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The use of blogs as a strategy for scientific dissemination for the teaching of sciences

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ABSTRACT

The understanding of scientific topics is still insufficient for a large part of the population, and one of the main reasons for this is the excessive use of terms unknown by the general public. The more technical than explanatory approach of scientific subjects hinders its appropriate assimilation. One of the strategies used to overcome this problem is Scientific Dissemination (SD). It consists of addressing scientific issues in a clear, simplified language. The democratization of scientific knowledge has found in information and communication technologies (ICT) a great ally. Together, they allow those who own important knowledge to reach the general public. Blogs are easy to create and maintain, so they are one of the most used strategies by science communicators on the internet. This research aimed to highlight the importance of using blogs as a means of disseminating science, and how these are received by the general public. For this, the blog entitled Biologando was created; it published biology-related contents. To have access to the participant's, and hence Biologando´s readers, perception on SD and blogs, a form had to be filled out by each and every one of them. Results highlighted the importance of SD for the introduction and teaching of previously unknown content. In addition, they confirmed that simplified language is one productive way to understand scientific issues, thus highlighting the importance of the Blog as a resource for Scientific Dissemination.

KEYWORDS: Scientific Dissemination. Blog. Science teaching.

1 INTRODUCTION

Scientific knowledge is considered one of the most important types of knowledge in today's globalized and technological society and as such has become a prerequisite for the education of citizens who are aware of world events (SANTOS; OLIOSI, 2013). Scientific knowledge can be seen as an accumulation of knowledge, generating a certain "product". Knowledge acts as an entanglement of both the process, which is the experience itself, and the product of knowledge that generates the logical organization of this knowledge, leading to meaning construction (LEITE, 1993).

Scientific knowledge and its sedimentation, which is scientific knowledge, are essential to allow the development of the subject. Given its relevance, scientific literacy is a term that has gained strength with regard to scientific issues so as to educate one to be able to make considerations on various subjects, interact with the scientific culture and insert oneself in science issues (SASSERON; CARVALHO, 2011).

Research carried out by the Program for International Student Assessment (PISA) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) indicate that Brazil ranks low in the dissemination of scientific knowledge, especially in basic education. This should be a worrying topic since scientifically literate subjects are of fundamental importance if Brazil aspires its people to construct and develop their nation (SILVA, 2015).

The teaching of Sciences with its own methods, languages, and contents aims to fully educate the citizen as a critical, active, and responsible being in regards to the members of society. From the very initial years of schooling, children are citizens under construction and only grow fully formed through their interactions with society and with the environment in which they live (SANTANA FILHO *et al*., 2011).

As an alternative resource allied to science education, Scientific Dissemination (SD) emerges being mainly used with the objective of contextualization, since it allows the dissemination of updates of research processes and their results. Its relevance is tied to the fact that scientific aspects cover different layers of society and reflect on progress as a community. Therefore, one should not consider science as a separate construction, but rather as a set of efforts that has a socio-cultural impact (LORDÊLO; PORTO, 2012).

Dissemination of information may or may not be considered inherent in the scientific process, but still, it is an important process for the inclusion of society because it provides the monitoring of scientific production in an accessible way for a non-specialized public (GONÇALVES, 2013).

Therefore, SD allows scientific concepts to be communicated in a simplified way, so that they are better understood by society. In this sense, communication supposes the translation of a specialized language, aiming to reach a wider audience (ALBAGLI, 1996). We must consider that scientific subjects are important for the population as a whole, because of this, one cannot hide or allow such knowledge to become difficult to understand and, with this, not be integrated into the largest part of society.

Access to information can be considered an element of power. When subjects are deprived of that, they tend to be in a condition of ignorance, which may favor dominant groups in society (SILVEIRA, 2000). Such a condition can become an impediment for one to fight against inequalities and indeed exercise his/her rights in a democratic society. Science has as one of its roles to become a means for progress side by side with the struggle of oppressed groups (AGUIAR, 2010).

