INFORMATIONAL GUIDE OF CANALCIÊNCIA AS A PEDAGOGICAL TOOL TO BRING CLOSER SCIENCE AND SOCIETY, KNOWLEDGE AND INFORMATION

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Abstract

Origin, conception and analysis of the pedagogical tools of CanalCiência (http://www.canalciencia.ibict.br), a portal created in 2002 by the Brazilian Institute for Information in Science and Technology (IBICT) with the support of the Ministry of Science and Technology, and whose main purpose is the scientific divulgation of Brazilian researches developed in universities, centers and research units in priority areas. In 2004 the CanalCiência started its educational activities exploring research-texts already indexed in its database, through workshops and theatrical shows in schools. The workshops showed some of the teachers' needs (Silva and Pinheiro, 2007), for supply this demand, the "Informational Guide for Teachers" (http://biblioteca.ibict.br/phl8/anexos/CanalCienciaGuiaProfessores.pdf) was elaborated, directed to the Science areas in general, to be used in high schools and technical schools in the Country. The Guide has a double purpose: scientific divulgation and informational literacy. In relation to the first purpose, the texts in the CanalCiência database are re-written in non-specialized language for easier understanding by the laymen. The second purpose addresses the problem of information literacy (competência em informação). Thus the central focus was on the search and citation of scientific information, respecting the intellectual property and adopting the standards of the Brazilian Association for Technical Standardization (ABNT-Associação Brasileira de Normas Técnicas). The CanalCiência uses for its own follow-up and evaluation the software AWStats (Advanced Web Statistics). This statistical tool was used in the bibliometric analyses for selecting the Guide's researches. The main conclusion of this work refers to the effects of the innovative aggregation of the two practices, scientific divulgation and information literacy: they act as complementary actions, with mutual reinforcement, with a great potential for expansion and multiplicative effects. This can be one way to bring forth a conscience for the proper use of scientific and technical information, fighting plagiarism and copying in school papers – rendered very common by the Internet. The Guide, as a pedagogical tool can also contribute to an integral education of students and for their better critical-reflexive thinking. Finally the Guide – as it puts together two converging actions, scientific divulgation and information literacy – promotes the transformation of information into "knowledge into action" (Wersig, 1993) and leads to the exercise of citizenship.

Keywords - scientific divulgation, information literacy, informational guide for teacher

1 INTRODUCTION

The science and society worldwide relationship has been drawn nearer by different sorts of actions, whose best example is the scientific divulgation, as it is called in Brazil, or science popularization, term used in other Latin American countries, or still, science vulgarization, as it is called in France. At first it reflected an isolated and unusual initiative, due to ideological reasons, will or personal stance, like writing in Italian and not in Latin, and choosing the dialogue format as Galileu Galilei did between the 16th and the 17th centuries (Sanchéz Mora, 2003[1]), and more recently Einstein being led to describe his theory in a simpler form in order to be understood by the general public (Massarani et Moreira, 2001[2]). However, from the Industrial Revolution onwards, it has become a more compelling social demand due to the need of labor training.

What is scientific divulgation? It is not an easy task to define; in fact, it is rather complex as no definition in itself is able to comprehend all its components and aspects, and something is always left

out. Nevertheless, definitions are necessary, and they are even more difficult when they concern a relatively new issue, as a new study field. According to Reis, considered the father of scientific divulgation in Brazil, "...it is the communication of science as a process, with its established principles and employed methodologies, in simpler terms" (Reis et Gonçalves, 2000[3]). This idea can be added by another specialist's in the area, Bueno (1984[4], 1995[5]), author of one of the first theses on the subject, when he states that this practice "presupposes the transposition of a specialized language into a non-specialized one in order to make its content accessible for a large public".

In the 20th century, the Information Society starts a new era, comparable to the industrial revolution, set off by the globalization, an economic phenomenon at first, which permeated other spheres, and together with the Technologies of Information and Communication – TICs, where the Web is included, enhanced and intensified the role of knowledge to the individuals, organizations and culture – "this change is revolutionary and has two dimensions, philosophical and technological" (Wersig, 1993[6]).

On the other hand, the development of technologies stressed the role of science in the society, which was well expressed by the following statement: "science, which today also shows its techno-science face, is the great enterprise in the modern world. Together with its inseparable partner, technology, live in our material and intellectual world, chair a good deal of the economic and power relations among the countries, and enter our private lives" (MASSARANI ; TURNEY; MOREIRA, 2005, p.7[7]).

