



The use of social media Instagram by the Recife Botanical Garden's communication team

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ABSTRACT. This article followed the following question: how does Recife Botanical Garden (RBG) use Instagram to communicate with its audience? Thus, the general objective of the work was to investigate how the use of social media Instagram by the RBG team is evidenced. The research adopted a primarily qualitative approach, although it used some percentage data to clarify trends, but nothing that implied the use of sophisticated statistical treatment. It also used the netnographic methodological proposal. A qualitative mapping of the content of RBG's Instagram posts was carried out, from November 24, 2016, to March 15, 2020, when 766 posts and 25,400 followers were counted. All steps were organized, with their respective descriptions, likes, comments and captions. The mapping of RBG posts on Instagram was carried out considering the criteria described by Jarreau, Dahmen and Jones. The analyzes carried out in the present investigation showed that mediation was little observed. However, it should be clarified that this lack of mediation is not exclusive to RBG, they are common difficulties presented by similar institutions. The lack of greater interaction with the public, failing to generate feedback, can be considered a gap in communication. The mediation channel could interact even after the physical or digital visit. It was possible to notice little presence of the human element in the posts. It was noticed that, apparently, the level of engagement presents in the interaction between RBG and its audience through Instagram can improve and reach levels more suited to its institutional mission. In the final considerations, opportunities for improvement in the interaction between JBR and its visiting public are indicated.

Keywords: engagement; critical museology; scientific divulgation.

El uso de las redes sociales Instagram por parte del equipo de comunicación del Jardín Botánico de Recife

RESUMEN. Este artículo siguió a la siguiente pregunta: ¿cómo utiliza el Jardín Botánico de Recife (JBR) Instagram para comunicarse con su audiencia? Así, el objetivo general del trabajo fue investigar cómo se evidencia el uso de las redes sociales Instagram por parte del equipo de JBR. La investigación adoptó un enfoque principalmente cualitativo, aunque utilizó algunos datos porcentuales para aclarar tendencias, pero nada que implique el uso de un tratamiento estadístico sofisticado, también utilizó la propuesta metodológica netnográfica. Se realizó un mapeo cualitativo del contenido de las publicaciones de JBR en Instagram, desde el 24 de noviembre de 2016 al 15 de marzo de 2020, cuando se contaron 766 publicaciones y 25,400 seguidores. Todos los pasos fueron organizados, con sus respectivas descripciones, me gusta, comentarios y leyendas. El mapeo de las publicaciones de JBR en Instagram se realizó considerando los criterios descritos por Jarreau, Dahmen y Jones. Los análisis realizados en la presente investigación mostraron que la mediación fue poco observada. Sin embargo, cabe aclarar que esta falta de mediación no es exclusiva de JBR, son dificultades comunes que presentan instituciones similares. La falta de una mayor interacción con el público, al no generar retroalimentación, puede considerarse una brecha en la comunicación. El canal de mediación podría interactuar incluso después de la visita física o digital. Se pudo notar poca presencia del elemento humano en los postes. Se notó que, aparentemente, el nivel de engagement presente en la interacción entre JBR y su audiencia a través de Instagram puede mejorar y alcanzar niveles más adecuados a su misión institucional. En las consideraciones finales, se indican las oportunidades de mejora en la interacción entre JBR y su público visitante.

Palabras clave: compromiso; museología crítica; divulgación científica.

O uso da mídia social Instagram pela equipe de comunicação do Jardim Botânico do Recife

