SPECIAL ARTICLE

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Publication of scientific journals on the Internet

Publicação de revistas científicas na Internet

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INTRODUCTION

Scientific publication is essential for all researchers and readers as the work in a research is only valid if the scientific community can appreciate it. Publication seems to be a way of spreading and preserving science as the research will always be on record, without being lost or hidden and will provide indicators of scientific production.

Scientists need to publish their work and research to transform the data into information and thus, to generate knowledge [1].

The first instrument used to spread scientific information was private letters that scientists sent to their friends to explain their most recent ideas and research in order to have opinions and criticism of their theories. They were personal and limited to small circle of people and took a long time to reach their final destiny.

The first scientific journals were created in 1665. On January 5th of that year, the French periodical *Journal dês Sçavans* started to be published in weekly editions with a content that was mainly about daily news and reports on physics, chemistry, anatomy and neurology. The periodical had its publication interrupted several times by French authorities that considered the material offensive to the Inquisition [2].

The second journal was the Philosophical Transactions of the Royal Society of London published in May 1665. Aiming at a more scientific aspect to the periodic, the Royal Society decided to invest in reports of scientific experiments. Published on a monthly basis, the

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Philosophical Transactions rapidly reached a total of 1200 copies per issue [2].

From this point on, the publication of scientific journals increased significantly and, as time passed, their contents became very important for scientists, students and researchers who wanted to have access to fast-developing and changing information.

In Brazil, scientific journals first appeared at the beginning of the 19th century, two hundred years after the first European periodicals. The first publications were the *Gazeta Médica do Rio de Janeiro*, in 1862, and the *Gazeta Médica da Bahia*, in 1866. However, the first journal published regularly in Brazil was the *Anais da Academia de Ciência*, with the name *Revista da Sociedade Brasileira de Ciências*.

With current advances in technology, the use of the computer in communication has become an important instrument to improve scientific publications. From the eighties onwards, advances in electronic editing rendered improvements in the quality and speed of the publishing process [3]. Following this evolution, the Internet, which links computers all over the world, rose and has become the greatest communication vehicle currently, providing access to numerous articles in many areas at any time.

1.1. Current scientific production

Recently, scientific production has been increasing in an extraordinary way. The number of articles published in scientific journals in 1981 was 440,286 worldwide with 1887 in Brazil. By 2002, there was a significant increase with 872,018 publications in many areas throughout the world and 11,285 in Brazil [3,5]. This quantitative growth has been followed by an increase in the participation of Brazilian science in the indexed databases of the ISI (Institute for Scientific Information). The participation of Brazilian publications represented 0.28% of the scientific literature in 1981 and 1.02% in 1999. In 2005, Brazil published 16,950 indexed scientific papers, representing 1.8% of the articles indexed in scientific journals all over the world and 44.4% of the Latin America production [6].

Castro [5], who obtained data from CAPES (*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*), noticed that the main vehicle for communicating Brazilian scientific production is national periodicals. However, Brazilian journals need to solve questions such as amateurism, delays at the editing process and deficient communication with readers and collaborators, among others.

1.1.1 Costs of printed journals

Conventional journals have difficulties with publication: time, limited amount of space, high cost of publication and high-priced subscriptions.

The production of a scientific journal is expensive. The first expense is the authors' who need to send the manuscript to the editor. The remaining costs are paid by the publisher, including selection, correction, diagramming, formatting, preparation of graphics and tables, editing the copies, sending proofs to the authors, preparation of reprints and the production of the journal itself. There is also the cost of the professional or company that is responsible for diagramming, editing and printing, which includes the preparation of a photolite, composition, layout, the printing process itself, setting up the pages and bookbinding.

Evidence suggests that US$ 4000 is necessary to produce, standardize, edit, and compose an article in scientific and academic publications, considering the direct and indirect expenses. The costs of printing and distribution are around US$ 40,000 per subscription. Thus, the preparation of the matrix of a periodical with 100 articles would cost US$ 400,000 (ignoring other items in the journal). Due to this high value, a journal with restricted distribution requires US$ 400 to cover the costs of the production plus US$ 40 for printing and distribution. As the circulation rises, the unit cost decreases rapidly [8].

