

# Effectiveness Analysis of Electronic Resources at the Hacettepe University

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**Abstract:** *It is important to collect and analyze the usage data of electronic databases and periodicals in order to make policies regarding the composition, improvement and more extensive utilization of electronic resources of libraries. The aim of this study is to investigate how efficiently the full text accessible electronic resources of Hacettepe University Libraries are used. For this purpose the usage data obtained from COUNTER Software regarding the electronic databases to which Hacettepe University Libraries subscribed in 2007 were examined. Full-text access to 13,270 journals within 13 electronic databases was found to be 585.843 in 2007. ScienceDirect is the most frequently used database, accounting for 56.1% of all accesses. Some 1,575 journals appear in more than one database and 2,912 journals were never used. A great part of the core journals identified by the Bradford Law are included in the ScienceDirect database.*

**Keywords:** *Digital libraries; electronic databases; electronic journals; core journals; bibliometrics; Bradford Law; efficiency analysis; Hacettepe University Libraries.*

## Introduction

Rapid advances in technology combined with an increase in the number of electronic resources has led to a parallel increase in the number of these sources in library collections. Today, considerable allocations are made from library budgets to electronic resources. With their active role in disseminating information, libraries have been immediately affected by this technological change. Getting acquainted with such new concepts as electronic databases, electronic periodicals and electronic books, libraries have rapidly transformed their collections into electronic resources. The emergence in library collections of electronic resources, which offer the advantages of quick access to information and user-friendliness, has forced libraries to undertake new and different initiatives in collection building and management. This process has made it necessary for libraries to review their collection building policies including selection, provision and evaluation, and to launch utilization and cost analyses to be used in review and decision-making processes.

The recently observed swift increase in the number of periodicals and their prices has led to an increase in the budget share of these publications, which are indispensable, particularly for academic library collections. Hence, libraries are bound to investigate how rational this investment is by assessing to what extent these sources are actually used. Libraries can do this by resorting to such assessment criteria as intensity of collection use, rate at which collections respond to users' needs and identification of most frequently and rarely used materials (Ünal, 2008).

For assessments related to periodicals, there is need to secure documentation and to examine data on in-library use or on articles downloaded from databases. This can form the basis of decisions as to which years of the periodicals should be included or excluded from the collection, to which electronic periodical databases there is need to subscribe or which periodicals in databases should absolutely be included in the collection. Further, among points which should particularly be considered in creating a collection of periodicals, there is the need to identify “core periodicals” which are the *sine qua non* of a collection and to check whether these “must” periodicals change over the years (Ünal, 2008).

The Hacettepe University (HU) Library, at one of the leading universities of Turkey, is aiming to be at the top also in terms of both its resources and the cost effectiveness of these publications. In line with this objective, there have recently been significant achievements in the context of membership to electronic databases providing full texts. The present study assesses, for the pilot year 2007, to what extent electronic databases with full text access are used by the academic staff of HU.

## Methodology and Tools

The present study focuses, for the year 2007, on the use of periodicals in full text access databases to which HU has subscriptions. In this context, it was first investigated whether periodicals in databases were effectively used by analyzing the frequency of use. The aim was to expose the effectiveness of databases that provided full text access to articles. For this purpose, the COUNTER software, known as the recording system of databases, was used first. On the basis of this software, the number of uses of full text was found for each periodical. Then, based on these figures, core periodical groups were found for each database and for HU in general. “Core periodical groups” refer to a relatively small number of periodicals that are used frequently. References for publications with the address of HU were identified in the database of Web of Science (WOS).

