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Science and communication: the presence of Brazilian institutions on YouTube

Ciência e comunicação: a presença de instituições brasileiras no YouTube

Ciencia y comunicación: la presencia de instituciones brasileñas en YouTube

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ABSTRACT

In Brazil, the consequences of covid-19 were exacerbated by the addition of an infodemic to a process of denial and discrediting of science by spreading fake news online. This article hypothesizes that, in the fight against fake news, search engine optimization (SEO) and web semantic strategies can improve the construction of the digital presence of institutional science channels in Brazil. The objective is to describe and analyze two institutional public science production channels on YouTube. For that, we used the quanti-quali method, with Social Blade metrics, direct observation, and questionnaire application. The results showed a preference for short videos, with substantial differences in artistic and narrative style. Having circulated in other digital social networks, the content generated conversations and reactions outside the academy. In conclusion, improving the optimization techniques on both channels, with appropriate hashtags and more attractive titles, broadened the final audience.

Keywords: Science communication; Disinformation; Scientific audio-visual article; Infodemic; Digital strategies.

RESUMO

No Brasil, somou-se à infodemia um processo de negacionismo e descrédito das ciências pelo espalhamento de *fake news* on-line, agravando as consequências da covid-19. A hipótese desse artigo é que as estratégias de Search Engine Optimization (SEO) e de *web* semântica podem melhorar significativamente a construção da presença digital de canais institucionais de ciência no Brasil, no combate às *fake news*. O objetivo é descrever e analisar dois canais institucionais no YouTube de produção pública da ciência. Para tal, foi

utilizado o método quanti-quali, com métricas do Social Blade, observação direta e aplicação de questionário. Nos resultados, constatou-se a preferência por vídeos de curta duração, com diferenças substanciais no estilo artístico e narrativo. Os conteúdos geraram conversações e reações externas à academia, devido a circulação em outras redes sociais digitais. Conclui-se que o aprimoramento das técnicas de otimização nos dois canais, a partir da utilização de hashtags apropriadas e títulos mais atrativos ampliou o público final.

Palavras-chave: Comunicação da ciência; Desinformação; Artigo audiovisual científico; Infodemia; Estratégias digitais.

RESUMEN

En Brasil, un proceso de negación y descrédito de la ciencia a través de la difusión de noticias falsas en línea se sumó a la infodemia, agravando las consecuencias del covid-19. La hipótesis de este artículo es que las estrategias de optimización de motores de búsqueda (SEO) y web semántica pueden mejorar significativamente la construcción de la presencia digital de los canales de ciencia institucionales en Brasil, en la lucha contra las noticias falsas. El objetivo es describir y analizar dos canales institucionales de YouTube de producción científica pública. Para ello se utilizó el método cuantitativo-cuali, con métricas de Social Blade, observación directa y aplicación de un cuestionario. En los resultados, hubo una preferencia por los videos cortos, con diferencias sustanciales en el estilo artístico y narrativo. Los contenidos generaron conversaciones y reacciones fuera de la academia, debido a la circulación en otras redes sociales digitales. Se concluye que la mejora de las técnicas de optimización en ambos canales, a partir del uso de hashtags adecuados y títulos más atractivos, incrementó la audiencia final.

Palabras clave: Comunicación científica; Desinformación; Artículo científico audiovisual; Infodemia; Estrategias digitales.

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INTRODUCTION

In 2020, within the context of the covid-19 pandemic, everything seemed possible, everything other than people who aimed to spread disinformation, fake news, and news with any kind of bias, especially in the health area (MACHADO *et al.*, 2020). Since 2018, in Brazil there has been a systematic process of denial and discrediting of the sciences, enhanced by the speech of politicians and public figures (MASSUCHIN *et al.*, 2021), worsening the consequences of the pandemic (OLIVEIRA, 2020). This scenario shed light on two factors: 1) the importance of science, because it became the target of external dissensions, in other words, its presence bothers people who are interested in manipulating the masses (FONTES, 2021); and 2) that scientists and scientific institutions are unprepared to take a stance in everyday conversations (LILLEKER, 2018), especially in the online environment. Development of communicational skills among scientists is not greatly encouraged. After all, the *Higher Education Personnel Improvement Coordination* (Abbreviated to Capes), a reference point for scientific productivity in Brazil, only considers publications in qualified scientific journals with peer review as strategic indicators of scientific communication (CAPES, 2020, p. 19). The impact of this is low communication of science to the public among scientists and university professors. Therefore, when considering laypleople or non-experts, the field of scientific reporting is underdeveloped in Brazil.

However, since 2015 the Scientific Electronic Library Online (SciELO), a platform for the circulation of peer-reviewed scientific articles, has required that journals indexed in the database present a marketing and dissemination operational plan including "the management of an updated list of potential researchers, national and international authors and users, potential readers, as well as related institutions" (SCIELO, 2014, p. 20), thus indicating the prospect of building up the social presence of science in the online environment. However, the repercussions of the little that is produced have been enough to disturb opponents, as can be seen from the continuous1 threats from fake news. This in itself reveals that the current direction has had some effect. Considering these aspects, this article analyzes two cases that seek to develop innovative strategies using YouTube to increase the presence of science in digital media in a consistent and affirmative way. Both cases are of institutions: 1) INCT-CPCT Scientific dissemination channel, from the National Institute of Public Communication of Science and Technology (INCT-CPCT), and the respective playlist The science of scientific dissemination, both of them are associated with Fiocruz, a national center of excellence for research in the public health area (FIOCRUZ, 2020); 2) UFPR TV channel and the respective playlist Amanzing Science2, with coverage in the southern region of the country which is associated with the Federal University of Paraná, the oldest federal institution of higher education (UFPR, 2021). This article aims to observe how scientific production is expressed through these channels and describe the communication strategies developed in each case. The method applied was the analysis and comparison of cases, with presentation of quantitative and qualitative data.