When technologies invade the citizen's life and routine, in any scale, they require specific learning in order to be socially acquired. This social need is translated into another action in the contemporary world, much related to the libraries: "information literacy". Although it is still named by different terms while there is not an established one, among whose is *alfabetização informacional*, it has been commonly acknowledged as *competência em informação* in Brazil, according to Hatschbach's MA dissertation (2002[8]). In her research, the author states that this expression was defined by Paul Zurkowski, who, in 1974, wrote a report in which he recommended the implementation of a national programme of *competência em informação*. It is worth noting that this document is from the *Information Industry Association,* thus, the first demand came from the productive sector, which brings back the need of labor training in the industrial revolution. In his conception, "people trained in the use of sources of information in their work can be called '*competentes em informação*' (information literates). They learn techniques and skills to deal with a great number of information tools, as well as primary sources, in order to find information for their problems' solution" (ZURKOWSKI apud Hatschbach, 2002[8]).

The origin of this initiative justifies it being technology-oriented, and bearing a tool character, in the USA, and that explains the term *competência em tecnologia da informação* (information technology literacy), which was implemented in secondary schools, according to Dudziak (2003[9]), one of the first Brazilians to study the subject in her MA dissertation, from which the cited paper was excerpted.

From the productive sector it reached the libraries, which can be evident in the paper presented by Burchinal, in 1976 (apud Hatschbach, 2002[8]) during the *Texas A & M University's* Symposium of University Libraries, bearing the following conception: "being competent in information requires a series of new skills, including how to find and use necessary information to solve a problem and for an efficient and effective decision making". From then on, the idea of information literacy became broader and eventually a research subject, among which Kuhlthau's, in several empirical studies, with students, that led him to two conclusions: "the search for information is a building process that involves life experience, feelings, as well as a person's thoughts and attitudes", and it is important to include this subject in the school syllabus.

The ideas that orient information literacy involve and intertwine libraries, Information Science and Education. In the latter, scientific literacy is being discussed, equal to scientific divulgation, however with a different approach, closer to "scientific culture" and "public understanding of science" (Durant, 2005[10]).

The current paper aims at describing and analyzing the experience of IBICT's CanalCiência, converging with scientific divulgation and information literacy, accomplished in the Information Guide for Teachers, pedagogical tool studied since its conception, in the historical context and conceptual of the two actions in Brazil.

2   SCIENTIFIC DIVULGATION AND INFORMATION LITERACY IN BRAZIL

In this topic, based on a historical outline until today scientific divulgation and information literacy are approached in their trajectory throughout the country, where the main initiatives are highlighted.

2.1   The scientific divulgation in Brazil

In our country, the first news on science divulged in the press dates back to 1808, when the Portuguese Royal family arrived in Brazil and the Royal Press was founded. These two historic facts, according to Massarani (1998[11]), were decisive for the scientific divulgation as they made the creation of the first Brazilian newspapers possible. In fact, the news was an embryo that did not correspond to what became known as scientific divulgation many years later.

Another researcher in the area, Gouvêa (2000[12]), grounded on different researches, also inferred that the existence of scientific divulgation in Brazil dates from the 19th century, though on irregular basis. Despite these evidences in embryonic stages, for José Reis, considered the father of Brazilian scientific divulgation, the beginning of these activities took place later on. In his overview one must take into account the history of Brazilian science whose development depended on the activities of scientific divulgation.

Science started developing in Brazil when the education system was reformed and Rio de Janeiro's Polytechnic School was created in 1874, though "extremely precarious" until the beginning of the Republic era (1889) (Schwartzman, 2001[13]). The expansion of teaching and research institutions evolved so rapidly that by the end of the 19th century there were several of them providing a fertile environment for scientific divulgation.

In the mid of the 20th century the news on science started to be published regularly in the Brazilian press, following an international movement triggered off by the launch of the first Russian satellite, Sputnik, in 1957, eventually occupying twice as much space in the newspapers, and even reaching the headlines (Gonçalves, 1998[14]).

And this Brazilian scientist, José Reis, mentioned earlier on in this paper, who not only did produce much about this theme, but also contributed decisively for the institutionalization of the area in Brazil, including the Universidade de São Paulo's Núcleo José Reis de Divulgação Científica [José Reis Scientific Divulgation Centre], founded in 1992, and the CNPq's [National Council for Scientific and Technological Development] Prêmio José Reis de Divulgação Científica [José Reis Scientific Divulgation Prize].