In history, it is well known that certain disadvantaged groups have been neglected in the scientific field. An example of this is the long time it took for the academy to recognize their value in science, as well as to encourage them to search for scientific knowledge (CASEIRA; MAGALHÃES, 2019).

This exclusionary feature that the lack of scientific knowledge can present negatively influences the educational endeavors we undertake. Thus, SD can become the basis for providing the individual with knowledge in order to exercise his/her right in decision-making processes. After contact with the scientific context, it is likely that there will be more substantiation allowing subjects to become aware of the impact of their choices (LORDÊLO; PORTO, 2012).

Knowing the role of science in society can also influence the exercise of fundamental rights such as, for example, the vote. This is true when we understand how relevant science is, and how it affects our daily lives, so that they could change the way of thinking about who should choose at the time of elections. In addition, the lack of information has contributed to the increase of movements such as the anti-science, noticeable today, because by not understanding some basic discourses and concepts, many tend to ignore the scientific facts and put them as invented subjects. This conviction can also influence the results at the elections (CARVALHO, 2016).

By understanding the central role of science in society, one gets to know that specialized knowledge should be discussed with the general public and not only in higher education institutions. This can be done by using other means of communication such as the internet. Digital media have enabled new ways of acquiring information, making it closer to being disseminated globally (RANGEL, 2009). Through the use of accessible devices, such as mobile phones, there is a tendency to have information more easily spread out. This set can be considered a way to favor the obtaining of educational content even outside the school environment (BATISTA; BARCELOS, 2013).

Talking about SD in the twenty-first century and not mentioning the internet is to leave aside a tool of great importance for the subject, since science was inserted in that space as a way to be disseminated (CARVALHO, 2016). There are ways to communicate science today that were not seen a few years ago, because research was restricted to laboratories, magazines, and specialized journals. The science landscape has changed dramatically with the advent of the internet and information and communication technologies (ICT), as the scientist and his/her research can today roam the internet in search of feedback and collaborations that were not previously easily found. (TONIAZZO; ROSA, 2012).

Blogs are electronic means in which communication is possible to occur and thus became a popular tool that allowed scientists to use it to popularize research in several areas (FLORES; GOMES, 2013). With them, researchers no longer have to rely on scientific journalists, nor on the advisory board of their

universities. Thus, researchers themselves may be the responsible actors for disseminating their research to the lay public.

To express oneself in an SD blog, one does not need to have a vast career in science. On the contrary, these roles are usually taken by students who are beginning their academic life, with little experience in the field. Any person, scientist or not, is able to read and make comments on blogs. This democratic aspect dissolves the norms of the hierarchy proper to the scientific environment, deeming blogs as spaces for reflection and subjectivity destined to students (FLORES; GOMES, 2013).

As Caregnato and Souza (2010, p. 72) emphasize in their research:

> The data obtained also allow us to infer that blog appropriations as means of science communication have been made not only by individuals related to the Academy. This indicates the atmosphere of interest of society in matters concerning scientific practices, which is corroborated by the high indexes of blogs created by lay people found in the analyzed areas [...].

Blogs may have been largely responsible for the current movement of SD in Brazil (CAREGNATO; SOUZA, 2010). The virtual space, the use of visual resources in the contents, as well as the knowledge production through entertainment are great educational allies, once they foster the development of a more playful educational process (FARBIARZ, 2010).

Given the context of Science Education and the importance of SD for society, this research aimed to both evaluate blogs as a means of science dissemination and understand the reasons and frequency with which the general public seeks such content on the internet.

2 METHODOLOGY

The research referred to the analysis of the blog tool as an instrument for SD. To this end, a blog and a form with questions were created and were made available between May 19 and 29, 2020. Fifty-one people took part in the study.

The target audience of this research was characterized by a broad group of individuals who had access to the internet, among the age groups (AG): AGI 10 - 15 years; AGII 16 - 19 years; AGIII 20 - 25 years; AGIV 26 - 30 years; AGV 31 - 40 years.