The first part of the article presents the theoretical discussion on disinformation, considering the relevant role of communication and science in combating the infodemic in Brazil. Subsequently, the research method, results and discussion are presented, in addition to final considerations.

1 In the article by Galhardi *et al.* (2020), the authors deal with the Eu Fiscalizo (I inspect/check) app, developed by Fiocruz, to combat fake news.

2 In Portuguese, the name of this playlist is Curta Ciência, based on the size of the films, shorts (*curta-metragem*) and likes (*curtir*) on social media. Then, the translation thus considered the expressed meaning and not the literal meaning of the word.

Distrust of institutions and their relationship with disinformation

In the context of the covid-19 pandemic, the phenomenon of disinformation has increased significantly (OLIVEIRA, 2020), corroborating the so-called infodemic. As its name suggests, this is an information epidemic. The infodemic (WHO, 2021) discourages compliance with effective disease prevention measures and expands the anti-vaccine movement (VIGNOLI *et al.*, 2021), worsening the consequences of the pandemic. "In this scenario, scientists, journalists and information professionals have worked to mitigate the effects of disinformation and provide the population with information based on scientific evidence" (MASSARANI *et al.*, 2021, p. 2).

In Brazil, political leaders themselves disclose unproven and decontextualized information (PINTO *et al.*, 2020), to discredit scientific institutions, making it difficult for "the citizen to differentiate between what is reliable or not" (OLIVEIRA, 2020, p. 16). Confidence in traditional institutions has been decreasing over the years, in an attempt to disqualify the democratic regime (RIBEIRO, 2011; BENNET *et al.*, 2018;). In the analysis of Latin American democracies, Ribeiro associates: "[...] growing distrust has its roots in frustration and broken expectations in relation to the concrete performance of the institutions that make up the regime" (RIBEIRO, 2011, p. 180). Regardless of the reasons, discrediting contributes to disinformation (ALBUQUERQUE; QUINAN, 2019). During the covid-19 pandemic, fake news generated distrust in science, health agencies and the World Health Organization (WHO, 2021).

Social networks became the main source of searched information in the covid-19 pandemic (CALVILLO *et al.*, 2020). This use is worrying, primarily because online platforms are not held accountable for verifying content (RECUERO *et al.*, 2021) – that is, content published by users on platforms is not verified for veracity. In addition, there are non-human apparatuses that interfere with the sharing of this information called clickbaits (ALDWAIRI; ALWAHEDI, 2018). Clickbaits are automated actions by algorithm systems programmed to classify diverse content according to its importance and make recommendations for each click on a link. This factor results in a scaling up of the circulation of this same link at high rates. These two aspects of social networks alone enable us to understand the danger posed by the dissemination of fake news.

However, a third element also contributes to this process, the automated marketing system3. In other words, sponsored channels without checks, which are found on YouTube (MACHADO *et al.*, 2020; SAMPAIO et al., 2021). Sleeping Giants Brasil denounced this practice (BEZERRA; BORGES, 2021), making public the fact that large companies were, without realizing it, sponsoring YouTuber channels that disseminated fake news. Thus, social networks drive and spread both serious and verified content as well as misleading content, and the responsibility currently rests with those who disseminate or share the content.

> Historical events, such as the holocaust or the military dictatorship in Brazil, are often denied or relativized, as well as global warming, the role of vaccines and even the sphericity of the Earth. Nowadays, ideas like these find fertile ground on the internet and social media, which deliver this type of content to large audiences (MARINELI, 2020, p. 1175).

These waves of distrust regarding science, come from the outside in, and indicate that contemporary society is living with the challenge of an epistemological crisis, accentuated by the development of language in social networks, extremely focused on narratives centered on the first person, characterizing what has been called post-truth, or "I-Pistemology" (VAN ZOONEN, 2012, p. 56). In I-Pistemology personal experience is equated with scientific knowledge. It is necessary to clarify that scientific knowledge differs

3 Automated marketing is an online advertising system that associates a product brand with content purely according to the profile of the users or the geographical region of reference, not considering the content itself. This is a widely practice technique on YouTube for monetizing channels, which can generate dissonance or communicational noise.

from personal experience, since "the use of one's own experience and senses from the perspective of the reference schemes of everyday reality does not necessarily function as a reliable criterion for characterizing reality" (MARINELI, 2020, p. 1183). Different didactic strategies are required in order to understand scientific knowledge. At this moment, it is urgent to train scientists and prepare public institutions of scientific production to interact in an accessible way and with simple language4, generating content for everyday conversations (BARBOZA, 2010). Thus, the initial strategy is to get space on social networks and YouTube channels in order to build a credible scientific and institutional online social presence (SANTOS, 2021) (MASSARANI; ROCHA COSTA; PEREIRA BROTAS, 2021). This can be seen in the cases analyzed in this article.

