ANALYSIS OF THEORETICAL AND METHODOLOGICAL ASPECTS IN RESEARCH WORKS WITH SCIENTIFIC DISSEMINATION

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Abstract

This work aimed to do a survey and analysis of Scientific Dissemination main-themed research works of the last 5 years. The selected materials were divided, categorized and analyzed for its theoretical and methodological basis. The central goal was to recognize how Scientific Dissemination is referenced and which are the main methodologies used in the found texts. It has been noticed, as a result, a group of texts with well-defined methodologies, that, however, present an incipient theoretical basis, showing the need of actions in that perspective, if we consider Scientific Dissemination as a potential area for science teaching researches.

Keywords: Scientific dissemination, text analysis, science teaching.

1. Introduction

Within the Scientific Dissemination (SD) field and considering current subjects, the concern about the crescent wave of disinformation that started to circulate, especially in social media, was one of the highlights so that different groups could start scientific dissemination and popularization works. Actually, SD has been gaining interest in academic researches (Fernandes et al, 2020; Recuero, Gruzd, 2019; Recuero et al, 2020; Soares et al, 2021; Oliveira, Martins, Toth, 2020). Furthermore, during 2020 and 2021, SD groups and projects evolving fact-checking agencies intensified or initiated their jobs trying to demystify the massive amount of fake news, emerged during the pandemic.

In spite of the creation and spread of fake news not being recent, (Mcintyre, 2018), its high increase, especially due to digital technologies (D'Ancona, 2018) draws attention. Because of a divided media environment, an increase of the distrust in the conventional media occurred, leading the audience to search for information in alternative sources, such as social media, websites and blogs that do not present accuracy in respect to the content disseminated (Chapman, 2017).

It is in this context that SD begins to gain more importance and massiveness. However, as many authors point out, the combat strategies against the fake news dissemination cannot be naive, based on the exclusive dichotomy between "fact or fake" (Oliveira, Martins, & Toth, 2020). A more deep understanding of the scientific and social aspects that compose the intentionality of fake news dissemination is needed and that must be done under the optics of documental analysis, searching for the comprehension of the social phenomena involved.

We highlight, for example, issues focused on the dissemination of information and aspects of post-truth. This term and its concernings with the fake news have gained relevance in a time that included Donald Trump's, former president from the United States election campaign and the Brexit process, in 2016 (English Oxford, 2016). The massive propagation of fake news that influenced (and still does) people's opinions are neither the cause nor the beginning of post-truth, but a result (Mcintyre, 2018). Some consequences of situations like these are pointed out by authors and, as synthesized by Cruz Jr (2021, p. 277), there is the favoring of "(...) a kind of collective resignation: when people give up (consciously or unconsciously) on understanding the reality rationally, its nuances and contradictions, settling for preconceptions, personal experiences and fragmentary narratives" (our translation).

Still, the comprehension of the typologies of denialist discourses enables the development of more robust SD actions. Cohen (2001) categorizes the kinds of denialists in literal, interpretative and implicatory terms, the first one being the one that explicitly denies the fact, claiming, for example, "that never happened" or "that is not true". The interpretative one does not present a denial to the fact, but looks for an own interpretation, giving the event a different meaning. The implicatory one does not deny the fact, nor its conventional interpretation. It is their moral, psychological or political implications that are denied or, at least, minimized.

It is in front of this vast context and its possibilities of comprehending the mechanisms of SD promotion that this work fits in. We aim to interpret SD meanings, including the research about SD. We justify this proposal considering that finding ways to do so, so we can contribute to the expansion of the knowledge produced in different areas is briefly important so it can be possible to articulate SD as a scientific and mediatic lecturing, considering perspectives to formal and non-formal education.

2. Objectives

This research's main objective is to analyze texts that involve research about Scientific Divulgation in science and math teaching areas published in the past five years in Brazil and overseas. The analysis aimed to recognize their goals, theoretical basis and methodologies applied. Our intention with this analysis is to identify elements that allow us to recognize how SD themed research has been done and what are the possibilities within this field to promote scientific literacy.

3. Methods

This paper is guided by a qualitative data analysis obtained from systematic reviews from the literature (Galvão; Pereira, 2014). As research sources, we used data bases from Google Scholar, Scielo and Web of Science to look for the words "divulgação científica", "scientific divulgation" e "scientific dissemination", limiting the works from 2018 to 2022. The selection criteria were these words' presence in the key-words or in the abstract. It was selected and separated for analysis articles with scientific divulgation as main theme. The reading and analysis by a posteriori categorization followed the methodological aspects defined by data codification according to Creswell (2012).