The age limitation to the maximum of 40 years is based on research carried out by the Regional Center for Studies for the Development of the Information Society, which is the Research on the use of Information and Communication Technologies in Brazilian households (ICT Households) in the year 2019. In this, it is evident that the percentage of internet users over the age of 40 falls to 24% when compared to users between 16 and 24 years old, whose age group is the one with the highest internet consumption.

2.1 Blog creation and posting

The Biologando blog (https://biologandounigranrio.blogspot.com/) was created using the Blogger.com platform, which is a service provided by Google

LLC that offers tools for creating, managing, editing, and hosting blogs. Templates were used for the visual appearance of the blog, available in the mentioned platform, for formatting items such as: header, title, body of posts, among others. The image used as the background (BG) of the blog was made using illustrations of viruses and animal, plant, and bacterial cells. These were superimposed on the green background through the use of an image editing program. An image of the blog is available as supplementary material.

Six posts regarding different topics were published on the blog, one of which was an expository-informative text in order to present the concept of SD to readers. The remaining topics of the posts were separated into broad topics: Evolution, Cultural Biology, Conspiracy Theory/Fake news, and Health. Thus, these were the main subjects addressed.

Concerning evolution, a publication entitled “Demystifying evolution" was posted, whereas in the topic related to Cultural Biology, the publication “What is cultural Biology? What do Pokémon, Zootopia and others have to do with it?” was the one to be aired. Two posts on conspiracy theory/Fake news were published. They were: “The man stepped on the moon?” and “Coronavirus: Pneumonia, antibiotics and some fake news”. The last post could be framed both as part of this topic and the topic Health. In regard to the topic Health, the post “Bacteriophages: A New Hope” was published.

In all posts, expository-informative texts illustrated with gifs and images were used to convey the idea of the post to the reader in an attractive, not dull, fashion. For the post "Coronavirus: Pneumonia, antibiotics and some fake news”, a video addressing the respiratory system and what Covid-19 can entail in it was produced. In addition, concepts about the use of antibiotics by patients of the new coronavirus were also highlighted.

2.2 Form creation and analysis

A form was drawn up in the application Google Forms. In its description, one could read the purpose of the research and the commitment of the researchers to preserve the identity of the participants, since no personal information such as name and/or email address was requested. In accordance with resolution CNS 510/2016, the form did not need to be approved by the Ethics Committee in research with human beings (CEP).

The form comprised 12 questions. Ten were closed (objective) questions and concerned the frequency of consumption of science popularization materials and their purposes for using the internet, to cite two. The other two questions demanded subjective answers so that participants could make comments on what they considered pertinent about satisfaction/dissatisfaction with the blog. They could also mention which content posted on the blog caused any difficulty to be understood. The subjective questions were not analyzed in the present article.

The results regarding the readers' perception of the blog Biologando and its contents of Scientific Dissemination were obtained through the “Answer" tool in the form. It was only made available to the developer of the form.

