[www.reciis.cict.fiocruz.br]
e-ISSN 1981-6286

Original article

Multidisciplinarity and specificity in scientific publication: discussion of the impact when assessing different fields[1]

DOI: 10.3395/reciis.v4i1.426en

Rogério Mugnaini
Statistician, MSc and Dsc in Information Science (Campinas Catholic University and University of São Paulo - USP). Teaches Public Policies Management with emphasis in Quantitative Methods, and is also a member of the Information Science Postgraduate Program , both at USP.
mugnaini@usp.br

Dinah Apparecida de Melo Aguiar Población
Full Professor at University of São Paulo - USP, librarian, specialist in Information Science (USP). MSc and DSc in Communication (USP). PhD at Universidad Autonoma de Madrid. Emphasis: Scientometrics, Documents in the Health field.
pobla@terra.com.br

Abstract

The bibliographic references may reveal how science is being published, and thus provide important information regarding the history of any magazine. When identifying the impact of different types of documents cited by five scientific journals of different fields, it was found that the book has considerably been more quoted in a particular magazine of Applied Social Sciences; meanwhile, the Public Health field makes use of this type of document about as much as it does with scientific articles. In journals of Physics and Medicine, citations from international journals are much more prevalent. As for journals in the field of Veterinary and Information Science, proceedings and dissertations stand out. These findings are important to understand how the scientific publication of different fields work. And that could also be observed when analyzing both the ratings of the journals in Qualis, and the criteria of existing field documents. Bibliometric indicators that are not restricted to an index are able to provide parameters to cooperate in establishing criteria for the assessment of scientific production in Brazil, according to the characteristics of different fields of knowledge.

Keywords

Scientific publication; Bibliometric indicators; Assessment; Database; Citation

The increasing trend of using bibliometric indicators to assess academic output proves that there is a need to discuss the matter and bring the methodology involved and the concepts they may measure to light.

The concept of "scientific impact", which is usually associated with "research quality", is assigned to published documents later when they are cited in other publications. Journal databases have been regarded as main source of information to measure such impact and, thus, the impact of some publication is transferred to its author, department, university, city, state and / or country, and that will provide the most diverse comparative analysis of academic performance.

Bibliometric indicators, are often used with isolated and independent focus on specificities of each field, and that obviously brings about questionable ranking consistency. For instance, considering the country impact ranking in Science Citation Index (from *Thomsom Reuters* - former *Institute for Scientific Information*-ISI), based on citations from articles published by researchers of each country (GIBBS 1995), it is possible to observe sources of inconsistency on each one of them, once various stages of scientific publication are covered.

1. Received citations - there are several reasons why authors cite, and that does not necessarily indicate good quality or relevance of

their research (BONZI; SNYDER, 1991; WEST; McILWAINE, 2002); it accounts to whether it was possible for the author to have access to the literature of the subject studied.

2. Database - The scope of a database determines the probability of citation (MACROBERTS; MACROBERTS, 1996), since it is for a specific target audience, in accordance with the existing collection, which, in turn, may consist of documents that differ in type, field of knowledge, period of existence, distribution, among others.

3. Journals - Journals are the final product when articles are selected and gathered for publication. They differ from each other in the quantity of yearly articles published, and also in the subjective selection of articles, which are assessed by different groups of people with diverged points of view and cultures (DAVYT; VELHO, 2000).

4. Articles- scientific articles aim to present the greatest and most updated information on the research matter and insert it in the most appropriate means of publication. However, their conclusions may vary depending on the methodology used, the data source used, and other choices made at each stage of investigation.

5. Author - Authors can choose to work alone or as co-authors; in such case, they may not even know how to interpret the research results found (GARCIA, 2007). Their participation in any project or any specific graduating program will depend on their curriculum, and on their particular political position, within and beyond their scientific field (BOURDIEU, 1994).