1.1.2 Indexation

The indexation of a journal is the process that provides an indicative of the necessary quality for a periodical to be part of one or more renowned international databases, such as MEDLINE, ISI and LILACS. It is an important vehicle to make scientific production internationally known and recognized and that is why journals need to follow basic formal presentation patterns and excellence of scientific content, which are internationally determined. A journal will only be indexed if it matches pre-established criteria determined by the database institution.

Indexation allows an efficient and fast retrieval of information. Souza [9] defines the process of indexation as an analytical technique of key word attribution, which expresses the content and construct of the article, that is, consists of the indication of the informative content of a document, by the determination of terms that will represent the paper. According to the author, there are three purposes of the process of indexation of a journal which are as follows:

- To ensure that any information may be retrieved by the user in an efficient and economical way at any time;
- To generate indexes to make the retrieval of the information easier;
- To give details of the informative content, through the determination of the subject of a document;

1.2 On-line publication

1.2.1 The use of Internet as an information disseminator

The Advanced Research Projects Agency (ArpaNet), created by the US Department of Defense, in 1969 was the first project to use new technologies to create a network of computers only for military purposes. This project connected four American universities: Stanford Research Institute, UCLA (University of California in Los Angeles), UCSB (University of California in Santa Barbara) and the University of Utah, for the first time together with military research centers. In 1970, at the peak of ArpaNet success, researchers and students of North American universities could already use e-mails [9].

According to Stumph [1], the concept of an EPC (Editorial Processing Center) started in the early seventies, under the auspices of the National Science Foundation. It was a cooperative enterprise among North American publishers created to offer automatized support for all stages of the production of a journal, aiming at reducing the expenses of a publication. The submission of the work by the author and the evaluation by referees from the same area of research, editing, printing and the journal management were some of the procedures offered by EPC. The difficulties in the viability of these centers were due to lack of compatible equipment and to the processing of the authors and referees texts. Nowadays, the majority of these problems have already been solved and almost all American journals are totally automatized.

The Blend-Birmingham and Loughborough Electronic Network Development project was developed in the eighties to try to improve the production of periodicals. Besides automatizing all the stages of the process, the project sponsored by the British Library aimed at the total substitution of printed publications by electronic versions of articles making their retrieval easier. To find programs and compatible equipment and the high costs of the process were also limitations in making the project viable. As it was not fully accepted by all the participants, the final evaluation suggested that printed journals would still endure for a long time [1].

In 1994, through NIB (Núcleo de Informática Biomédica of UNICAMP – Universidade Estadual de Campinas) the first projects of electronic scientific publication on the Internet emerged in Brazil. One of the first was the Brazilian Virtual Hospital that is a resource of medical information on the Internet. Soon after, the e*pub, Group of Electronic Publication in Medicine and Biology, a division of NIB, responsible for the development of electronic journals, emerged. They developed the first purely electronic Brazilian scientific publication, the On-line Journal of Plastic and Reconstructive Surgery.

In 1995, the number of periodicals on the web, another name given to the Internet, throughout the world was 306 covering many different areas. In 1997, few journals published complete texts with illustrations on the Internet. An enormous change occurred when traditional scientific editors entered the web. At the beginning of 1999, Reed Elsevier already had 1200 on-line periodicals and Springer and Academic Press had 360 and 174 on-line journals, respectively. Today, it is rare to find a good publication without its web version and the lack of the electronic version can even represent a risk [10].

Internet is the third or fourth vehicle of communication that exists, reaching a huge population; in absolute terms, there are more than 600 million users worldwide, including both private and professional users according to the data from 2002. In some developed countries, such as the USA, 60% of the adult population has access to the Internet. In Canada, 98% of students use the Internet. In Finland, the most 'internetized' country in the world, 78% of families have access [11]. In Brazil, the quantity of users connected to internet exceeded 12 million people in 2005. This is the equivalent to 10% of the population but the country is first in terms of numbers of hours of home access, as illustrated in the report of 11 countries monitored by Nielsen/ NetRatings [12].