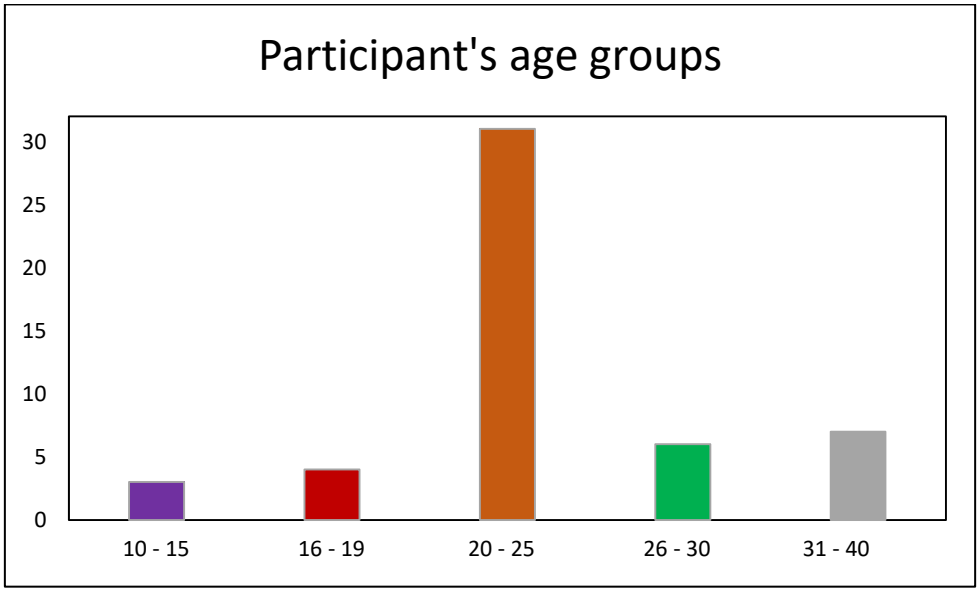
The link of the blog and the form was made available through social networks (*Twitter* and *Facebook*) as well as a messaging application (*Whatsapp*), aiming to reach a greater audience. A brief explanatory text was used on the content of the link and the purpose of its dissemination.

To those who accessed the link through a laptop/a desktop computer shortly after viewing the contents present in the blog, by closing their page, they automatically had a new tab with the form for data collection opened. Participants who accessed it through mobile/other technologies needed to access the link of the form individually using the address in the explanatory text.

3 RESULTS AND DISCUSSION

After analyzing data, the results showed that, by the time of data collection, most of the participants were aged between 20 and 25 years old (AGIII). The age groups I (10 to 15) and II (16 to 19) had the lowest participation rates. If the research ICT households in 2019 were considered, we would expect to obtain greater adherence of the age group II (16 to 19). As it was not the case, the low participation of this group is a surprising result.

Figure 1- Answers (in percentage) to the question related to the age group of the participants.



Source: Research data (2020)[1].

The form was mostly answered by people who self-declared female (71.5%), followed by the participation of people who self-declared male (26.5%), and non-binary (2%).

Historically, women have had less participation in science than men and several reasons can be considered for such an affirmation, sexism being noted as the greatest impediment. This problem leads to a historical disparity in the interest of women in science.

(...) at the moment when modern science is institutionalized and legitimized, women are excluded from it, repeating a double norm: women are admitted

> to scientific activity practically as equals until this activity is institutionalized or professionalized; and the role of a woman in a given scientific activity is inversely proportional to the prestige of such activity. As the prestige of the activity increases, the role of the women decreases (HAYASHI *et al*., 2007, p. 172).

However, in recent years there has been a growth in the female presence in regards to basic and higher education. According to a report published on the page of the National Institute of Educational Studies and Research Anísio Teixeira (INEP) with data referring to the school census of the year 2019, “of the total number of enrolments in professional education, 56.7% are female". Also according to INEP, now referring to the 2016 census, “women represent 57.2% of students enrolled in undergraduate courses”.

A study by the scientific publisher Elsevier (2017) suggested that both in Brazil and Portugal women made up 49% of the research community during the years 2011 to 2015. This research also constitutes that the parameter of 40% of men and 60% of women, and vice versa, is already adequate to the so-called "gender balance" in the scientific field. Through comparison and analysis between two distinct periods (from 1996 to 2000 and from 2011 to 2015), we noted that women obtained an 11% increase in the population of researchers in Brazil, and with this, they went from gender imbalance to gender balance.

Knowing that the research discussed in this article did not make gender distinction, allowing democratic participation, we noticed that the participation of women more than doubled in relation to men in the interaction with the blog and the filling of forms. Drawing from the other references in the specialized literature, we can understand that the interest in science can increase and reach satisfactory levels of participation of the female public.