Communication and science in the fight against infodemic

Fake news stimulates emotional and irrational attachment to content by making use of devices such as sensationalist headlines and hashtags with high rankings in search analytics such as Google Trends or Web Analytics. The large-scale spread of content across various open social networks is accentuated by the creation of false profiles which are inserted in groups and the use of bots in the replication of content. These same strategies are used in private networks, such as WhatsApp and the like, to achieve the financial and political objectives of their creators (MASSUCHIN *et al.*, 2021). It is almost impossible not to be faced with at least one item of fake news per day (LEWANDOWSKY *et al.*, 2012). Are these the new rules of the game? What stance should you take online when the opponent 'plays dirty'? It is important to recognize the effectiveness of fake news communication, given that many fake news items determine the mass media agenda.

The performance of institutional scientific dissemination, combined with elementary and high school education, becomes structural in the defense of science, in order to minimize the impacts of disinformation, political polarization and denialism. The processes and concepts transmitted in clear and accessible language must have a critical stance towards the social markers that they leave: " [...] for example, the conceptions about science, people and institutions responsible for this production –; their texts and choices – formality, language, themes, images – that make up these texts; and also how these productions are received (PEZZO, 2018, p. 94)".

It is about media literacy (TEIXEIRA, 2020) and educommunication (SOARES, 2019), applied to the concept of public communication of science (COSTA; SOUSA; MAZCOCO, 2010), or even open science (FECHER; FRIESIKE, 2014), when it is developed for citizenship. Studies show that public communication and communication in the public interest should not be carried out by governments alone, advocating the importance of social participation.

> If a majority believes in something that is factually incorrect, the misinformation may form the basis for political and societal decisions that run counter to a society's best interest; if individuals are misinformed, they may likewise make decisions for themselves and their families that are not in their best interest and can have serious consequences. (LEWANDOWSKY *et al.*, 2012, p. 107).

When the scientific community expands its social presence in other communication spaces and interacts with citizens, in general it is a "way of being accountable for investments to financing agents or to society itself" (OLIVEIRA, 2020, p. 16).

4 We refer to a communication technique linked to a cause of social inclusion. It began in England and the United States in the 1940s under the name plain language. In Portuguese it is known as *linguagem clara* (clear language), or *linguagem simples* (simple language) (BARBOZA, 2010).

Communication and Algorithms YouTube

Audio-visual content mediated by the YouTube platform allows a massive presence and greater interaction with the audience, mainly by ranking in search engines and through link sharing, when distributed on open or closed social networks, such as WhatsApp (FONTES, 2021; SAMPAIO *et al.*, 2021). Analysis of the performance of digital scientific communication practices on internet platforms and social networks was discussed by Oliveira (2018, 2020) and Araujo (2015, 2018). The authors proposed some metrics and analysis methods. Oliveira (2018), when addressing the mediatization of science, proposes reflection on five central points: competition × visibility; the dispute between human × non-human actors (bots and clickbaits); scientific communication for non-peers as a form of accountability for the society of investments made; languages and formats adapted for non-academic society (extramural relationship); and understanding the social spaces of mediatized science from dynamic spheres of political and social disputes (relevance of information × legitimation of knowledge × commodification of knowledge).

These are important reflections for understanding the complexity of the field of scientific communication when considering a more general social context. Such ideas are not explored in a deep way within digital scientific marketing related to social media metrics. These reflections allow a critical look at the concept. Araujo (2015) proposes that digital scientific marketing be understood as the joint action of digital marketing and scientific marketing as a strategy used in science products, offering services aligned with the needs of users. Araujo (2018) researched the presence of scientific journals on social media. Based on this factor and with a focus on the Facebook network, he proposed five digital marketing indices adapted to analyze the online presence of scientific products: visibility; influence; engagement; reputation; and conversion.

In this article, these indices were adapted to understand the performance of YouTube channels, considering the reflective elements and ethical aspects pointed out by Oliveira. The categories for analysis were defined as follows: 1) visibility: measured by the audience reach of each item of content, by the frequency of publication and the average time the content was viewed, by the use of sharing bots or paid campaigns, by the use of hashtags; 2) influence: measured by the authority of those who publish, whether an institution or an individual, by recognition within the area of operation; 3) engagement: measured by engagement with the public, including comments, user reactions, sharing inside and outside the main social network, proactive use with the students of high and elementary school; 4) reputation: measured by the good connected performance of the three previous indices, related to cohesion and editorial coherence, measured in lives, partnerships with other channels and citations in the media; 5) conversion: downloads, participation in external lives, channel monetization, content sponsors, content appropriation by the audience for other educational or artistic purposes.

As proposed by Oliveira (2018), it is necessary to reflect on the impact of this logic on the production of knowledge. Science cannot and should not depend on the performance of marketing relationships, but rather use its resources to build a presence closer to the general public. For this purpose, a sixth index was developed: 6) contribution to scientific literacy, whose premises are: use of simple language; adherence to audio-visual accessibility techniques – such as subtitles, sign language and audio description; capturing new audiences of any age group or any education level. Thus, for the development of digital strategies, the use of media literacy techniques and resources associated with educommunicative practices are indicated.

Based on the information uncovered, this article seeks to expand research on YouTube channels specifically related to the little explored niche of public institutions of scientific production channels, looking for the construction of a consolidated online presence with a good reputation regarding the quality of the information transmitted. Of the topics and indexes presented by Oliveira (2020) and Araujo (2018), visibility is mainly related to the concepts of the semantic web and search engine optimization (SEO) (BUENO

et al., 2019; CRUZ, 2021), concepts that influence the dynamics of online content circulation, based on the algorithmic behavior defined by search processes in internet browsers.