Since then, Brazilian scientific divulgation has become increasingly stronger with the creation of courses, specialized magazines, public programmes and projects, all mapped by Valerio (2005[15]) in his PhD thesis. Among them, we highlight the following:

- the first chair discipline of Scientific Divulgation in the world, approved by UNESCO, in January 2005;

- the launch of Revista Ciência Hoje [Today's Science Magazine], in 1982, and Ciência Hoje das Crianças [Children's Today's Science] , in 1986, by SBPC – [Brazilian Society for Science Progress]; and

 - a Scientific American Brazil, in 2002.

Concluding these initiatives, there are implemented in public agencies, like USP's Estação Ciência, science interactive centre; UFRJ's Science House (Federal University of Rio de Janeiro), and Fiocruz's Life Museum. At the Ministry of Science and Technology, the Museum of Astronomy and Related Sciences - MAST, one of the first ones to engage in scientific divulgation actions, and Emilio Goeldi Museum of Pará - MPEG. MAST promotes events to the general public, from lectures on Astronomy and scientific film shows through sky watching, inflatable planetarium shows, and programmes like Playing Maths, Animated Science, Cooking with Chemistry.

In the electronic environment, in the late 20th century and the early 21st, there has been a increasing volume of initiatives, and we highlight the scientific divulgation website CH ON-LINE (Ciência Hoje) (http://cienciahoje.uol.com.br/materia/view/397), among others.

Within the public policies scope, it was worth mentioning the implementation of a Department for the Popularization and Diffusion of Science, in the Science and Technology Office for Social Inclusion – SECIS – at MCT. Among its activities, this Department carries out the National Week of Science and Technology, a national movement which articulates teaching and research institutions from other

ministries, offices and city offices in multiple and simultaneous activities. Every year, the National Week focus on a central theme that may represent a universal and contemporary issue in science and technology, like an inventor and innovator, for example, Santos Dumont, or Charles Darwin's and Alfred Wallace's pioneering theories.

IBICT is included in the group of institutions that deliver scientific divulgation through teaching and research as well as electronic service, like the scientific divulgation portal CanalCiência where the Information Guide for Teachers was designed, which is the subject of our paper.

2.2   Information literacy in Brazil

In Brazil, the first dissertation ever known on information literacy is the one already mentioned in this work, Dudziak's (2001[16]). Among the important data she raised, one of the most significant is the one on the presence of this theme in the world literature, which there is no single work in Portuguese, thus, our country was absent. The author made use of two database sources, one on Education, ERIC – Education Resources Information Center – and the other on Information Science, LISA – Library and Information Science Abstracts –, from 1974 to 2000, within a 26-year time span. On the other hand, the USA recorded the highest volume with 249 documents in ERIC and 297 in LISA, where the United Kingdom comes second with 29 works in the first database and 30 in the second one (Dudziak , 2001[16] apud Hatschbach, 2002[8]).

Brazilian absence is indirectly stated in the Green Book of the Information Society in Brazil, and Hatschbach (2002[6]) draws attention to the following lines: "the school syllabuses, generally speaking, do not include formation in the use and importance of information" and "…there is a need for greater institutional articulation among the different programmes concerning the introduction of information and communication technologies in the Brazilian school system at its different levels".

Another MA dissertation, Cardoso's (apud Hatschbach[8]), reaches the same result, once the 26 systems of Brazilian libraries and federal university libraries, included in her research, do not offer any sort of training in information literacy.

It must be highlighted that the two mentioned dissertations, Cardoso's and Hatschbach's, were presented at IBICT's Post-graduation Programme in Information Science, in arrangement with UFRJ.

When, Hatschbach (2002[8]) attempted to identify practices of information literacy in Brazil, she found few initiatives, one of the first at IBICT, the website "How to find", created by Prossiga – Information and Communication for Science and Technology –, a support service for internet users, offering a 'Researcher Kit' with websites of information back-up, translation and page monitoring etc., besides customized assistance for orientation and localization of sources ('How to find's Online Support'). Unfortunately, in 2003, this Prossiga's important and pioneering initiative was disabled, together with most virtual libraries and dozens of produced portals.

Other pioneering services in Brazil were: *WebQuest*, started at USP's Future School and Pro-student Programme. The former, is no more related with USP, it was presented as a "methodology to integrate students and teachers in an education-oriented process, encouraging research, critical thinking, production of materials and youth actions". The latter offered two tools: "How to find information on internet" and "Basic Manual to Access Internet".