6. Line of research - Researches carried out in any department will depend not only on the interests of its members, and on the funding provided, according to the relevance of the research, before the scientific community of the field to which it belongs, but also before other departments in the same university and politics in its various instances (personal, institutional, etc..) (POBLACIÓN; OLIVEIRA, 2006).

7. Field of knowledge - Different fields and their scientific publication practices differ significantly, as much as the development of their theoretical *corpus*.

8. University - The excellence of universities or research institutes, achieved through research developed over the years may be automatically assigned to the production of their researchers (ESCOBAR, 2007), regardless of how their various departments have given continuity to such work.

9. Country - The measurement of a country's scientific activity is not based solely on published research, neither on journal articles.

10. Scientific Politics - The research agenda and assessment, set at a national level, determine the topics and means, directing the publication, and directly influence the process of scientific publication (MUGNAINI, 2006).

The various possible deviations in the various stages of scientific publication flow may suggest that the sum of all these biases could invalidate a fully bibliometric indicator, since it fails to provide a reliable estimate of such phenomenon. Thus, bibliometric studies should ensure a sufficient amount of data to come up with consistent results.

According to the Theory of Probability, the Law of Large Numbers guarantees under certain assumptions that the realization of n independent repetitions of a random variable will cause the arithmetic average of n observations to approach the actual probability of that phenomenon. For instance, when tossing a regular coin, the real probability of getting "heads" is 0.5. However, the final outcome of the first ten throws can result in seven times "heads", ie, probability of 0.7. Thus, according to the Law of Large Numbers, the average of the results obtained from a large number of trials should be close to the expected value, and will tend to become closer as more trials are performed.

The level of aggregation considered in a bibliometric analysis can reveal or conceal important discoveries that data can provide, and one should also consider that the lower the level of aggregation, the more significant the effects of errors in the final result. The concept of scientific production indicators should prioritize larger volumes of information, related to more significant periods and that cover a wider variety of document types.

Bibliometric indicators have been increasingly considered to be parameters for the assessment of national scientific production, and are usually solely obtained from databases of articles published in scientific journals. The Journal Citation Reports (JCR) is a source of indicators which has consolidated, and its use as single source of data is mainly due to ease of

access and its gained credibility, since it has been available for more than three decades. This fact, which on one hand has allowed the use of these indicators for all these years, and on the other hand, has consolidated the Impact Factor as the main indicator, even with the many inconsistencies exhaustively described in the literature (GARFIELD, 2006; ARCHAMBAULT; LARIVIÈRE, 2007).

Currently the development of large repositories of scientific information accessible online, allows the collection and analysis of additional sources that reduce the limitations inherent to the restricted use of JCR indicators (Mugnaini, 2006). Alternative sources such as Google Scholar are beginning to emerge, where you can retrieve and measure impact through citations from journals, and also from different types of documents, provided that the contents are available on the Internet (MUGNAINI; STREHL, 2008).

All these issues are highlighted in national scientific policy, which makes use of sources that are known and consolidated, and increasingly considers other secondary sources, as each field of study takes them by consensus. This kind of assessment can be conducted through the examination of field documents of the various areas comprising Qualis, which is a system that assesses Post Graduation programs and is managed by CAPES (Coordination of Higher Education Personnel Improvement).

This work takes some scientific journals of different fields, and analyzes the relevance of information sources and different types of documents cited in issues within a decade. Thus, it brings the analysis of the information on such articles as an indicator that is able to provide parameters to cooperate in establishing criteria for the assessment of scientific production in Brazil, according to the characteristics of different fields of knowledge. Finally, the present work shows comparisons of its results with criteria of Qualis, according to the fields which the journals are evaluated.

Methodology

The SciELO platform was used as a source of data because it has a multidisciplinary collection that allows its users to identify the types of documents cited through the articles of its indexed journals (SciELO, 2010).