But at the end of the day, what does that mean? It means that the words that people type in search engines such as Google, Bing, Yahoo, Safari are ranked by importance, according to the number of times they are searched, which generates an algorithm. The search term is identified as belonging to a group of words – this is called the semantic web. For example, if you go to the search bar and want to check what the weather will be like tomorrow, you can put 'climate', 'city name', 'month' and 'year' and the search will return a lot of results, based on similar searches previously carried out with similar topics that were clicked on. Thus, pages will appear with the word 'climate', but also with the word 'weather' or 'vacation', if the month you searched is in January or July, 'sun', 'rain' and so on, configuring a semantic field or a word cloud that relates to the term searched – 'climate'.

From the semantic web, SEO techniques are developed, ways to assertively use the search parameters so that the content appears on the first page of the search, thus increasing the chances of the content being clicked on. One of these techniques is the identification of the keywords of the semantic web related to the term you want to disclose. To this end many make use of Google Trends to define the hashtags of the publication. Another way is to use Boolean operators to test the term in search to subsequently define the text of the title or description of the video and thus achieve what is called digital traffic optimization from algorithmic measurement, or use Web Analytics in similar well ranked profiles to verify the semantic field used. According to Cruz: "When it comes to technological experiments by information providers, they are definitely more concerned with performance that keeps them in power (political and economic) than with collective knowledge" (CRUZ, 2021, p. 5). Therefore, the task of scientific dissemination in audio-visual media depends to a large extent on the knowledge required to build a significant online presence.

In this article, the research was carried out based on the concept of a scientific audio-visual article, which, according to Mendes (2017), in addition to being in keeping with the characteristics of scientific dissemination, such as clear and accessible language, must have good film production quality, including: a script, full HD filming (1920×1080 pixels or in the 16:9 ratio), explanatory graphics, editing and post-production of image and sound. This has become the predominant format since the Three Minute Thesis award (3MT)[5], created by the University of Queensland in Australia in 2008, when a competition was proposed to support the "capacity to effectively explain their research in three minutes, in a language appropriate to a non-specialist audience." (3MT, 2021,). The format gained notoriety and, in 2011, the award was already taking place in more than 900 universities in 85 countries. Brazil was not sit out, and today awards for the best videos disseminating theses and dissertations are common in almost all public universities in the country and in research funding agencies.

In addition to these factors, the interest in analyzing the format of the audio-visual article in the digital short film environment also derives from the option of the YouTube platform to encourage the dissemination of shorts, very short and vertical videos. This format was defined by the TikTok platform, Instagram's lives and reels. Due to these factors, the trend of short videos has become part of digital metrics used in order to boost YouTube channels. In the cases of TikTok and YouTube shorts, a second aesthetic change occurs, which is the presentation of the videos in the 9:16 format, reversing the conventional format, which is 16:9, due to the shape of cell phone screens (BRENOL *et al.*, 2022). During the covid-19 pandemic, this aesthetic was appropriated by the media as an additional form of journalistic coverage and audience participation. Thus, the cell phone screen gradually became the main screen and, to a large extent, has created alternative standards of audio-visual framing. These reasons are more than enough to justify the investigation of how science and communication can work together and what the future trends are. The impact of covid-19 on

5 This excerpt of the text and other information can be accessed on the Three Minute Thesis (2021) page.

audio-visual production for YouTube has also brought challenges to scientific dissemination. The dispute for narratives between scientists and deniers, according to Massarani *et al.* (2021), indicates the need to look more closely at the issue of engagement and the role of entertainment influencers, considering the potential for new forms of scientific dissemination.

In accordance with what has been discussed so far, this article aims to analyze two practical cases of scientific dissemination produced by public scientific institutions to identify the strategies used in the affirmative presence online on YouTube, such as the dissemination of dissertations and theses.

METHOD

A netnography methodology was chosen to research YouTube with a case study to describe, compare and analyze communication strategies. Netnography has stemmed and developed from the ethnographic method – used as the main research method in anthropology, with immersion in the researched field, proximity to interviewees, use of notes and reflections on what was observed –, conceived and performed in a virtual environment. This virtual environment is understood as a space that requires digital socio-technical mediations in the interaction process. As such, the method was conceived and developed from the critical discussion on netnography proposed by Polivanov (2013).

In this research, netnography enabled in-depth immersion in channels and playlists for a better understanding of aesthetic choices and content, as well as some communication strategies for circulation. The Social Blade tool was used for the comparison of performance between channels. No appropriate digital tool was found for the analysis of playlists, particularly regarding comparability, so we opted for netnographic analysis followed by comparison. The criteria for selecting YouTube channels were: channel belonging to a public institution of scientific production; presence of a specific playlist for the dissemination of theses and dissertations, accessible to the public; permission to analyze the channel; and authorization for an interview with a member of the production team.

Given its links to Fiocruz, the INCT-CPCT Scientific dissemination channel was a significant option for approaching. This was due to the public recognition that the institution has in the area of public health and scientific dissemination. The channel has a playlist with the characteristics indicated in the inclusion factors called The science of scientific dissemination, which deals with theses and dissertations made on scientific dissemination.

The UFPR TV channel, included for comparative purposes, also met the inclusion criteria due to the proximity of the researchers to the institution. It is a channel that belongs to the Federal University of Paraná, and the selected playlist which is called Amanzing Science has videos of theses and dissertations nominated for awards by the institution.

Once the channels were defined, the quantitative data of both were tabulated from Social Blade, a free website that discriminates and evaluates the channels according to their performance. The channels are evaluated from A+ to D- for the best and worst performances respectively. In its consideration of appropriate characteristics, this is a system with a similar logic to that applied by Capes, in the evaluation of scientific journals.