Nowadays, the Future School offers several services like the Laboratory of Digital Inclusion and Community Education, the Laboratory of Sciences and Technology Teaching – LECT (http://darwin.futuro.usp.br) and LabVirt – Virtual Didactic Laboratory (http://www.labvirt.fe.usp.br), which objective is to "build a pedagogical and technological framework – community and learning – that makes the development of Physics projects in schools easier, and encourages the students to have a criticism thinking, use of scientific methodology, interest in science, and, above all, reflection and understanding of the world that surrounds us".

So far in Brazil, most actions have been oriented to university students, and the portals like WebQuest have multiplied immensely.

A sign of the growth in information literacy in the country was the Workshop "Information literacy", held in Curitiba in July 2005. This event was included in the XXI Brazilian Congress on Library studies, Documentation and Information Science's programme, and it aimed at "providing a general overview on the theme in national and international scenario".

Finally, IBICT takes part in the Information for All Programme – IFAP –, and it leads the National Committee of Coordination for IFAP in Brazil, under the MCT. Some of the main IFAP's focuses are Information Literacy, digital preservation, among others.

3   IBICT'S CANALCIÊNCIA

Scientific divulgation started at IBICT as a research field in the Post-graduation Programme, the first in the area in Brazil and Latin-America, created by the Institute in 1970, in an arrangement with UFRJ. In that decade, Scientific Communication was introduced as a mandatory subject. In the following decade, a line of studies in Scientific Divulgation started, resulting, in 1987, resulted in the first MA dissertation on the issue was based on an analysis of magazines Ciência Hoje and Ciência e Cultura. These studies in this field have been carried on and totals around 15 dissertations and theses about different aspects of scientific divulgation.

In this context, in 2006, it was likely the incorporation of CanalCiência, which came from Brasilia´s IBICT headquarter to Rio de Janeiro, settled in its Coordination of Education and Research, Science and Information Technology.

This Portal represents one of the typical services of the contemporary world, which came along with the Information and Knowledge Society, as expressed by NORUZI (2008[17]): "the popularization of science in its electronic format is intertwined with development of the Web in the 1990's…the popularization of science has become more and more involved with the society based on the Web. Therefore, the Web has become an important technical support for science popularization".

Furthermore for the same author, science is benefited because the divulgation on the Internet "increases accessibility, visibility and popularity of science and scientific research, as a result, and also increases quotations and research or educational impacts from a journal or scientific article" (NORUZI, 2008[17]).

3.1   Origin, objectives and framework

In 2001, the Federal Government, concerned about Education in the Information Society, organized the National Conference for Science, Technology and Innovation, event that resulted in the 'Green Book', conceived by the MCT and Brazilian Academy of Science. The 'Green Book', mentioned in the previous topic, advocated the idea that scientific and technological education should go beyond the school walls in the country as a whole, stressing both the network expansion of centers that produces and disseminates scientific knowledge and the democratization of public access to the Information and Communication Technologies (TICs).

In this scenario, IBICT's CanalCiência's portal (http://www.canalciencia.ibict.br), dedicated to scientific divulgation started in 2002, launched in Brasília/DF by the MCT. The Institute, one of the Ministry's research units, aims at contributing for "a progress in science, technology and technological innovation in the country through the development of communication and information in these areas", and begins to be responsible for disseminating Brazilian researches and provide information sources by net in S&T to the citizens.

CanalCiência delivers service for bringing science and society relation closer and expects to disseminate the results of significant Brazilian scientific researches developed at universities, centers or institutes of research in priority areas of Science, Technology and Innovation. The Portal's team rewrites the specialized language into a non-specialized reader-friendly one, aiming at laypeople, the society as a whole.

CanalCiência's information framework presents the following access points in the main menu: Research database, S&T Notables, Links Directory, More details, About us, Contact us. Here are some outlines:

In "Database research" scientific divulgation texts are available, and they define 3 main points: what research is (presentation); how it is carried out (methodology description); and what the importance of the research (report on the main results), in texts that may include graphic schemes and image to illustrate the researches.

In "S&T Notables" is presented a gallery of notable scientists who have contributed for Brazilian S&T nationwide. It includes biographies of Brazilian researchers, complementary texts, specialized

addresses and audio files from the historic collection.SBPC– Brazilian Society for the Progress Science.

In "Links Directory" there are websites of educational and scientific culture projects, museums and science centers, glossaries and news services in science and technology, among others.

In "More details", events and courses, prizes and contests, multimedia, videos, didactic materials concerning scientific and technological divulgation, and also in science teaching-learning support.