For this work, we have first selected the Journal of Public Health (Revista de Saúde Pública), which had the most complete collection of issues, which enabled an analysis of a period of four decades (1967-2006), since its first issue. Furthermore, the area of Public Health is an example in which the book and the magazine are document types considerably relevant to its academic community; differing from other areas where the value of the book as far as publication is being disregarded, as noted in the criterion used for the assessment of several fields, according to Qualis (CAPES, 2010a).

For the representation of other fields of study, four different journals were chosen from different theme fields, accordingly with the classification of Capes Journal Portal (Portal Periódico da Capes): Forensics Medicine (Revista da Associação Médica Brasileira - Journal of the Brazilian Medical Association), Physics (Brazilian Journal of Physics), Veterinary Medicine (Pesquisa Veterinária Brasileira - Brazilian Veterinary Research) and Information Science (Ciência da Informação - Information Science). For this selection, it was mainly taken into account the availability of data in the past decade, in a way to allow comparison with the Journal of Public Health (1997-2006). Other journals from the same field may certainly show similar results, and totally different results, and that could be assessed in further studies, since it is not an important issue at this time.

The bibliographic references from a group of issues published within a year were acknowledged according to the different kinds of cited documents. This method was made possible due to the structure of the citation records at SciELO[2]. Th work began by comparing those five journals within the period of ten years. Then, the Journal of Public Health was analyzed using issues published within the period of forty years, divided into eight five-year-period groups.

In a total of 116,426 references from 5355 articles, the types of documents found were: proceedings, dissertations, books (complete, by chapter, and other types of papers) and journals(as indexed in SciELO and / or ISI, other Brazilian journals and other not identified[3]). To identify titles such as those indexed in SciELO and ISI database, the SciELO current collection and JCR 1998-2004 issues were taken into account, regardless of which year the cited document was published[4].

Finally, this work sought to compare the characteristics of journals with the assessment criteria of Qualis, according to different assessment fields of study, and the relevance of each type of document, for each field (CAPES, 2010th).

Results

The analysis of distribution of bibliographic references according to the type of document shows what literature is preferable in journal articles from each field. In other words, this analysis shows the information used for the developed

argumentation in journal articles. It can be said that this is an analysis of journals, through the scientific matter on which they are based, it is thus important to know the sources of information cited.

Given the criteria for the assessment of national scientific production, which enhances the publication in indexed journals, mainly on ISI bases, articles published in those bases are supposed to be cited, both in journals that are indexed there, and in national journals from a national base.

An issue that has encouraged this work analysis, considering that the different fields of study had very specific characteristics with respect to the cited sources, was the strong reliance of impact indicators, which calculation is based strictly on citations from articles. When analyzing journal databases, it is clear that other types of document have great relevance for the literature published in journals of different fields. Mugnaini, Meneghini and Packer (2007), also in a study based on journals indexed in SciELO, show that fields tend to prioritize one type of document, setting it apart from others. In the figure below, which has derived from a multivariate statistical analysis, and on which dots represent fields of study, and diagonal axes the types of cited documents, one can observe the association among them, indicated by the closeness of points and axes in the plane.