1.3 SciELO

Another advance in electronic publication in South America emerged in 1997. The Scientific Electronic Library On-Line (SciELO) [13] is a non-profitable making electronic library that includes a select collection of Brazilian scientific journals.

SciELO is the result of a research project sponsored by FAPESP, the State of São Paulo Research Foundation and BIREME, the Latin American and Caribbean Center on Health Sciences. Since 2002, the project has had technical support from CNPq – The National Council for Scientific and Technological Development. Its aim is to develop a common methodology to prepare, to store, to circulate and to evaluate scientific production in an electronic format.

SciELO constitutes an electronic library that provides broad access to collections of journals as a whole, to individual issues and to complete articles. The retrieval of the articles can be achieved through indexes and search engines. SciELO's interface allows access to its contents by the titles, an alphabetic list, a list of subjects and also by searching of titles of periodicals, areas and the name of publishing institutes and place of publication. The interface also provides access to complete articles through author and subject indexes or through an article search, which searches for items that are included in the document, such as authors' names, key words, subject, words in the text and year of publication.

The number of articles in the SciELO database has increased significantly. Currently, SciELO has up to 150

indexed journals with completely free access. The access to the web site gives an idea of how popular SciELO articles have become in Brazil and in other countries: the transference of information increased exponentially, reaching 75 million hits in 2002. Twenty percent of the accesses were from foreign countries. Meneghini concluded that SciELO is a success and other countries are already participating with their scientific journals, including Chile and Cuba; Mexico, Venezuela, Portugal and Spain will start in the near future [14].

With the advances in communication technologies and the passionate search for information, scientific publications had to find new directions: they must be available anywhere, anytime and at an affordable price. The Internet supplied an alternative for scientists, providing solutions to the necessities and demands for information. There are many organizations all over the world who want to facilitate the spread of information to a larger number of people, through open files, access to libraries and the creation of databases like SciELO.

The evaluation of the quality of periodicals is achieved through an analysis of the bibliometric indicators. These are tools that help researchers to determine where to publish their articles and for librarians to perform an analysis of journals. The most recognized bibliometric index that assesses the quality of a journal is indexation. Indexes help to verify information on publications, number of reviewed articles and their spread, through published references. SciELO is considered a bibliometric index. Its value as a reference database was mentioned in Nature [15]. The bibliometric indicators adopted by SciELO methodology are equivalent to the ones of the Journal of Citation Reports published by ISI.

CAPES has a System of Periodical, Annal and Journal Classification (Qualis) available on-line which is used to help to assess post graduate programs. The vehicles of communication mentioned by post graduate programs are classified according to two criteria, quality and scope of circulation. The categories of quality (A, B or C) are associated to the region covered by journals. (local, national or international) with nine possible classifications. According to CAPES, these classifications are indicative of the importance of the vehicle used and of the article published [7]. CAPES uses these parameters to qualify scientific production of professors and students and to evaluate the performance of post graduate programs, aiming at contributing to their improvement.

1.4 PLOS – Public Library of Service

The Internet was a great discovery in all areas, mainly for research. With the Internet, it became possible to quickly and cheaply access articles from many areas. As time passed, the main publications started restricting their content, allowing complete access only through subscriptions. The Public Library of Science (PLoS) emerged with the proposal that any scientist throughout the world should be able to read articles without paying, while the author would pay a fee to publish the paper. Like SciELO, it is an important advance for researchers who understand English to have access to articles only through Internet without charges.

The first printed journal was published by PLoS in October 2003 and there are articles available on-line by PLoS Biology and PLoS Medicine. The articles published by PLoS are in English and the public has free access to them. Each author allows the article to be freely accessed with appropriate copyright. PLoS stipulates a citation of the work as one of its conditions [16].

CONCLUSION

On-line publication allows the spread of knowledge with a certain interaction between the author and the reader. Articles are simple to access and quick to publish, there is constant upgrading and the cost is affordable. However, it is still necessary to solve problems like the difficulties of accessing the contents of publications especially in developing countries, because of the insufficient number of computers and the cost charged by some journals. Initiatives like SciELO and PLoS are an important step to extend the access to the Internet and as a consequence, to scientific diffusion.

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