The quantitative analyses evaluated the number of subscribers to the channels, the number of views, posting frequency, the number of likes, the number of comments on the posts, the date the channel began and the playlist. The qualitative data from the playlists allows analysis of the organization of the YouTube channels, which facilitates content localization. To tabulate the data of the respective playlists – The science of scientific dissemination and Amazing Science –, it was necessary to mine the information, whereas Social Blade does not have a tool for this type of analysis. The number of playlists within the channels and the

number of videos in the selected playlists were analyzed. Furthermore, the averages of post frequency, video running time, views, likes, and comments per video were calculated.

The teams of each channel answered a questionnaire, sent by email, to enhance understanding of the communication strategies used. In the qualitative analysis, the ways SEO techniques were used (thematic classification of the channel, hashtags, terms in the posts titles, among others) were investigated through netnography. Communicational approaches regarding external connections to other social networks (Facebook, Twitter, Instagram, WhatsApp, and Telegram) were examined within the questionnaire responses. The people responsible for the answers are journalists with PhDs; in the case of the INCT-CPCT Scientific dissemination channel, the journalist is a civil servant and has a stable position; in the case of UFPR TV, the journalist has a CLT (consolidated labor laws) contract and does not have a stable position. In total, 17 questions were sent, with no obligation to answer all of them. They were divided into four blocks: 1) about the channel itself (creation demand, editorial line, public communication model of the science adopted, visual identity of the channel); 2) referring to the audio-visual design of the videos (aesthetics of the covers, motivation for the short format, chosen themes, approach to the themes); 3) about the composition of the teams (how many people make up the team, if there are design professionals, journalists, if undergraduate and graduate students participate or if there are other instances of university involvement in the preparation of the videos); and 4) regarding the circulation and contextual impact: feedback analysis, how fake news impacted on content production, if there is use of SEO techniques or semantic web suggestions in the titles and descriptions, how the videos are circulated beyond the YouTube platform, if there is any award linked to the production of the videos, how is the construction of the social presence of science in the virtual environment stemming from the videos perceived. The interviews served to triangulate the findings of the netnographic research case study.

RESULTS AND DISCUSSION

The presentation of the results is divided into two stages: 1) data and analysis of the channels; 2) the respective playlists.

YouTube Channels: INCT-CPCT Scientific dissemination and UFPR TV

Table 1 shows the channels data in the Social Blade metrics. The INCT-CPCT Scientific dissemination channel, linked to Casa Oswaldo Cruz and Fiocruz, received the C+ concept. The new nature of the channel justifies its grade. The UFPR TV channel, from the Federal University of Paraná, received a B- classification. It is an older channel than the first one and has produced more. The INCT-CPCT Scientific dissemination channel is not configured as an educational channel making it difficult to find content in search engines. However, although the UFPR TV channel is designated as such, in the analyzed playlist there was no 'education' or 'educational' hashtag which hinders pairing and optimization in search engines.

Table 1 – Metrics of YouTube channels INCT-CPCT Scientific dissemination and UFPR TV

	INCT-CPCT Scientific dissemination.	**UFPR TV**
Starting date	August 13, 2019	October 10, 2011
No. of subscribers	772	51,4K
No. of views	18,795*	5,890,805*
No. of ***uploads***	95	3,853*
Channel category	Not indicated	Educational
Social Blade classification	C+	B-

* Numbers are written in American format, as provided by YouTube.
Source: Prepared by the authors, based on data from Social Blade (5 Aug. 2021) and from data collected from channel links.

This ranking alone indicates that the SEO techniques used are ineffective across both channels. The better performance of UFPR TV, indicated by the number of subscribers and views, is due to extensive content production (3,853 uploads) and being older, having started approximately eight years earlier than the INCT-CPCT Scientific dissemination channel. The performance of the UFPR TV channel is aligned with the educational audience segment. This alignment does not take place in the INCT-CPCT Scientific dissemination channel. In Figure 1, the audience reach performance is shown by the slope of the line which is similar in both channels and less than 45º. When looking at the text, on the left is the INCT-CPCT Scientific dissemination channel and, on the right, the UFPR TV channel.