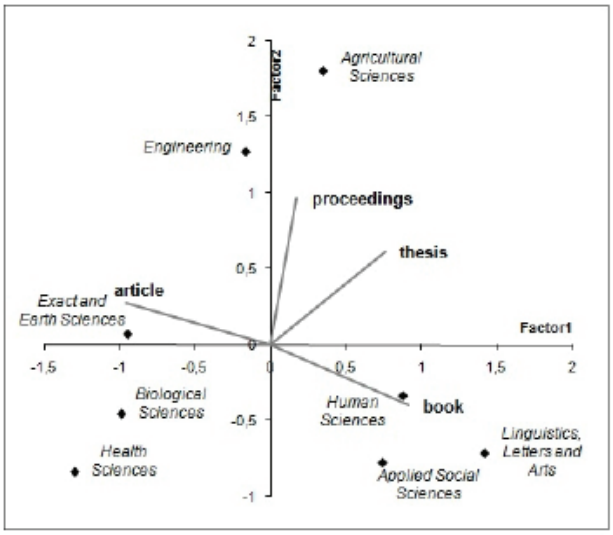
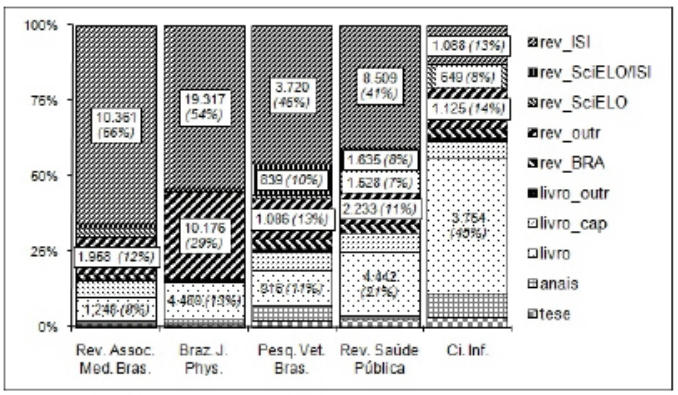


Figure - Factor Analysis between citing field of study and cited document type - base year 2004.

In Graphs 1 and 2, the citations of journals are represented by parallel stripes; the stipple refers to books; and the gray literature (proceedings and dissertations) is marked by gray tones (in square shapes). It was possible to note that journals generally have similar characteristics to those of their classification areas, as shown in Figure 1.

The citations of Journal of the Brazilian Medical Association, Brazilian Journal of Physics, and Brazilian Veterinary Research, showed that journal articles account for over 75% of the information that is consumed. These same journals show a predominance of journals indexed in ISI, suggesting that there is clearly significant research based on literature published in international journals.

The field of Physics has a significant amount of citations from "other journals", ie, non-indexed articles which must correspond to open access archives - this field of study is pioneer in this model of scientific publication since 1991.



Graph 1 - Distribution of the ten-year bibliography of journals in different fields of study according to type of document cited - from 1997 to 2006.

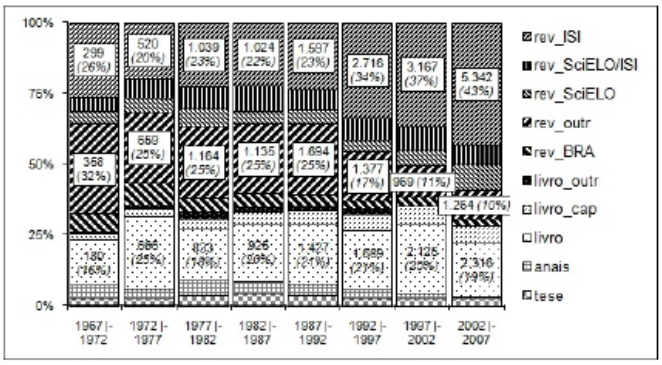
The field of Veterinary Medicine stands out because it cites SciELO / ISI journals, and some major Brazilian journals in this field have also been indexed in SciELO since then.

As for the journal of Information Science, it shows how relevant books are in this field of study, and it also values documents that have been published in proceedings. It may be noted that it has the greatest amount of citation distributed to various document types.

Book chapters represent about 6% of all literature cited of all journals, except for the Physics journal, which also shows almost no presence of national journals (SciELO and other journals from Brazil). Another important observation is that ISI journals are not the most accountable in the amount of citations of journals.

The Journal of Public Health had forty years of issues available at SciELO, and that enabled an observation of the consistency of indicators based on a lot of information, once clear tendencies can be observed over the five-year periods (Figure 3). A continuous increase in the percentage of citations to ISI journals is noted starting from the 90's, which may be due to the access to ISI base journals, which has been increasingly encouraged by the Brazilian government, and by the online technology in recent years.