In "About Us" one can read the editorial, the development background and scientific divulgation actions and the team identified, it can also be a space of media material divulgation about CanalCiência and the section "Contact us" is an open communication channel that offers a form for suggestions, criticisms and doubts to the internet users.

On the main Portal's page there is also "Science Memory" that offers interviews with personalities from the scientific community. It is a historic collection of radio programmes, Tome Ciência [Take Science] and Encontro com a Ciência [Meeting with Science], produced from 1984 to 1989, in an arrangement with SBPC, Radio USP, Radio Cultura and CNPq.

3.2   Information management at CanalCiência

Any information service, presential or electronic, must be constantly updated and evaluated in order to accomplish the feedback stage and necessary adjustments for a good quality performance. CanalCiência is not different and, even being short-staffed to answer all management situations it attempts to minimize the difficulties by adopting suitable tools. Besides the data entry policy, already described, there are specific demands like the topical subject of the National Week of Science and Technology, that is different every year. At Portal, the orientation is to include one research at least in this line, the same for some new national issues, from diseases like *Aedes aegypti* to floods and environmental situations, domestic and international.

Thus, one of the main management aspects is measuring and analyzing the flows and accesses to the Portal's information, and having this goal in mind the statistics programme *AWStats* (*Advanced Web Statistics*) was adopted and presented in a Conference by Silva e Pinheiro (2007[18]). With this tool it is possible to measure annual and monthly accesses, browsers, external pages, and identify the origin of the access, most frequent phrases and key-words, and from then it is possible to help users with their demands of service. According to Le Coadic (2005[19]) the identification of types of user´s behavior intends to "... convert a visitor into a consumer (*e*-client)".

The analysis of the information was developed with the support of Bibliometrics, defined by Pritchard (1969[20]) as "all studies that attempt to quantify processes of written communication" or the "application of mathematical methods to books and other means of communication". Later, the terminology of the area developed and other terms appeared and were synthesized according to Egghe (2005[21]). For this researcher, Informetrics comprises Bibliometrics, Scientometrics and Webmetrics, defined "as a broader term, comprising all metric studies related to Information Science, including Bibliometrics (bibliographies, librarians…), Scientometrics (scientific policy, quotation analysis, research assessment…), Webmetrics (metrics on the Web) on the internet and other social nets like quotation and collaboration nets".

According to results of statistical analyses the volume of Portal's users has been increasing: in 2003 with 70.663 accesses/visits to 545.759 in 2006, and in the latest three years (2006-2008) 455 thousand accesses/visits. Besides this follow-up, it was also possible to prioritize the themes of the researches to be indexed by bibliometrics analysis of frequency of accessed words and phrases, as well as the selected ones to integrate the Information Guide for Teachers, oriented by the results from CanalCiência's Workshops.

3.3   The workshops as orientation to the Guide's conception

When all Portal's actions were limited to the production of texts, the writings of research results in scientific divulgation language, and the gathering of electronic information in the context of scientific divulgation, the team perceived an inevitable requirement beyond the activities developed for the Net. It was realized that CanalCiência should assist not only internet users, but also to be present in the support to science teaching in general, at schools or non formal teaching facilities, in the form of network, in other words, adding partners that can contribute with presential practices, not only in scientific and technological areas, but also in the art, culture and education field.

Therefore, in 2004, CanalCiência starts emphasizing educational, playful and interactive activities, just when the first edition of the National Week of Science and Technology was announced, whose main focus has been the promotion of activities that approach, arise and encourage society for scientific and technological themes.

In planned presential actions held by CanalCiência team, the users carry on their access to the Portal's services, though linked to other ways of science divulgation like lectures, educational and playful workshops; origami (paper folding), cut and glue workshops, theater shows, etc., in wider and more diversified spaces, as previously mentioned, with non-formal, inter and multidisciplinary aspects.

Under this topic, we focus on Workshops that resulted in the Information Guide for Teachers, comprised of theoretical and practical activities that aim at developing competences and skills related to scientific and information topics in the classroom, at public and private schools, and which can be held anywhere in the country. At first they were student-oriented, but from 2008 on, after CanalCiência team's assessment, they have been also delivered to teachers, mainly for the actions' repercussion and multiplier effect.

At first they were more theory-based than practical. However, some teachers lacked confidence due to the quick progress in information and communication technologies that reached the schools and, in an attempt to unite efforts, the teachers started expressing other demands.