## Bradford Law

Another analysis envisaged under the study was to check whether full article use statistics of databases subscribed to by HU were in conformity with the Bradford Law. The Bradford Law “identifies the dissemination to or distribution of a literature on a specific topic in periodicals” (Garfield, 1980). According to this law, “if scientific periodicals are arranged in order of diminishing returns of articles produced on a specific topic, then periodicals can be divided into a core group of periodicals publishing articles only on this specific topic and multiple groups or zones containing the same number of articles with this core group.” (Tonta & Al, 2007) Garfield comments on the Bradford Law as follows: “If you want to compile a bibliography on any topic, there will always be a small core group of periodicals that provide a substantial part (1/3) of articles on that topic or discipline. A second group which is larger than the previous one provides the other 1/3 and finally a much larger third group for the last 1/3.” (Al & Tonta, 2007). The distribution of full article use by periodicals was investigated separately for each database and for HU as a whole. The formula suggested by Egghe was used for the Bradford Law. Some values must be known in advance in order to use this formula. These are values  $p$ ,  $y_0$ ,  $r_0$  and  $k$ ,  $y_0$  being the value obtained when the total number of articles in bibliography ( $A$ ) is divided by the number of selected sub-groups ( $p$ ) while  $k$  is the Bradford multiplier, and  $y_m$  stands for the number of articles in the periodical which contains the largest number of articles. Finally,  $e^Y$  in the Bradford multiplier is the Euler coefficient = 1,781. (Egghe and Rousseau, 1990).

$$y_0 = A / p$$

$$k = (e^Y y_m)^{1/p}$$

$$r_0 + r_0 k + r_0 k^2 + \dots + r_0 k^{p-1} = T$$

from the equation above:

$$r_0 = (T(k - 1) / (k^p - 1)).$$

## Findings and Discussion

### *Frequency of Use of Electronic Databases and Resources by Academic Staff*

Under the study, data from 13 databases to which Hacettepe University Libraries have subscriptions were obtained (Table 1).

Table 1. Databases for which data available and used in the analysis

Database	Number of journals	%
ACS	37	0.3
Annual Review	41	0.3
ASC	2,436	18.4
Blackwell-Synergy	1,038	7.8
BSC	1,136	8.6
Nature	79	0.6
OVID	288	2.2
Oxford	191	1.4
Proquest	1,694	12.8
ScienceDirect	2,412	18.2
Science Online	1	0.0
Taylor	3,315	25
Wiley	602	4.5
Total	13,270	100.0

Use statistics pertaining to 13,270 periodicals were obtained for these 13 databases. A total of 1,575 of these periodicals appear in more than one database. It should be noted that eight journals that appeared in more than one database were never used at all, even though HU paid at least twice for those journals (e.g., *Acta Archaeologica*, *Acta Mechanica Solida Sinica*, *Advanced Powder Technology*, *Archaeology*, *Ethnology and Anthropology of Eurasia*, *Forstwissenschaftliches Centralblatt*, *Gesunde Pflanzen*, *Journal of Scheduling*, *Reproductive Medicine and Biology*). It is observed that the issue of journals included in more than one database has been neglected in studies carried out so far. To solve this problem, the Clementine (SPSS) data mining software was used and these journals and the number of their uses in each database were combined. The frequency of full text article use was  $50,06 \pm 184,13$  for all periodicals.

Of 13,270 periodicals for which data were available in this analysis, 1,575 that appeared in more than one database were excluded and the study was carried out with the remaining 11,695. Out of these 11,695 periodicals, 2,912 (approximately 25%) stood out for zero use, despite their paid subscriptions (sometimes paid for at least twice, see above).

Table 2. Frequency of use of the journals included in the study

# of times full text used	# of journals	%
0	2,912	24.9
1-5	4,047	34.6
6-10	983	8.4
11-25	1,086	9.3
26-50	745	6.4
51-100	638	5.5
101-200	548	4.7
201-500	480	4.1
501-1000	180	1.5
1001 +	76	0.6
Total	11,695	100.0

The number of uses of 13 electronic databases providing full text access to electronic periodicals that the libraries of HU subscribed to in 2007 is given in Table 3. In HU, 585.843 full text articles were downloaded from these databases that year. The majority of these articles (56.1%) were provided by the ScienceDirect database.

Table 3. Distribution of full text use in 2007 at HU of 13 databases (data obtained from COUNTER)

Database	Number of times used	%
ACS	13,275	2.3
Annual Review	3,542	0.6
ASC	12,926	2.2
Blackwell	57,566	9.8
BSC	7,124	1.2
Nature	19,217	3.3
OVID	32,597	5.5
Oxford	22,184	3.8
Proquest	16,664	2.8
ScienceDirect	329,760	56.1
Science Online	3,990	0.7
Taylor	39,059	6.6
Wiley	30,259	5.1
Total	585,843	100.0

Examining the average number of uses of periodicals in electronic databases in the year 2007, we find that the figures for the ACS and Nature databases are higher than others. ASC and BSC have the lowest number of uses per periodical title (Table 4).