The incidence of SciELO journals proved to be practically constant throughout the period, with a significant increase in 2005 and 2006, which may have been due to the possibility of retrieving articles through Google from this period on. Meanwhile, there is a decrease of citations of "other journals" and Brazilian journals, and this shows an increasing relevance of indexed journals.



Graph 2 - Five-year period distribution of bibliographic references of Journal of Public Health, according to type of cited document - from 1967 to 2006.

The following table shows the ratings of journals according to Qualis; the journals were graded on their qualifications in different fields (A1=7; A2=6; B1=5; B2=4; B3=3; B4=2; B5=1; C=0).

The Journal of Public Health is qualified in 30 fields of study, followed by the Brazilian Journal of Physics (20 fields), Brazilian Veterinary Research (18 fields), Journal of the Brazilian Medical Association (17 fields), and Information Science (13 fields).

The fields of study that are more closely related to the theme of each journal are marked in red. It is important to note that the journals of Physics and Medicine are less qualified in their own fields than other journals. The fact that the journals of Information Science, Veterinary, and Public Health have shown a lower tendency for international literature in their citations, showed that these journals had a more privileged "spot" in the assessment of such area. For the other journals we observe the contrary, and they were the only ones that received at least one qualifying C.

Another explanatory comparison resulting from the assessment of each one of these journals can be made based on the mean and median scores that the journals received for those several fields. The journals were graded on the following decreasing order, with the Journal of Public Health best qualified, with mean and median superior to the least qualified one, the Journal of the Brazilian Medical Association.

Considering that the strata that each journal occupies in the different fields are determined by assessment criteria, according to the document of each area, to which it is considered the main areas of each journal (marked in red in Table 1).

Table 2 shows that the sources of information are crucial for the qualification in various fields. JCR contained in criteria of Mathematical and Earth Sciences, Agriculture, and Health from the previous three years, is now used in Applied Social Sciences in the current period of three years, which may be due to the significant number of Brazilian journals inserted in the base over the past three years.

Like the recent adoption of JCR by Social Sciences, other databases are being considered by different fields, for instance, Scopus, SciELO, and several specific bases from each field. However, the indicators offered by them take some time to be adopted, which is understandable, since the indicators attain greater consistency as the thematic coverage is consolidated on the base through the admission of journals in that field. A prominent initiative is the Portal of Electronic Journals in Psychology (PepsiCo - Portal de Periódicos Eletrônicos de Psicologia), which consists of a base composed of Latin American journals - not all of the journals were admitted at SciELO, however they adopted the methodology for the formation of a field citation index. An indication of how relevant this source has become is the fact that it is among the sources within the assessment criteria of the field of Health.

The Impact Factor is the only indicator that has been an assessment parameter of the fields with larger international tendency. It is noted that only the Science Information journal does not consider it as a parameter. On the other hand, the field of Public Health prioritizes the h-index in Scopus journals, using the JCR Impact Factor if it is not indexed in Scopus. This study highlights the relevance of the SciELO base, in this field, it is crucial for the classification in