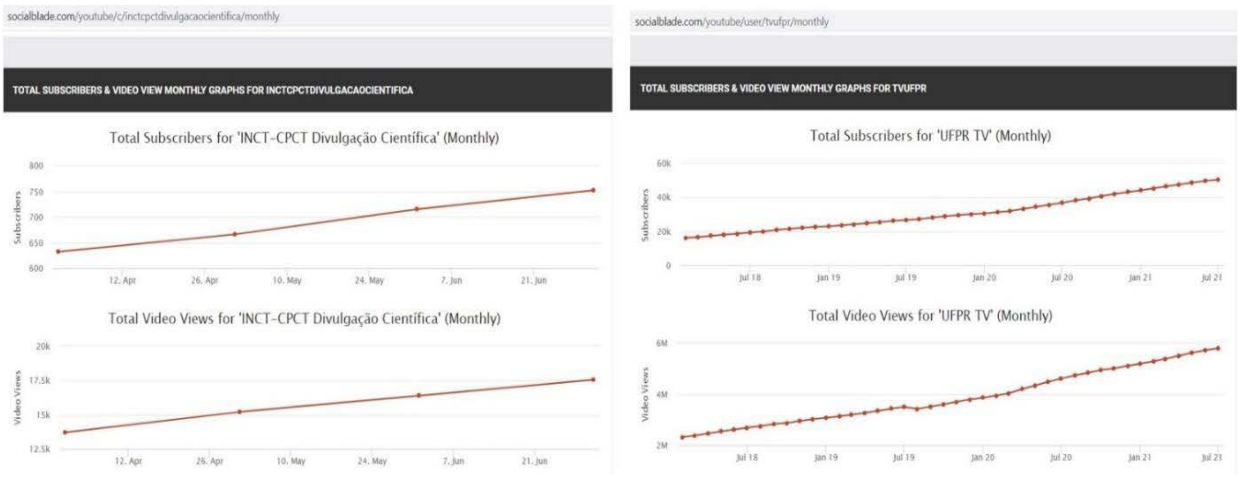

Figure 1 – Comparison by month of subscriptions and views on both channels
Source: Generated by Social Blade (5 Aug. 2021) and placed side by side by the authors.

This angle of less than 45º suggests that there is space for the application of SEO techniques in both channels.

Playlists: The science of scientific dissemination and Amanzing Science

The preference of the two playlists – The science of scientific dissemination (FIOCRUZ, 2020), from the YouTube channel INCT-CPCT Scientific dissemination; and Amanzing Science (UFPR, 2021), from the YouTube channel UFPR TV – for short videos (between 2 and 9 minutes), according to the average presented in Table 2, follows an international trend which began in 2008, with the Three Minute Thesis (3MT) award, from the University of Queensland. However, only Amazing Science is connected to the awarding of theses and dissertations.

Table 2 – Playlists data of each YouTube channel

	INCT-CPCT Scientific dissemination.	**UFPR TV**
No. of playlists	5	26
Playlist analyzed	The science of scientific dissemination	Amazing Science
Starting date	May 20, 2020	March 5, 2020
No. of Uploads	49*	14
Upload frequency	1 × per week (on Wednesdays), with some exceptions where it takes place bi-weekly	Bi-weekly (on Thursdays), with a tendency to upload 1 × per month, from 2021
Average duration/video	6 min. and 30s., excluding a 23 min. long video.	3 min. and 30s.
Average views	Of the 3 most viewed: 610 From the entire playlist: 183	From the total: 272 on average
Average likes	From the top 6 likes: 55 From the entire playlist: 21	From the total: 15 on average, excluding the inaugural video with 162
Average comments	Of the 15 videos that had comments: 4	Of the 11 videos that had comments: 1.6
Average hashtags	3 (included in videos as of August 12, 2020)	3 (included in videos as of February 25, 2021)
Subtitles	In all videos	None
Digital accessibility	There is, but not in all videos	None

Source: prepared by the authors (5 Aug. 2021) and updated with YouTube data (5 Dec. 2021).
*For this data, only videos with standardized covers were considered, in accordance with the playlist.

With only two months of difference between the releases of the two playlists, the production strategies used on the videos are different. The number of videos posted on the INCT-CPCT Scientific dissemination playlist is 3.5 times higher than on the UFPR TV channel playlist. However, the images are of medium quality, and the content is prepared in a declarative way, with a fixed camera. In part, this factor can be explained due to the need for social distancing during the covid-19 pandemic – which forced the conversations to take place remotely.

On the other hand, the low frequency of uploading to UFPR TV's Amanzing Science playlist is due to visual improvements to the video with the use of graphics and archive footage. During the covid-19 pandemic, the Amazing Science team made an instructional video available (LOPEZ, 2020). In this way, the researchers were able to pay more attention to the position of the camera, light and microphone during remote production. The narrative is scripted to give dynamism to the videos, and the montage values artistic aspects. This justifies the lower number of uploads.

It should be noted that both teams have two or three people working on the production of each episode. The average likes and comments show cautious circulation and engagement – with some advances, after embracing the use of hashtags both in the description of videos and in the YouTube post template. In order to define hashtags with greater effectiveness, it would be ideal to understand the semantic web of the topics covered in the videos. However, in both cases this issue is still little improved. The option of subtitles and digital accessibility, such as sign language, is available in all videos on the INCT-CPCT playlist Scientific dissemination. This is highly recommended as an SEO strategy, as this factor expands the audience through social inclusion. This procedure has not yet been adhered to by UFPR TV's playlist Amanzing Science, which chose to insert part of the text as a graphic design to aid explanations of the research.

When calculating average views some unusual exceptions were removed. For example, if the Amazing Science playlist considered the inaugural video (with 4,816 views) the average would rise to 2,544 views, however this data would not reflect the average of the rest of the videos, which stands at around 280 views. The same occurs for the three most viewed videos (20, 21 and 44) of the INCT-CPCT playlist, with an

average of 610 views, while the overall average stands at 183 views. These parameters allow us to identify that both experiment with varied strategies to identify what works or not in the posting and circulation of products. In this regard, there are some limitations to this research on the strategies of each particular video, as more in-depth qualitative research would be required. However, a recent article was published in which more details about the Amazing Science playlist were presented, based on a participatory ethnography (ARAUJO; PIRES; JOHN, 2021).

The two YouTube channels seek to maintain some regularity in their posting doing so on a specific weekday, a highly recommended SEO strategy: in INCT-CPCT's The science of scientific dissemination playlist, the periodicity tends to be weekly, with posting on Wednesdays; in UFPR-TV's Amanzing Science playlist, the periodicity tends to be bi-weekly, on Thursdays. However, at the beginning of the pandemic, production was suspended for a few months.