Most participants (94.1%), regardless of gender, accessed the blog by means of their mobile phones, while the other 5.9% accessed it through a laptop or a desktop computer. These are figures close to those presented in the 2019 survey conducted by the Regional Center for Studies for the Development of the Information Society, through the research of the use of Information and Communication Technologies in Brazilian households (ICT Households in 2019), which demonstrated that the “mobile phone is the most used device (99%)” among Internet users. The mobile phone, then, confirmed to be one of the main tools for accessing the internet.

Of all the participants, 74.5% characterized Science Dissemination as a type of entertainment, while 25.5% did not. This result is important when considering that learning through entertainment can make learning more enjoyable, and thus allow the creation of a basis for scientific development in a more playful way (FABIARZ, 2010).

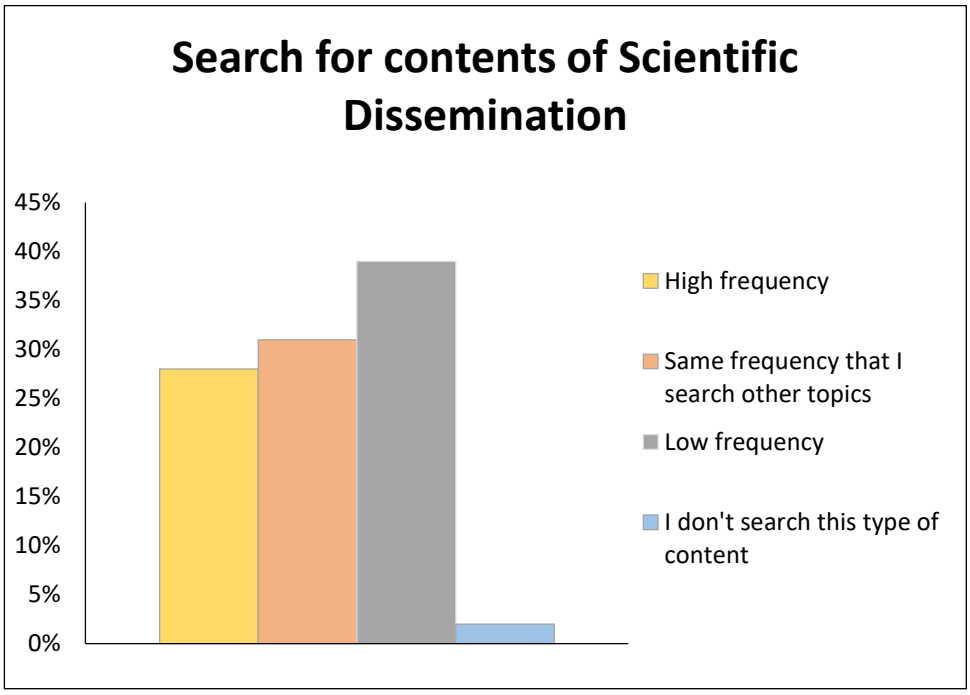
Regarding internet access, 35.3% of people claimed they had as a priority the search for "Entertainment", 27.4% had "Communication" (WhatsApp, Messenger, etc.) as their priority and 21.5%, "Social networks". Only 5.9% of the participants answered “Study”, while 3.9% reported “Work” as the reason for accessing the internet. "Social networks and work”, “News”, "Communication and studies" obtained a lower percentage, with only 2% each.

On the topics covered by the blog (Evolution, Cultural Biology, Conspiracy theory/Fake news, and Health), 35.3% reported that they did not know from 1 to

2 of the subjects commented, 29.4% did not know from 2 to 4 subjects previously, 27.5% reported they knew all the subjects addressed, and 7.8% did not know about 4 to 6 subjects. Although the majority of participants stated that they consider Science Communication as entertainment (74.5%), and entertainment is the main reason why participants use the internet, a large number of participants (72.5%) did not know at least one of the topics covered by the Blog, even if these were not deemed high-complexity content.

Regarding the frequency of access in matters related to SD, the results are shown in Figure 2.