Revista	Braz. J. Phys.						Ci. Inf.					Pesq. Vet. Bras.					Rev. Assoc. Med. Bras.						Rev. Saúde Pública						
Área Qualis Estrato *	B1	B2	B3	B4	B5	C	A2	B1	B2	B4	B5	B1	B2	B3	B4	B5	B1	B2	B3	B4	B5	C	A1	A2	B1	B2	B3	B4	B5
ADMINISTRAÇÃO, CIÊNCIAS CONTÁBEIS E TURISMO							6																7						
ANTROPOLOGIA / ARQUEOLOGIA																									5				
ASTRONOMIA / FÍSICA					1																								
BIOTECNOLOGIA				2											2							0					3		
CIÊNCIA DA COMPUTAÇÃO				2																									
CIÊNCIA DE ALIMENTOS													4							2									
CIÊNCIA POLÍTICA E RELAÇÕES INTERNACIONAIS									4																				
CIÊNCIAS AGRÁRIAS I	5										1	5																	
CIÊNCIAS BIOLÓGICAS I				2										3						2									2	
CIÊNCIAS BIOLÓGICAS II				2																		0							2	
CIÊNCIAS BIOLÓGICAS III					1										2						1						3		
CIÊNCIAS SOCIAIS APLICADAS I							6											4											
DIREITO																									5				
ECOLOGIA E MEIO AMBIENTE		4																							5				
ECONOMIA																													1
EDUCAÇÃO								5																	5				
EDUCAÇÃO FÍSICA																		4							5				
ENFERMAGEM																	5						7						
ENGENHARIAS I																													1
ENGENHARIAS II		4							4																				
ENGENHARIAS III	5								4			5													5				
ENGENHARIAS IV		4								2									3								3		
ENSINO DE CIÊNCIAS E MATEMATICA						0				2																		2	
FARMÁCIA			3											3					3							4			
FILOSOFIA/TEOLOGIA subcomissão TEOLOGIA										2																			
GEOCIÊNCIAS		4											4																
GEOGRAFIA																1													
HISTÓRIA																									5				
INTERDISCIPLINAR	5							5				5						4						0					
LETRAS / LINGUÍSTICA										2																			
MATEMÁTICA / PROBABILIDADE E ESTATÍSTICA			3																										1
MATERIAIS		4																											
MEDICINA I										2			4						3							4			
MEDICINA II		4											4						3							4			
MEDICINA III													4						3							4			
MEDICINA VETERINÁRIA												5													5				
ODONTOLOGIA		4											4						3						5				
PLANEJAMENTO URBANO E REGIONAL / DEMOGRAFI																								0					
PSICOLOGIA																									5				
QUÍMICA				2											2							0							
SAÚDE COLETIVA													4					4						0					
SERVIÇO SOCIAL																									5				
SOCIOLOGIA																									5				
ZOOTECNIA / RECURSOS PESQUEIROS												5																	
Média	3,05						3,46					3,59					2,59						4,20						
Mediana	3,50						4,00					4,00					3,00						5,00						

*Revistas classificadas duas vezes (versões online e impressa) em alguma área, normalmente são classificadas no mesmo estrato, sendo raros os casos onde há diferenciação – por exemplo, a Revista de Saúde Pública é recebe classificações B1 e B4 da área ENGENHARIAS III, para as versões impressa e online, respectivamente - tomando, nestes casos, a melhor classificação.

Table 1 - Classification of journals according to the Qualis Assessment Area and Strata - from 2007 to 2009.

second strata of higher value (A2), which is in accordance with the analysis of citations of the Journal of Public Health. It is worth mentioning an extract from a paper of this field, which expresses the importance of national journals:

In the field of Public Health, over the years, there was the consolidation of several journals published in Brazil. They have been gaining increasing international awareness, both with regard to indexing and citation, and with regard to receiving contributions from other countries. (CAPES, 2010b)

And it is finally noted as well that the areas of Public Health and Applied Social Sciences I assign a less percentage(40%) to journal articles in the intellectual production category, regarding Post Graduation Programs. This scenario can also be foreseen through the analysis of the citations of journals of this field, as shown in Graph 1.