Table 4. Use of electronic journals by database

Database	Number of Journals	Number of Full Text Usage					Percentiles		
		Total	Mean	S.Dev.	Min	Max.	25	50	75
ACS	37	13,275	349.3	-	-	-	-	-	-
Annual Review	41	3,542	86.4	101.0	0	490	9.0	64.0	125.5
ASC	2,436	12,926	5.3	11.2	1	284	1.0	2.0	5.0
Blackwell-Synergy	1,038	57,566	55.5	135.5	0	1,377	.0	5.0	44.0
BSC	1,136	7,124	6.27	17.1	1	373	1.0	2.0	5.0
Nature	79	19,217	243.3	389.2	1	2,993	60.0	156.0	300.0
OVID	288	32,597	113.2	209.0	1	2,211	10.0	41.5	135.0
Oxford	191	22,184	116.1	242.7	1	1,386	9.0	22.0	98.0
Proquest	1,694	16,664	9.8	26.8	1	531	1.0	2.0	7.0
ScienceDirect	2,412	329,760	136.7	327.0	0	5,299	1.0	24.5	133.0
Science Online	1	3,990	3,990.0	-	3,990	3,990	3,990.0	3,990.0	3,990.0
Taylor	3,315	39,059	11.8	50.0	0	997	.0	.0	3.0
Wiley	602	30,259	50.3	140.4	0	2,021	.0	6.0	38.0

### *Core Periodical Groups for Electronic Databases*

Analyses were made separately for each database to check conformity with the Bradford Law. It was found that none of 13 databases complied with the law. Considering all periodicals in general, the core periodicals group university-wide for 11,695 periodicals was identified and a test was conducted to check conformity with the Bradford Law. Outcomes are given in Table 5 and Figure 1. In all

databases, there are more periodicals than envisaged by the Bradford Law in Group 1 (the group that constitutes the first 33% of full text use). Further, examining Figure 1 showing the cumulative distribution of total articles belonging to each database by total number of periodicals, we obtain outcomes similar to the ScienceDirect database. In other words, a relatively small number of periodicals out of the total respond to the need for articles.

One possible reason for having no database complying with the Bradford Law could be the fact that the databases comprise periodicals from different areas. It is observed that there is no homogeneity of subject matter. Since database managers strive to include popular periodicals in their series, periodicals from very different areas may come together disproportionately. In general, scientific advances are faster in medical and natural sciences than in social sciences. Considering that most popular periodicals are from the latter, non-compliance with the Bradford Law should be no surprise. While checking conformity with the Bradford Law, the number of groups is accepted as 3 in line with other studies in relevant literature. Nevertheless, conformity was also checked by making 5 and 7 groups, but still no conformity could be found for any database.

Based on this analysis, the first 20 from the core periodical list of HU and numbers for full text usage are given in Table 6.

Table 5. Conformity with Bradford Law for 11,703 journals in the databases to which HU subscribed in 2007

Group	According to times full text articles used			According to Bradford Law		
	Number of Journals	Number of Papers	%	Number of Journals	Number of Papers	%
	n	N		n	N	
1	152	195,259	33.3	16	63,561	10.8
2	539	195,364	33.3	520	290,059	49.5
3	11,004	195,220	33.3	11,159	232,223	39.6
Total	11,695	585,843	100.0	11,695	585,843	99.9
<i>ym</i> = The number of articles in the most commonly used journal			5,559			