Qualitative analysis (see Figures 2 and 3) reveals the use of descriptive and unappealing titles for the videos in both cases. This does not stimulate following the link and hinders optimization in search engines. There are differences in other areas, such as, for example, regarding the video covers: the playlist The science of scientific dissemination has more aesthetically pleasing covers, as it uses diverse colors, albeit randomly, as they are not related to colors in the areas of expertise.[6] However, serif fonts have been used which is not recommended for the online environment.

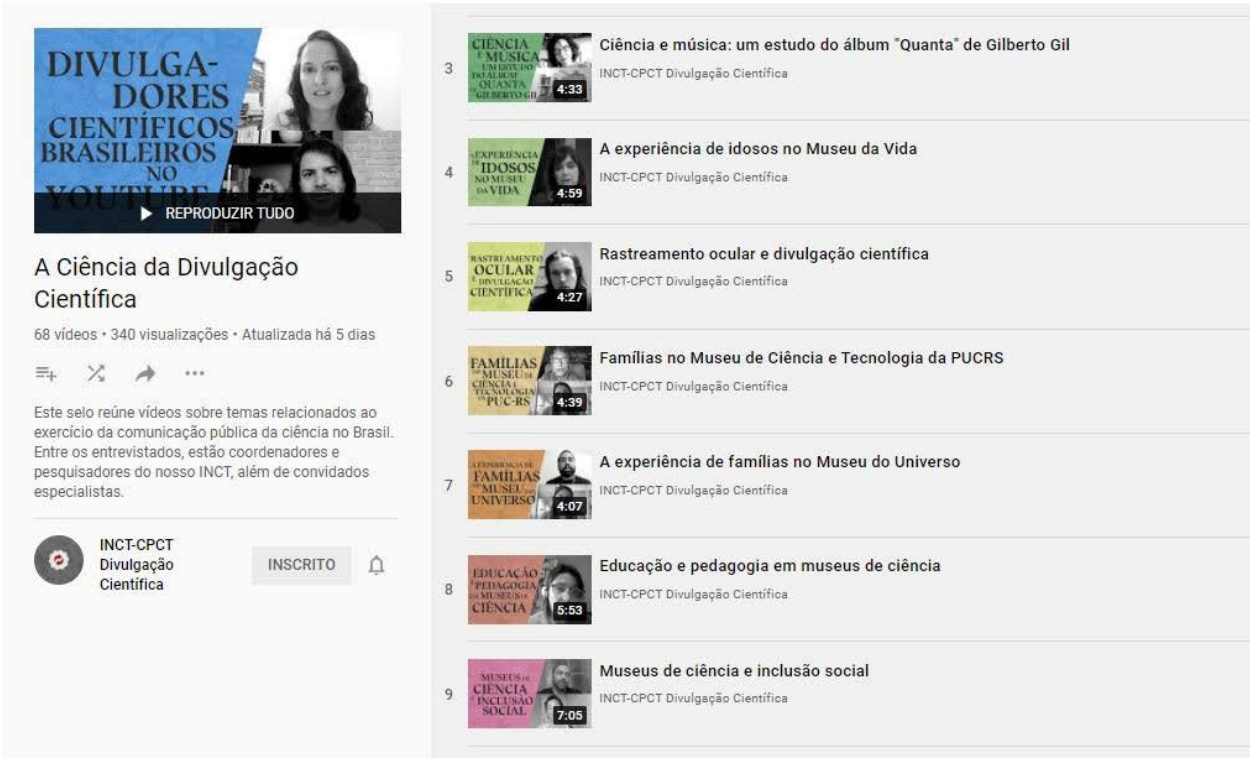

Figure 2 – Aesthetics and titles of videos in the playlist The science of scientific dissemination, from the INCT-CPCT Scientific dissemination channel
Source: Print of the YouTube channel made by the authors.

6 In Brazil, the Conselho Nacional de Desenvolvimento Científico e Tecnológico (National Council for Scientific and Technological Development, CNPq) has developed color classification for areas of knowledge, which are: green for the health sciences and for the biological sciences; blue for the exact and earth sciences and for engineering and technology sciences; and red for the applied social sciences, humanities, linguistics, and arts. However, there is no clear and explicit consensus on this subject, especially if the nine areas of current knowledge defined by Capes or eight areas defined by CNPq (EDUCA+BRASIL, 2019) are considered. This is considered a factor for not explicitly associating color with the area on the covers analyzed.

The covers of the Amazing Science playlist feature a superimposed gray film and a different color for each of them, causing some visual fatigue (see Figure 2). This technique discourages following the link, and although the videos have more aesthetically elaborated narratives with scripted text, the covers do not induce the user to view them.