4. Results

After analysis of the titles, abstracts and key-words, 15 articles in Portuguese and 7 in English were selected and fully analyzed. The abstracts' reading enabled the following a posteriori categories: 1) articles pandemic-centered, 2) articles with social media-focus, 3) articles with health area-focus and 4) articles that bring a SD project as theme. In these works, we aimed to identify their i) objectives; ii) theoretical basis; iii) methodological aspects. Table 1 shows the number of papers in each one of the categories, by year and language. We highlight that some works were placed in more than one category, so that the final total of the articles in the table is higher than the previously said.

Table 1. Articles categorized.

Category	Articles in Portuguese	Articles in English	Publication Year
Articles pandemic-centered	3	4	2020 (5) 2021 (2)
Articles with social media-focus	5	3	2019 (2) 2020 (3) 2021(2) 2022 (1)
Articles with health area-focus	1	4	2019 (1) 2020 (1) 2021 (3)
Articles that bring a SD project as theme	5	3	2019 (1) 2020 (2) 2021 (5)
Others	6	-	2018 (1) 2019 (1) 2021 (2) 2022 (2)

Source: Copyright

5. Discussion

5.1. Works' general structure and objectives

Concerning the first category, were selected articles whose structures rely directly on the pandemic, having it as their main theme and/or their basis. On the other hand, the second category includes papers that focus on the SD done in social media, and/or social media as a way to do it, depending on the media used. Almost all the articles reference at least one social media and its peculiarities, also the

characterization of some media were used as a criteria to classify the papers under this topic. The third category holds works with the main (or only) theme being the SD of subjects in the health area, with some of the texts from the first category were included under this classification depending on whether they contained or not information about COVID-19. The fourth category comprehends texts that describe some project, magazine, paper with data analysis, reach and/or its development. So, it was selected works that, unattached to whether they present references concerning SD, have some SD project as the main theme of the text. Then, we created the category "Others" for texts that did not match any of the previous categories, but that presented potential to be used as future query or theoretical foundation.

Throughout the selected articles, we noticed that texts in English, in general, are papers focused on the pandemic time or health related (not necessarily limited to COVID-19). As shown in **Table 1**, 4 out of the 7 articles in English have the pandemic as its theme. Regarding the Brazilian articles, this statistic drops to 3 in 15.

From the article's readings, it was observed that the international texts start from a problem or a specific project to talk about SD (like prostate cancer, radioactive oncology, APJTM), while this is less frequent in the Brazilian ones, present in 5 out of the 15 found texts. Therefore, we were able to find a higher number of Brazilian texts that talked about SD in a more embracing way.

Articles written in English health-themed also prevail in number: 4 out of 5 articles. We noticed that while there are 4 international texts in this area, there is only 1 Brazilian text for the same theme. This subtopic concerning the works may be the main difference between Brazilian and international articles. We also noticed another difference concerning the text sizes; texts in Portuguese are, in general, longer than texts in English, most of them being short publications without the structure of a scientific article and containing a brief analysis of a certain project, as is the case with the text "Twitter-based Prostate Cancer Journal Club (#ProstateJC) Promotes Multidisciplinary Global Scientific Discussion and Research Dissemination)".

5.2. Works' theoretical basis

About the theoretical references discussed in a deep way in the texts, only 7 out of the 22 selected works presented them in their structure. This is a fundamental aspect to consider when we think of SD as a strategy, not only of a translation of concepts in a more technical language to a more informal one, but also as a strategy regarding teaching and learning content (Oliveira, Martins e Toth, 2020).

We highlight the text analysis "As ambivalências da divulgação na era digital" written by Lucia Santaella, which brings out a wider discussion about different aspects related to SD, such as topics related to social media credibility, filter bubbles, trust and perception of science and controversies in it, connecting them to classic science sociology authors like Thomas Kuhn and contemporary authors like Bruno Latour. This work is a theoretical work that has the matter to be used as reference to other researches and, for that, deserves emphasis in our analysis.

Another highlight work in this theme is the one written by Lorenzetti, Raicik and Damásio (2021), who did a SD-themed texts review, interpreting them under the optics of Science History and Philosophy and Science Epistemology, so that to recognize methods for which SD is done, why is done, and to whom. In this material, there is an important reference crossover, trying to bring together SD and Science teaching.