Revista	Grande Área (CNPq)	Grande Área (CNPq)	Critérios: fontes de informação e indicadores	Roteiro para classificação de Livro?	Peso atribuído a artigos em revista na Produção Intelectual
Braz. J. Phys.	ASTRONOMIA / FÍSICA	Ciências Exatas e da Terra	Fator de Impacto (JCR)	não	50
Ci. Inf.	CIÊNCIAS SOCIAIS APLICADAS I	Ciências Sociais Aplicadas	Indexação no JCR, Scopus, SciELO, entre outras bases da área	sim	40
Pesq. Vet. Bras.	CIÊNCIAS AGRÁRIAS I	Ciências Agrárias	Fator de Impacto (JCR); Indexação na Scopus, SciELO, entre outras bases da área	não	55
	MEDICINA VETERINÁRIA			não	55
	ZOOTECNIA / RECURSOS PESQUEIROS			sim	55
Rev. Assoc. Med. Bras.	MEDICINA I	Ciências de Saúde	Fator de Impacto (JCR); Indexação no Medline, SciELO, entre outras bases da área	não	50
	MEDICINA II			não	50
	MEDICINA III			não	50
Rev. Saúde Pública	SAÚDE COLETIVA		Índice h (SCImago-Scopus); Fator de Impacto (JCR), se não está na Scopus; SciELO , desde o nível A2; PEPSIC, desde o nível B3	Sim	40

Table 2 - Assessment criteria of journals - Qualis field documents, from 2007 to 2009.

Conclusions

The proposition of indicators or criteria for the assessment of journals, may come with a more detailed analysis of them. Accordingly, the bibliographic references may depict how scientific documents are being published, providing important information regarding the history of any journal or, in a higher level, the history of fields of study.

The methodology used made it possible to highlight different types of documents, according to the citations of the journals studied, from different scientific fields. Books are considerably more cited in Applied Social Sciences journals than in Health Science journals. The field of Public Health engages this type of document in similar proportions as those of scientific articles. In journals of Physics and Medicine, citations from international journals are much more prevalent. As for journals in the field of Veterinary and Information Science, proceedings and dissertations stand out.

These findings are important to understand how the scientific publication of different fields work. And that could also be observed when analyzing both the ratings of the journals in *Qualis*, and the criteria of existing field documents.

The fact that bibliometric techniques and tools have not yet been made sufficiently common makes simple descriptive analysis of citations, as developed in this study, not known by researchers that comprise the assessment committee managed by Capes. However, regardless of this fact, there is strong similarity between the criteria and the citations. Moreover, the use of such information could enrich the assessment criteria, that it does not rely on a single indicator.

Notes

1. Research supported by CNPq (process No. 483095/2009-5)

2. Access was directly to the SciELO database, which is in ISIS (Integrated Scientific Information System) in the Linux operating system, structured in different types of individual records, which contain specific fields for information storage. The different types of records are issues; articles, which are stored separately in different records containing bibliographic information about published articles. In addition, each reference in the bibliography of the article has its respective record, which is structured according to the type of document cited, enabling their identification. Statistics of these fields are available in several tables in Microsoft Excel format, for all SciELO (country and thematic) in <http://www.scielo.org/php/level.php?lang=pt&component=56&item=27>. Access: 21 December 2010.

3. The cited title standardization procedure acknowledges, among other publications not identified as being from ISI and / or SciELO, Brazilian titles, however, among the "other unidentified publications" there might be some Brazilian titles that are not in the ISSN base (source of information of publishing country).

4. That is, when reading the results one must consider that the citations were from ISI journals cited some years ago, even if in the year that it was cited the journal was not included in such database.

References

ARCHAMBAULT, E.; LARIVIÈRE, V. Origins of measures of journal impact: historical contingencies and their consequences on current use. In: INTERNATIONAL CONFERENCE OF THE INTERNATIONAL SOCIETY FOR SCIENTOMETRICS AND INFORMETRICS, 11, 2007, Madrid. **Anais...** Madrid: CINDOC-CSIC, 2007. p.45-50. Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.95.3835&rep=rep1&type=pdf>. Accessed in: 10 fev. 2010.

BONZI, S.; SNYDER H.W. Motivation for citation: comparison of self citation and citation to others. **Scientometrics**, v.21, p.245-254, 1991.

BOURDIEU, P. El campo científico. **Redes.** Revista de estudios sociales de la ciencia, v.1, n.42, p.131-160, 1994.