From then on, the Workshops, under the scientific divulgation and information literacy perspective, aim at encouraging the proper use of information, whether electronic or printed; contributing for the development of skills in information that are necessary to knowledge enhancement with the purpose of carrying out searches in legitimate virtual sources and reaching proper uses of information.

Their presentation takes place in two moments. In the first one, there is a brief introduction about the scenario, importance and national policy of incentive to scientific divulgation in the country. In the next moment, there is a description of CanalCiência's framework (information, scientific and technological content) and the participants perform exercises both in surfing on 'protected' and legitimate sources by respectful institutions, indexed at Portal, and acknowledging and using the several types of electronic material properly: websites, excerpts from a website's text, electronic magazine, excerpt from electronic magazine, image, video, multimedia, CD-Rom, online games, among others.

From 2004 to 2007, there were 08 workshops held with students from 3 grades of secondary education, distributed in 04 workshops at public schools and 01 at a private school in Brasília/DF; 01 Workshop at Fundação de Apoio à Escola Técnica/FAETEC, in Paracambi/RJ, and 02 at Centro Federal de Educação Tecnológica- CEFET/Quintino, in Rio de Janeiro/RJ, assisting about 650 students in total.

During a SBPC's Regional Meeting, "Education and Science for a Sustainable Development of Baixada Fluminense", the workshops were open to the Foundation of Support to Technical, Science, Technology, Sport and Leisure of Duque de Caxias) FUNDEC educators, with the participation of a few students, in Duque de Caxias/RJ.

The results by oral evaluation and recorded in electronic mail are represented by the students' words: "*I was very happy to have the chance to take part in that Workshop, it has been very important to me, my family and my friends who are taking advantage of a more proper use of internet information"; "I had never thought about responsibility in the use of Internet information!"; "I learned a lot because I did not know how to use information!"*; and still, from a IT teacher who mentioned that as a professional until then *he could only see "information by information" on internet and that he did not use to evaluate whether it was reliable, from a reliable source.*

4   INFORMATION GUIDE FOR TEACHERS

The Information Guide for Teachers was devised from an interdisciplinary approach – taking into account contents from Information Science, Education, Librarianship, Web design and Information Technology – as a useful tool for science teachers in primary as well as secondary and technical schools in order to orient access to and use of information on the internet.

It is a tool designed to enable the relationship between professionals in teaching and scientific divulgation and their students in the proper use of the scientific and technological information available in the virtual medium, allowing students to develop information literacy and necessary skills through

internet searching, and therefore stimulate the transformation of information into knowledge, adopting the motto "information is knowledge in action" (Wersig, 1993[6]).

The educational activities at CanalCiência's Workshops, described in the previous topic, showed that students and teachers need to acquire information in order to distinguish the quality of the many electronic pages and that there is general unawareness concerning both intellectual property and the ABNT's [Brazilian Associaton of Technical Norms] norms, which, whether printed or electronic, follow similar quotation patterns.

Among the problems raised by teachers and cited by Silva e Pinheiro (2007[18]), there is also the overuse of the resource "Ctrl+C" and "Ctrl+V"; scarce reading and revision of school work papers; appropriation of speeches and ideas from researched authors, without crediting them, the websites or portals, etc. Bearing that in mind, the Information Guide for Teachers included two objectives that complete each other in an original way: orienting information searches on the internet as a complement to portal actions, and incorporating skills, knowledge and values for a proper practice of referring researched information in the World Wide Web of computers.

The Guide is comprised of a part concerning the presentation, with its objectives and justification, and it is complemented by 12 brochures on Brazilian researches, indexed at CanalCiência and presented in a concise form (scientific divulgation part), and exercises towards information literacy.

An example of the Guide's content is the brochure entitled "Star evolution: Eta Carinae shines in the Milky Way" (Figure 1), developed by the Institute of Astronomy, Geophysics and Atmospheric Sciences of USP researchers and it is presented in both printed and electronic formats.

Fig.1: Guide´s page of brochure.

For each research, the brochure suggests activities concerning information literacy, and for this case it is as follows:

"Communication with image resources is a way of transferring information and encouraging interaction. The responsible researcher for this research, Dr. Augusto Damineli, suggests different readings about Eta Carinae. Access the research text and enjoy the beautiful images (Zoom in PowerPoint and Videoclip in Windows Media Player) and doing the exercise for referring these documents in your work!"