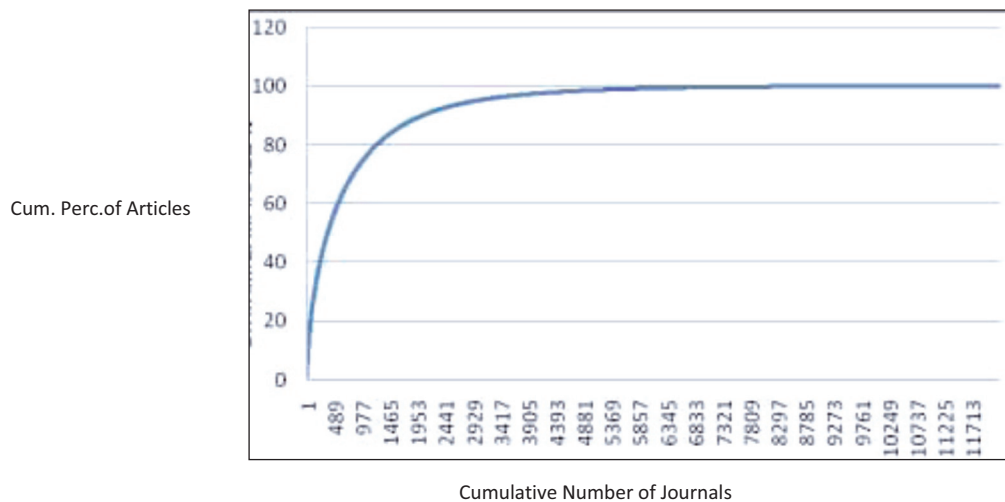


Figure 1. Bradford curve of 11,695 journals in databases to which Hacettepe University Libraries subscribed in 2007

Table 6. Core list of journals for Hacettepe University

Journal Name	Number of Uses
Lancet	5,559
Fertility and Sterility	4,494
Science	3,990
Food Chemistry	3,848
Journal of Chromatography A	3,757
Nature	3,055
Biomaterials	2,907
International Journal of Radiation Oncology*Biology*Physics	2,879
International Journal of Pharmaceutics	2,747
Analytica Chimica Acta	2,347
Journal of the American College of Cardiology	2,320
Journal of Prosthetic Dentistry	2,316
Plastic and Reconstructive Surgery	2,211
Journal of Food Engineering	2,131
Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology	2,027
Journal of Applied Polymer Science	2,021
Journal of Hydrology	1,936
Journal of Pharmaceutical and Biomedical Analysis	1,928
Journal of the American Dietetic Association	1,919
Journal of Chromatography B	1,873

## Discussion

HU full text use statistics were evaluated both separately for each of 13 databases and for all databases in general. According to this analysis, the most frequently used database is ScienceDirect with 329,760 articles. The least used is the Annual Review database with 3,542 articles. As for average use per periodical, the ACS database leads the list with 349.34 while the ASC is at the bottom of the list with 5.30. The ScienceDirect database as the most frequently used is in the upper part of the list in terms of average figure per periodical with 136.7. It is clear that this finding can serve as a significant criterion for effective use. It became clear that the equation “the more periodicals = the more uses” may not hold true all the time. The authorities need to conclude contracts with database dealers on the basis of these findings and data.

According to statistics on use, for all 13 databases use is concentrated in a relatively small number of periodicals. These periodicals may therefore be considered as “core” for the databases concerned. Many other studies (Tonta & Ünal, 2007; Bensman, 2005; Tonta & Ünal, 2005; Wiley & Chrzastowski, 2002) have reached the same conclusion. However, the most important point to make here is that it would be a mistake to keep, solely on the basis of use statistics, only frequently used periodicals in library collections and terminate subscriptions to others. Especially in universities teaching in different branches of science, academic staff/student ratio may vary with respect to departments. It is therefore necessary to investigate how important less frequently used and out of core periodicals can be for different departments. The simplest and most effective way of doing this is to administer questionnaires (to assess the effect of periodicals in their respective areas). “Branch of science” oriented questionnaires to be completed by users should be evaluated together with use statistics.

Table 7 gives a comparative account of Bradford analyses in a study conducted in the period 2001-2007 on libraries in Turkey having membership in ULAKBIM for articles downloaded from ScienceDirect and Wiley databases (Tonta & Ünal, 2008a) and our own findings. In neither study do periodical uses comply with the Bradford Law.

