3.281	2,37%	58,86%
1993	106	3.387	1,90%	60,76%
1992	125	3.512	2,24%	63,01%
1991	103	3.615	1,85%	64,85%
1990	90	3.705	1,61%	66,47%
1989	90	3.795	1,61%	68,08%
1988	112	3.907	2,01%	70,09%
1987	100	4.007	1,79%	71,89%
1986	76	4.083	1,36%	73,25%
1985	86	4.169	1,54%	74,79%
1984	69	4.238	1,24%	76,03%
1983	82	4.320	1,47%	77,50%
1982	68	4.388	1,22%	78,72%
***	***	***	***	***
1555	1	5.574	0,02%	100%

In the biennium 2011/2012, were computed 7.066 citations (cf. table 1). We selected 5.574 citations of books and book chapters in both traditional format as in electronic format. This amount represents 78.88% of the total analyzed citations that were dated between 1555 and 2012, going back, 458 years.

To determine the half-life, we proceeded the same as in the biennium 2007/2008 and it was found 15 years as the half-life of

Literature Science area in the 2011/2012 period. It was observed that in 1998 reaches the half-life and from 1983 the literature is becoming obsolete. The year 2005 focused the highest number of citations, with are 242 citations, as shown in Table 3.

5. Conclusions

The half-life in this study did not surprise because, although there is a difference of one year between the two periods analyzed, it was considered to be valid, whereas the areas of knowledge are dynamic with respect to the development of scientific research and publishing results.

If we compare with some fields of knowledge Literature Science has a half-life relatively long. As Gomes et al. (2013), Information Science has half-life of 7 years; Foreign Trade, 5 years; Chemistry of 8 years; Botany, 11; Keratoconus, 6-7 years; Cataract extraction, 7.5 years; Information users, 13; Law of 8 years and finally Information Science published in Proceedings of the Encontro Nacional de Pesquisa em Ciência da Informação (ENANCIB) 2012, between 8-10 years.

It is observed, that in the second period analyzed, the uses of the internet doubled from the first period (from 3.58% to 8.46%), considering all documentary typologies. This fact should demonstrate the increased use of the Web also in this field of knowledge, following the global trend presented in all of human society.

It was found that this area of knowledge is used in a number of classic literature, such as philosophical texts and literary texts of different phases, depending on the approach used by the researcher.

After the analysis embracing all areas and research lines of the Post-Graduate Program considering the differences existent in each area, it may be necessary to examine separately. The distinction between classical literature and the theoretical and conceptual texts is also a factor to measure the half-life of this area of knowledge, as indicated by Burton and Kebler (1960, p. 20).

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