The answer is inserted on the back:

"Presentation of electronic slides:

DAMINELI, Augusto; BESSA, Patricia. [Eta Carinae: zoom]. [2005?] Slides, color. 1.4mb. Available at: http://www.etacarinae.iag.usp.br/plots/eta_zoom.ppt Accessed on: Oct.10, 2008.

Videoclip:

[ETA Carinae: videoclip]. Directed by: André Fonseca Silva. São Paulo: USP, [2005?] Videoclip 860kb zipped, color. Available at: http://www.etacarinae.iag.usp.br/arts/Etaorbit.zip Accessed on: Oct.19, 2008."

The printed Guide provides a CD version, and the material in electronic format is available for download from any user at *Saiba mais > Didáticos em C&T do CanalCiência* [More details > CanalCiência's Didactics in S&T] and at IBICT's Library Catalogue: http://biblioteca.ibict.br/phl8/anexos/CanalCienciaGuiaProfessores.pdf

It is handed out at Workshops promoted by CanalCiência and at schools, especially during events like the National Week of Science and Technology, and by electronic media, to elementary, secondary and technical school teachers as well as to researchers whose research texts are included in the Guide.

CanalCiência's team designed an evaluation form; however, apart from the formal evaluation, not yet applied, the Guide's repercussion, when first used, can be evaluated by a teacher's electronic message to her school's teaching board during the V National Week of Science and Techonology's Workshops: "*Note how CanalCiência presents the material to RESEARCHERS! As it reflects the way we see ourselves as teachers, it is very well referred for our educators' team, isn't it?*"

The Guide's importance and usefulness are also expressed by emails sent to researchers with researches divulged by the Portal. We highlight, as na example, the words of a researcher from the National Institute of Research of the Amazon (INPA), that show the multiplier effect of this work: *Thank you for the sent material. I've copied it in my pen-drive and I will take it to some school teachers in the backlands of the Amazon. Congratulations for the material organization!*

5   CONFLUENCE OF SCIENTIFIC DIVULGATION AND INFORMATION LITERACY: AN INNOVATIVE ACTION

The main conclusion from this work is that the innovative joint-effort of two practices, the scientific divulgation and information literacy, work as complementing actions and imply a mutual effort with great capacity of expansion and multiplier effect.

On one hand, Brazilian researches are being divulged to a non-specialized public and, in this issue, some of them discuss matters about the major importance region for Brazil and the world, and a strategic and central focus of debates about the environment, and from which planet's life quality as well as the living beings' survival depends on.

On the other hand, the set of information in the exercises aims at developing teachers' skills and, thus, students' as well, once those work as a support to guide searches and proper use of scientific information, bearing ethical work, respectful of authors' rights and quotation norms. This can be one way of consciousness raising in the use of scientific and technological information, fighting against copies and cheating in school work, which has become more and more usual as Internet provides easy access to the means of communication on internet.

The Guide suggests interactive challenges that involve watching, reflecting, questioning, comparing, investigating, among other actions in the pedagogical process. The purpose is not to keep its content as a mere acquisition of information, but to make the reader-user takes it to reflection, teaching and

practice in the classroom. The main perspective of this Guide is that this kind of activities can contribute for an analytic use of information by users, generating multiplier agents for the good, proper and ethical use of information so as to apply acquired knowledge and perform inter and multidisciplinary actions at school and in life, exerting citizenship.

6   REFERENCES

[1] SÁNCHEZ MORA, Ana María. *A Divulgação da ciência como literatura*. Rio de Janeiro: Casa da Ciência, UFRJ, 2003.

[2] MASSARANI, Luisa Medeiros; MOREIRA, Ildeu de Castro. Aspectos históricos da divulgação científica no Brasil. In: MASSARANI, LUISA; MOREIRA, ILDEU DE CASTRO; BRITO, FÁTIMA. (Org.). *Ciência e público*: caminhos da divulgação científica no Brasil. Rio de Janeiro: Casa da Ciência, 2002. p. 43-64.

[3] REIS, José; GONÇALVES, Nair Lemos. Veículos de divulgação científica. In: KREINZ, GLÓRIA, PAVAN, CRODOWALDO (Org.). *Os donos da paisagem*. São Paulo: Publicações NJR, 2000. p. 7-69. (Divulgação científica, 3).

[4] BUENO, Wilson da Costa.   *Jornalismo científico no Brasil*: os compromissos de uma prática dependente. 1985. Tese (Doutorado)- Escola de Comunicações e Artes, Universidade de São Paulo, São Paulo, 1984.