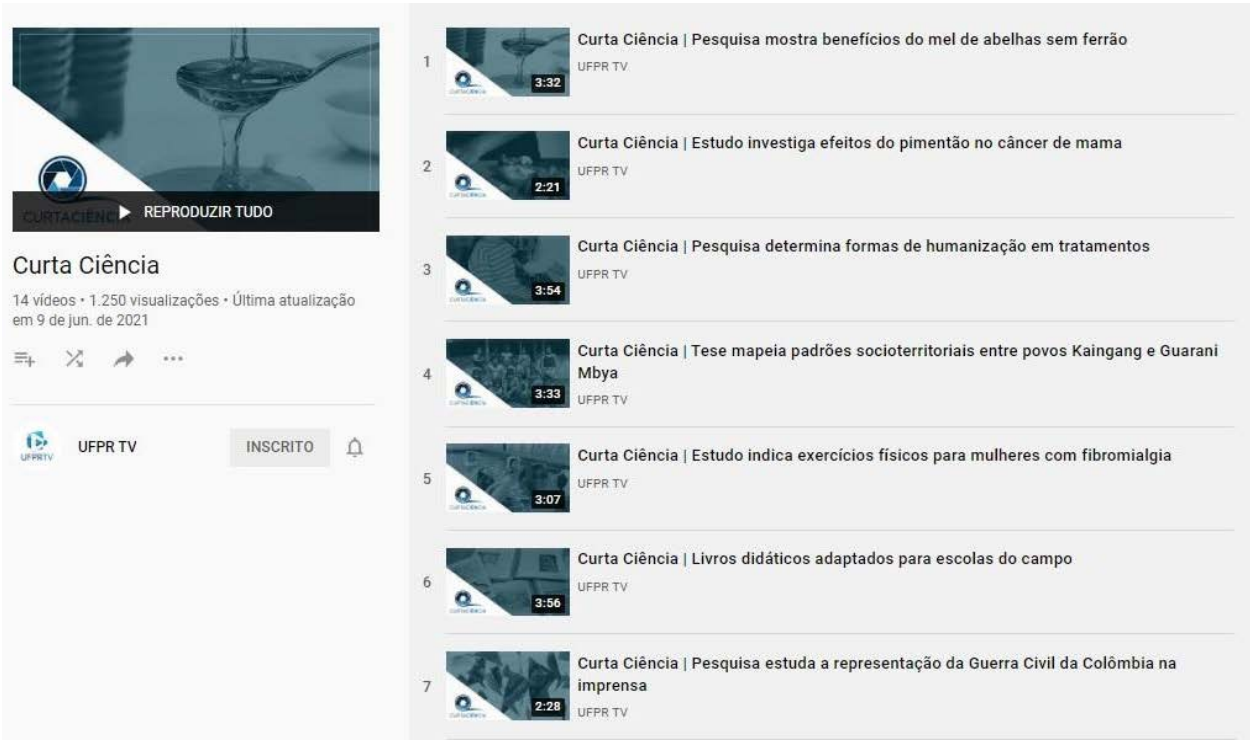

Figure 3 – Aesthetics and titles of videos in the playlist Amazing Science, from the UFPR TV channel
Source: Print of the YouTube channel made by the authors.

In terms of external connections, the INCT-CPCT Scientific dissemination channel confirmed the circulation of videos from the playlist on Facebook, Twitter, Instagram and IGTV. UFPR TV made connections on Facebook and Instagram, and on WhatsApp in a non-institutionalized way. Neither of them circulates content on Telegram or LinkedIn, in an institutionalized way, which is worrying, since these social networks have been widely used in Brazil, either as suggested sources for journalists or for spreading content.

In terms of specific actions related to fake news and the pandemic, the two channels opted for different strategies. On the INCT-CPCT channel, the subject is dealt with in a transversal way within the channel's various playlists. Analyzing the playlist The science of scientific dissemination, 20% of the available videos have words in the title from the semantic web related to the topic. There are 10 videos (1, 12, 13, 24, 25, 27, 28, 44, 49 and 50) with at least two of these related words: infodemic, disinformation, vaccine, controversy, rumors, revolt, checking, facts, health, fake, covid-19, YouTube, epidemic, science, denialism. On the other hand, the strategy adopted by UFPR TV channel was the creation of three specific playlists to deal with coronavirus*:* Coronavirus-Reports, with 24 videos*;* Coronavirus-Communicates, with nine videos; and UFPR Responds-Coronavirus, with 50 videos. While the first strategy focused on the semantic web in relation to fake news, the second preferred the semantic web related to the pandemic and within an exclusive space, to aid the finding of content. Consequently, in the Amazing Science playlist, no video about the pandemic or fake news was found.

FINAL CONSIDERATIONS

The internal aesthetics and the look of the covers, as well as SEO techniques and the semantic web, when worked on in unison, qualify the online social presence of science. However, the strategies adopted by the institutional channels analyzed are still experimental and require greater optimization in both their posting and circulation processes. The article discussed the fundamental role of institutional scientific dissemination on YouTube as a reliable source of information and on the developments in digital social networks, whether public or private, to generate everyday conversations about science. To increase engagement, the authors recommend the use of SEO strategies, regular analysis of metrics by Google Trends, the definition of keywords from the semantic web, as well as the use of other online tools, such as Social Blade.

Expansion of the audience can be improved with the establishment of partnerships with public education at elementary and high school levels, offering partnerships for the circulation of videos by teachers in media literacy and educommunication activities in schools. For the researchers who participate in the videos, minimal training in educommunication is recommended, so that they can understand how the communication process works, as well as understand the dynamics of the online circulation of the content.

The limits of this article are related to the indicators generated by Social Blade and the crossing of data from the tool with the data mined by qualitative research during netnography and interviews. It should be noted that Social Blade does not require in-depth knowledge of algorithmic programming, which facilitates its use by public managers. However, there is no similar tool for the analysis of playlists, which was overcome with the application of the questionnaire and the direct analysis of the channels.

Within the scope of this article, other questions to be explored are suggested, such as the evaluation of the impact on the reception of online scientific dissemination actions in elementary and high school education. Finally, given that there are other instances of audio-visual content use in scientific research i.e. it is not restricted to scientific dissemination alone, this data still needs to be further explored in future research.

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