The other works that point to theoretical references brings out, in general, SD definitions, quoting, in its majority, Massarani, L. and Dias, E. (2018), Bueno, W. (2010), and Albagli, S. (1996). Some correlations are made in a summarized way with aspects from Science, Technology and Society and with Science Epistemology aspects, however, for not being study and investigation subjects, these references are not deepened.

One interpretation for the fact those works don't rely enough on theoretical references is that, in our survey, most part of the papers fit in a analysis profile of how a certain theme shows up in the SD materials (how COVID was treated; how science public perception appears; in which and how many materials SD has been done, for example). In that regard, the works' structure presents a robust methodological case, but the analysis restrain themselves to groundless theoretical basis quantifications or interpretations.

Another term that can be highlighted is the recent characteristic of SD themed research and the complexity of establishing parallels with different references. The texts from Santaella (2019) and Lorenzetti, Raicik and Damásio (2021) make that connection, becoming potential references for new proposals. Notably, aspects from Science Nature, Science History and Philosophy, scientific learning and teaching, among others, can be worked together with SD. However, as it represents a more recent area that involves media communication aspects and, also, in a deeper scenario, scientific journalism issues and its derivations (media training, semiotics, multimodality, etc), the theoretical basis in those articles is, yet, to be developed.

Another example of these aspects mentioned above, despite the absence of a theoretical deepening in the references, only 5 out of the 22 works do not present any references. However, excluding the 7 articles previously mentioned (which bring out a bigger discussion about the references), the other works present a theme of variability without a connection to data or the analysis made, such as SD definitions, fake news, social media and misinformation categorizations, cyberspace definitions, among others.

5.3. Methodological aspects' analysis

Among the found articles, 9 do not present a methodology or data analysis based on the qualitative or quantitative research area. Those texts, sometimes, search for an access' data systematization or the frequency number of a certain theme or a brief action classification. We noticed that the other 13 texts present a well-defined methodology and, in general, the texts are based in bibliographic and documental researches and in a couple of cases there is an additional with interviews (*"Blogs institucionais como ferramenta de divulgação científica em universidades públicas: análise do Blogs de Ciência da Unicamp e do UFABC Divulga Ciência" [Institutional blogs as scientific dissemination tool in public universities: Unicamp Science Blogs and UFABC Disseminates Science analysis]*) or analysis of other aspects (watch the videos, extract subjects from them, then analyze the moral density]).

As discussed in the theoretical basis topic, despite only 7 texts, although only 7 texts present a deep discussion on theoretical subjects, 13 of them describe methodological aspects. This fact, as quoted above, is connected to the kind of research (documental and bibliographic). However, it is an aspect that draws attention and must be considered as a discussion topic.

As said by Lorenzetti, Raicik and Damásio (2021), understanding how, why and to whom SD is done is crucial. To comprehend the SD texts and the produced materials' reach is important, but to interpret those facts grounded by SD and teaching and learning theoretical references can increase ways to the SD understanding and use as a strategy to the lecturing (formal or non-formal) and also to strengthen that new investigation theme.

Recapturing some of the issues discussed in our theoretical mark, there are, in the science teaching field, countless matters that can be linked to the SD work. Concepts' hiperparticularization aspects, post-truth related issues, Science Nature and even aspects related to the media training are possible to be under studies. However, debating those propositions under the optics of appropriate references and making connections among theoretical and methodological references and the data from researches, that being documental, empirical or from another nature is primal to strengthen the works.

6. Conclusions

Despite SD being done since the beginning of the past century in Brazil, in the past 5 years the publications related to it had a huge impact (in the past 2 years in particular due to the pandemic), as well as misinformation practices and fake news circulating in social media.

The analysis done in this work points out that international and national articles have differences in their structures and themes, in the references and in the depth of discussions. With respect to the deepening, part of the found works, in spite of presenting diverse themes, do not present a deep discussion about SD nor its relation to other concepts of references in the distinct areas. However, the other works that do present it can become theoretical contributions in future texts.

We do not have, as a goal in this work, to criticize SD actions. We understand, although, that recognizing the SD field as a potential area for research and for the development of science teaching and learning activities and also in the promotion of a media lecturing, it is primal that a robust theoretical basis is associated with those activities, recognizing the area's specificities. Thus, to recognize that there are, still, ways to the construction of a theoretical basis, as well as to adjust appropriate methodologies to the field, is a task that needs to be developed with bigger intensity in the articles.

Finally, this work highlights the importance of the continuity of SD research so that deeper discussions about that can be generated and more SD theoretical contributions can be developed. The sharing of our reflections and analysis is, therefore, a way for us to reflect collectively about the area's potential in future perspectives.

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