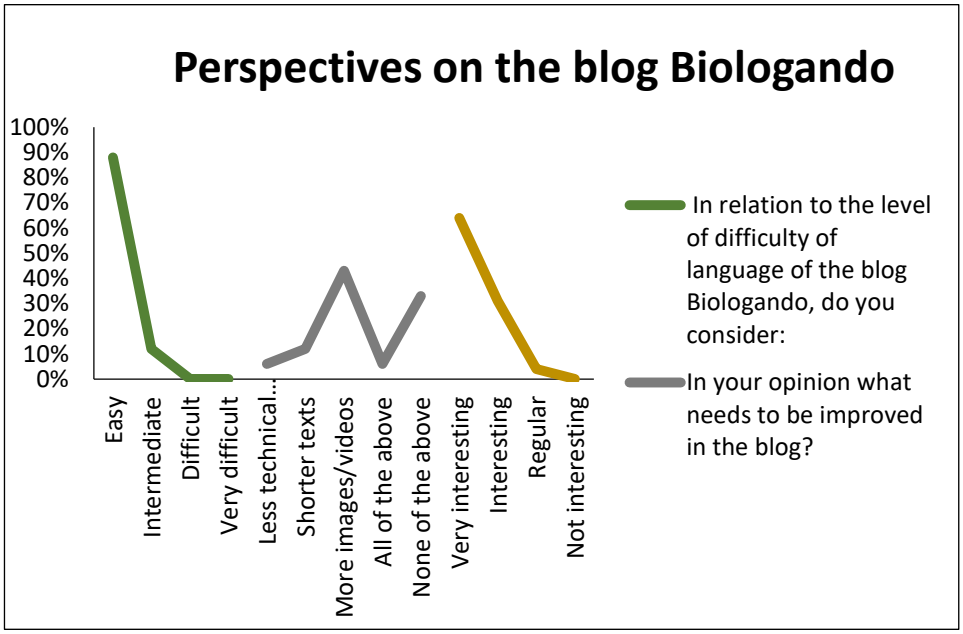
Figure 2 - Answers (in percentage) to the question: "In relation to Science Communication, how often do you search for such content?"



Source: Research data (2020)[1].

Regarding the blog, three questions were asked: "In relation to the level of difficulty of language of the blog Biologando, do you consider:", "In your opinion what needs to be improved in the blog?" and "What did you think of the topics covered in the blog?". The results of these questions can be analyzed in Figure 3.

Figure 3 - Graph related to the three questions regarding the blog Biologando.



Source: Research data (2020)[1].

In a piece of research carried out by Santiago *et al*. (2017, p. 5) with basic education teachers of Science and Biology on their perspectives in relation to the concept of texts of Scientific Dissemination, they noted that:

> Despite the fact that all the participant teachers stated that they knew and frequently read texts related to Scientific Dissemination, most of them would confuse Scientific Dissemination texts with the scientific article itself or a simplified version of it, which characterizes an erroneous conception. Only a few teachers consider scientific dissemination texts as being characterized by the presentation of scientific discoveries in a simplified form.

This way, we observe there is still great confusion regarding the concept of Scientific Dissemination. The ignorance of such concept shown by a large part of the participants allows us to conclude that the blog was responsible for presenting at least one new topic to these subjects, fulfilling its role of dissemination and allowing interaction between the reader and the topics covered.

> The Internet is a tool that can be used to facilitate greater involvement of citizens in debates and discussions involving science. (...) in this sense, blogs stand out as an easy-to-use tool that can promote faster and more effective communication between the author and his/her audience (SILVEIRA; SANDRINI, 2014, p.12).

In relation to the suggestions to improve the blog itself (Figure 3), 43.1% (higher percentage) of respondents reported that it would greatly benefit if it had more visual resources (images/videos/conceptual maps), corroborating the idea that these are important tools for learning and encouraging the audience. The importance of the use of visual resources had already been noticed, even in the school context. In the context of his research, Freitas (2013) applied a questionnaire to a class of 1st-year high school students, who attended lecture classes and more dynamic, full of visual resources classes. His research reports

that 80% of the students argued they “liked the resources used by the teacher and that they benefited the most when they could see and hear about certain content” (FREITAS, 2013, p. 33-34), which consequently led the students to grade higher than before.