[5] BUENO, Wilson da Costa. Jornalismo científico: conceitos e funções. *Ciência e Cultura*, São Paulo, v. 37, p. 1420-1427, set. 1995.

[6] WERSIG, Gemot. Information science: the study of postmodern knowledge usage. *Information processing and management*, Elmsford, v.29, n. 2, p.229-239, 1993.

[7] MASSARANI, Luisa Medeiros; TURNEY, John; MOREIRA, Ildeu de Castro. Apresentação. In:_____. (Org.). *Terra incógnita*: a interface entre ciência e público. Rio de Janeiro: Casa da Ciência, 2005.

[8] HATSCHBACH, Maria Helena de Lima. *Information literacy*: aspectos conceituais e iniciativas em ambiente digital. 2002. Dissertação (Mestrado em Ciência da Informação)- CNPq/IBICT-ECO/UFRJ, Rio de Janeiro, 2002.

[9] DUDZIAK, Elisabeth Adriana.   Information literacy: princípios, filosofia e prática. *Ciência da Informação, Brasília,* vol.32, n.1, p. 23-35, 2003. Available on: http://revista.ibict.br/index.php/ciinf/article/view/123/104 Acessed at: 01 maio 2009.

[10] DURANT, John. O que é divulgação científica?. In: _____. (Org.). *Terra incógnita*: a interface entre ciência e público. Rio de Janeiro: Casa da Ciência, 2005. p.13-26.

[11] MASSARANI, Luisa Medeiros. *A divulgação científica no Rio de Janeiro*: algumas reflexões sobre a década de 20. 1998. Dissertação (Mestrado em Ciência da Informação)– CNPq/IBICT-ECO/UFRJ, Rio de Janeiro, 1998.

[12] GOUVÊA, Guaracira. *A divulgação científica para crianças: o caso da Ciência Hoje das crianças*. 2000. Tese (Doutorado)- UFRJ/CCS, Rio de Janeiro, 2000, 305 f.

[13] SCHWARTZMAN, Simon. *Um espaço para a ciência*: a formação da comunidade científica no Brasil. Tradução Sérgio Bath e Oswaldo Biato. Brasília: Centro de Estudos Estratégicos: Ministério da Ciência e Tecnologia, 2001. 357 p. (Brasil, Ciência & Tecnologia, 1).

[14] GONÇALVES, Nair Lemos.   Divulgação científica. In: KREINZ, GLÓRIA; PAVAN, CRODOWALDO (Org.). *A espiral em busca do infinito*. São Paulo: Publicações NJR, 1998. p. 65-79. (Divulgação científica, 1).

[15] VALERIO, Palmira Maria Caminha Moriconi. *Periódicos científicos eletrônicos e novas perspectivas de comunicação e divulgação para a ciência*. 2005. Tese (Doutorado Ciência da Informação)- CNPq/IBICT-ECO/UFRJ, Rio de Janeiro, 2005.

[16] DUDZIAK, Elizabeth A. *A information literacy e o papel educacional das bibliotecas*. 2001. Dissertação (Mestrado Ciência da Informação e Documentação)- Escola de Comunicações e Artes, Universidade de São Paulo, São Paulo, 2001.

[17] NORUZI, Alireza. Science popularization through open access. *Webology*, v.5, n.1, March 2008.

[18] SILVA, Márcia Rocha da; PINHEIRO, Lena Vania Ribeiro. Análise de metrias para dimensionar o acesso, o uso e a repercussão do portal de divulgação científica CanalCiência. In: CONGRESSO BRASILEIRO DE JORNALISMO CIENTÍFICO, 9., 2007, São Paulo. *Anais eletrônicos*... São Paulo: Associação Brasileira de Jornalismo Científico, 2007. Available on: http://biblioteca.ibict.br/phl8/anexos/silvamarcia2008.pdf Acessed at: 2008.

[19] LE COADIC, Yves F. 50 anos e os 5 e-princípios da informação eletrônica. Ciência da Informação, v. 34, n.3, p.13-15, set./dez. 2005. Available on: http://revista.ibict.br/index.php/ciinf/article/view/817/658 Acessed at 05 maio 2009.

[20] PRITCHARD, Alan. Statistical bibliography or bibliometrics? *Journal of Documentation*, v.25, n.4, p.348-349, Dec. 1969.

[21] EGGHE, Leo. Expansion of the field of informetrics: origins and consequences. Information Processing and Management, Elmsford, NY, v.41, n.6, Special issue on Informetrics. p.1311-1316, Dec. 2005.