CAPES. QUALIS, BBS **(site)**. Available at: <http://qualis.capes.gov.br>. Accessed in: 30 nov. 2010a.

CAPES. Documento de área 2009: saúde coletiva. Available at: <http://qualis.capes.gov.br/arquivos/avaliacao/webqualis/criterios2007_2009/Criterios_Qualis_2008_22.pdf>. Accessed in: 30 nov. 2010b.

DAVYT, A.; VELHO, L. A avaliação da ciência e a revisão por pares: passado e presente como será o futuro? **História, Ciências, Saúde - Manguinhos**, v.7, n.1, p.93-116, 2000. [doi: 10.1590/S0104-59702000000200005]

ESCOBAR, H. Produção científica cresce mais de 200% nas grandes universidades. **O Estado de São Paulo,** 1, ago. 2007. A-13.

GARCIA E.S. Borboletas da ciência: olho neles. **Jornal da Ciência,** v.21, n.601, p.12, 2007.

GARCIA-ZORITA, J. C. **La actividad científica de los economistas españoles , en función del ámbito nacional o internacional de sus publicaciones:** estudio comparativo basado en un análisis bibliométrico durante el período 1986-1995. Espanha. 2000. 405f. Tese (Doutorado em Documentação) – Universidad Carlos III de Madrid, Madrid, 2000.

GARFIELD, E. The history and meaning of the journal impact factors. **JAMA**, v.295, n.1, p.90-93, 2006.

GIBBS, W. W. Lost science in the third world. **Scientific American**, v.273, n.2, p.76-83, 1995.

MACROBERTS, M. H.; MACROBERTS, B. R. Problems of citation alysis. **Scientometrics,** v.36, n.3, p.435-444, 1996.

MUGNAINI, R. **Caminhos para adequação da avaliação da produção científica brasileira:** impacto nacional versus internacional. São Paulo, 2006. 253f. Tese (Doutorado em Ciência da Informação) - Escola de Comunicações e Artes, Universidade de São Paulo, São Paulo. 2006. Available at: <http://www.teses.usp.br/teses/disponiveis/27/27151/tde-11052007-091052/publico/TESE_mugnaini_r.pdf>. Accessed in: 10 fev. 2010.

MUGNAINI, R. ; MENEGHINI, R. ; PACKER, A. L. . Citation profiles in Brazilian journals of the SciELO database in different scientific areas. In: INTERNATIONAL CONFERENCE OF THE INTERNATIONAL SOCIETY FOR SCIENTOMETRICS AND INFORMETRICS, 11, 2007, Madrid. **Anais...** Madrid: CINDOC-CSIC, 2007. v. II. p. 904-905.

MUGNAINI, R.; STREHL, L. Recuperação e impacto da produção científica na era google: uma análise comparativa entre o google acadêmico e a web of science. **Encontros Bibli,** v.13, p.92-105, 2008. Available at: <http://www.doaj.org/doaj?func=fulltext&passMe=http://www.periodicos.ufsc.br/index.php/eb/article/view/1127/1570>. Accessed in: 10 fev. 2010.

POBLACIÓN, D.A.; OLIVEIRA, M. Input e output: insumos para o desenvolvimento da pesquisa. In: POBLACION, D.A.; WITTER, G.P.; SILVA, J.F.M. (Orgs.). **Comunicação e produção científica:** contexto, indicadores e avaliação. 1ª ed. São Paulo: Angellara, 2006, p.57-79.

SciELO. Indicadores bibliométricos da rede SciELO. Available at: <http://www.scielo.org/php/level.php?lang=pt&component=56&item=27>. Accessed in: 30 nov. 2010.

WEST, R.; McILWAINE, A. What do citation counts count for in the field of addiction? an empirical evaluation of citation counts and their link with peer ratings of quality. **Addiction,** v.97, p.501–504, 2002.