According to Table 7, our study points to 69 periodicals in the core group for the year 2007 whereas the other study found this number to be 93 countrywide. However, taken generally, the use behavior of Hacettepe University is still close to the country figure for this particular database. The earlier study did not consider 2007 data for the Wiley database. Still, if comparison is made on the basis of 2006 data (Table 8) the HU use profile is again close to the country profile.

Table 7. Comparison of the group distribution of the journals for the articles downloaded from the ScienceDirect database by member libraries of HU and The Turkish Academic Network and Information Centre (ULAKBIM)

Group	Our Study 2007	Tonta & Ünal 2008a
1	69	93
2	215	257
3	2,128	1,663
Total	2,412	2,013

Table 8. Comparison of the group distribution of the journals for the articles downloaded from Wiley database by member libraries of HU and ULAKBIM in Turkey

Group	Our Study 2007	Tonta & Ünal 2008a
1	14	19
2	44	57
3	544	361
Total	602	437

Another study conducted in Turkey (Tonta & Ünal, 2007) found that researchers in universities having membership in ULAKBIM provided for a large part of their need of articles by referring to relatively few core periodicals available in electronic periodical databases in ScienceDirect, SpringerLink, WileyInterScience and EBSCOHost of ULAKBIM. Our study, on the other hand, found that the core periodical group of HU comprised 160 periodicals. Examining these periodicals by their fields we find that they are mostly concentrated in medicine and medical sciences. Hence, considering that the list does not encompass all branches of science in the university, it would be incorrect to treat the list as the core periodicals group of the university.

## Conclusion and Suggestions

Creation and maintenance of library collections is difficult and requires costly investment. Hence for their effective utilization there is need for keeping correct use statistics and analyzing these statistics properly. Otherwise it may happen that unsound investment is made in periodicals which are not used at all or used only rarely or double payment is made for the same periodical since a single periodical can be marketed to libraries by more than one database. At the stage of determining frequencies of use, there is a need to take into account some very important points. Since databases are accessible from different web addresses, a single periodical can be counted more than once as if different periodicals are in question, which has a misleading effect on frequency of use as well as showing the number of periodicals to be greater than the actual number.

When the title of a specific periodical appearing in different databases starts with an upper case or lower case letter depending on the choice of the database, or if a title is with or without suffixes in English, the list of periodicals obtained from the COUNTER software may turn out to be longer than it actually is. For example, the periodical cited as *Lancet* in one database may be cited as *The Lancet* in another, or *Kidney International* in one database becomes *Kidneyinternational* in another, which may lead to double counting. These factors should be analyzed carefully. This analysis should be conducted not by hand but through methods like text mining which are technically more sound and which minimize the possibility of error. For efficient utilization of such a costly investment, researchers who will utilize relevant services have to fulfill their responsibilities just as library management rendering relevant services has their specific duties to perform. It is a must for researchers to learn more about this immense source of information that they can access in seconds by using their computers, to be determined and willing to use accessible electronic databases more correctly and effectively and to receive training if necessary.

Given that 1,575 of 13,270 periodicals which are found in HU Libraries and are covered by this study appear in more than one database; that 2,912 periodicals (25% of total) have never been used; and that 8 of these zero-use periodicals are marketed by more than one database, it appears that it would be economically more sound to subscribe to periodicals individually rather than on the basis of

databases. This suggestion is further supported by the unequal distribution of frequency of use of periodicals in a database and the rather pronounced nature of this inequality.

Meanwhile, the concentration of the core group of periodicals identified in the study in a few disciplines indicates that statistics of use alone would not be sufficient in a study of this kind. In efforts to create a core group of periodicals for an academic institution like HU, there is a need to take into account such other criteria as branches of science in the institution and number of users in respective branches. In other words, a core group of periodicals should be established for each and every branch of science. It is considered that the findings of the present study on HU, one of the leading universities of Turkey, are quite important for the relevant literature. This importance derives from the fact that the university encompasses a wide range of academic units including Medicine and Health Sciences, Science and Social Sciences, Engineering, Law, Fine Arts, Music and Stage Arts; that sources of information provided by the library are quite rich and diverse; and that the group of users is quantitatively large. Conclusions drawn from the model of such a large and diversified university can serve as a model for many other academic institutions.

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