The second highest percentage regarding this issue (33.3%) would read that “there is nothing to be changed in the blog”, which is intrinsically related to the approach adopted, aimed at the use of simplified language to allow participants to better understand the content. This statement can be confirmed through the response of the participants themselves when 88.2% considered the Biologando Blog as easy to understand, while 11.8% considered it to be of intermediate (medium) understanding. Other studies also highlight that language and understanding are intertwined. Silva Neto (2018, p.14), for instance, argues that “the use of entertainment and interaction mechanisms for the dissemination and transmission of scientific information is highly desirable, as well as the use of accessible communication channels and clear language to the lay public”.

However, it should be noted that 5.9% suggested that the blog creators “reduce the use of technical terms that make it [content] difficult to understand”, 11.8% “post shorter texts”, and 5.9% “all the above options”. Thus, to obtain better results, authors of Scientific Dissemination who use the Internet as their platform need to be attentive to the opinions of readers in order to produce more attractive content that facilitates people's understanding. Such recommendation meets the findings of research conducted by Rocha and Massarani (2016, p. 20). Through the analysis of comments made in the texts of the online Journal Ciência Hoje das Crianças, the results demonstrated that readers nurture a positive opinion about the content published in that journal and inferred that web pages can “be a good model of science communication in the virtual environment, even if yet to be improved”.

4 FINAL REMARKS

The results corroborate the initial hypothesis that blogs should be considered as a good option for Science Communication, mainly because they are free of cost and free of the sieve of the mainstream media, which allows anybody to create one and discuss what they deem relevant. Another point that emphasizes the value of blogs as a means of disseminating science is the variety of content that can be published. On Biologando, texts, images, videos and also a junction of all these media have been published, since such multimodality facilitates the transmission of content and allows the reader to easily understand the idea being explored.

Blogs as internet tools have no magical properties on their own (SILVEIRA; SANDRINI, 2014). They demand an active attitude in order to produce interesting content to the public and to teach scientific knowledge to the lay population.

O USO DA FERRAMENTA BLOG COMO ESTRATÉGIA DE DIVULGAÇÃO CIENTÍFICA PARA O ENSINO DE CIÊNCIAS

RESUMO

A compreensão de temáticas científicas ainda é insuficiente para grande parte da população, e um dos principais motivos para tal se dá pelo uso excessivo de termos desconhecidos pelo grande público. A abordagem mais técnica do que explicativa faz com que não haja assimilação adequada dos assuntos científicos. Uma das estratégias utilizadas para driblar tal problemática é a Divulgação Cientifica (DC), e esta consiste em propiciar que assuntos de cunho científico sejam abordados com linguagem simplificada. A democratização do conhecimento científico ganhou nas Tecnologias de Informação e Comunicação (TIC) uma grande aliada. Com isso, a união destes recursos propicia que aqueles que possuam conhecimentos importantes consigam atingir o grande público. Os blogs são de fácil criação e manutenção, por isso são uma das estratégias mais utilizadas pelos divulgadores científicos na internet. A presente pesquisa teve por objetivo evidenciar a importância da utilização de blogs como meio de difundir a ciência e como estes são recebidos pelo público. Para isto, criou-se o Blog Biologando, no qual se publicou conteúdos de biologia. A percepção dos leitores do blog foi obtida por meio de preenchimento de formulário, que abordou a DC em si e o blog em específico. A análise das respostas salientou a importância da DC para a apresentação de conteúdos até então desconhecidos. Além disso, evidenciou que a linguagem simplificada é um caminho eficiente para o entendimento das questões científicas, reiterando, portanto, a importância do Blog como recurso de Divulgação Científica.

PALAVRAS-CHAVE: Divulgação Científica. Blog. Ensino de ciências.

NOTE

1 Data organized by the authors.

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