RESUMO. Este artigo partiu do seguinte questionamento: Como o Jardim Botânico do Recife (JBR) utiliza o *Instagram* para se comunicar com seu público?, e seu objetivo geral foi de investigar como o uso da mídia social *Instagram* é evidenciado pela equipe do JBR. A pesquisa adotou uma abordagem prioritariamente qualitativa, embora tenha utilizado alguns dados percentuais para clarificar tendências, mas nada que implicasse o uso de tratamento estatístico sofisticado, e utilizou a proposta metodológica netnográfica. Realizou-se mapeamento de caráter qualitativo do conteúdo das postagens do *Instagram* do JBR, no período de 24 de novembro de 2016 a 15 de março de 2020, quando foram contabilizadas 766 postagens e 25.400 seguidores. Todas as etapas foram organizadas, com suas respectivas descrições, curtidas, comentários e legendas. O mapeamento das postagens do JBR no *Instagram* foi realizado considerando-se os critérios descritos por Jarreau, Dahmen e Jones. As análises mostraram que a mediação foi pouco observada. Porém, deve-se esclarecer que essa falta de mediação não é exclusiva do JBR, porquanto são dificuldades comuns apresentadas por instituições semelhantes. A falta de mais interação com o público, que deixou de gerar um *feedback*, pode ser considerada uma lacuna na comunicação. O canal de mediação poderia interagir mesmo depois da visita física ou digital. Foi possível perceber pouca presença do elemento humano nas postagens e que, aparentemente, o nível de engajamento presente na interação entre o JBR e seu público, através do *Instagram*, pode melhorar e alcançar níveis mais adequados para sua missão institucional. Nas considerações finais, são indicadas oportunidades de melhorar a interação entre o JBR e seu público visitante.

Palavras-chave: engajamento; museologia crítica; divulgação científica.

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Introduction

To democratize scientific knowledge, existing practices must be rethought. To achieve this, it is necessary to evolve from an exclusive concern with formal learning spaces to a paradigm in which non-formal and informal spaces are valued as privileged locus of learning. While, in the past, scientific learning was seen as related only to rigid curricular structures perpetuated in school environments, nowadays, the importance of exercising it in places such as vegetable gardens and Botanical Gardens and in scientific exhibitions and Science Weeks is recognized. Thematic sciences, for example.

It is easy to understand the fact that learning in non-formal spaces has caught the attention of researchers. In this investigation, we chose to investigate a space (the Recife Botanical Garden) that is accessible to everyone and that meets the requirements of, in the context of Critical Museology, non-formal learning, social responsibility and cultural preservation and dissemination.

The Recife Botanical Garden (JBR) was created in 1979 and is located in the Curado neighborhood, in the city of Recife, in Pernambuco. It has stood out as an important educational and leisure space for the population and has already received a number of visitors that, on average, total more than 100,000 per year. Recently, due to the pandemic, public access was reduced, and this number dropped significantly. However, there is no official data on exact visitation values.

According to Fernandes and Santos (2013, p. 1), “[...] the commitment to doing research is combined with shared, collective and creative work with daily learning about reality”. In this sense, knowledge, products and services originated by Science must no longer be accessible to only a limited public. Society, as a whole, must take ownership of these achievements, most of which are supported by public funding. Fernandes and Santos (2013, p. 2) state that scientific dissemination “[...] fulfills the role of producing the effect of externality of science, since the scientist leaves his place of dialogue legitimized by another scientist to produce dialogues with other non-scientist readers”.

Therefore, with scientific dissemination, knowledge would not only be restricted to knowledge producers, but also present in people's daily lives, with emphasis on a multiplicity of interlocutory relationships produced through written, oral, visual and audiovisual texts (Fernandes & Santos, 2013). In other words, according to the authors, “[...] scientific dissemination is aligned with initiatives to popularize science, by seeking, via the socialization of knowledge, to guarantee democratic access to information for the entire population” (Fernandes & Santos, 2013, p. 2). From a more conceptual point of view, Conceição and Chagas (2020, p. 1) state that

[...] the term 'scientific dissemination' falls within the semantic field of the term Science. Disseminating Science was often related to understanding the individual responsible for producing knowledge and the way of producing it. In other words, Science, the production and dissemination of scientific knowledge make up a tangle of interdependent meanings related to research and the researcher.

JBR has a website (Jardim Botânico do Recife, 2019), through which visitors can obtain various information about its location, opening hours, its themed gardens and details about the multiple activities carried out, whether educational or research activities., dissemination or conservation. JBR also has a Facebook page and an Instagram account. In both cases, there are posts about educational activities, curiosities about nature, articles published in *Revista Arrudea*, among other information.

Scientific dissemination at JBR is also carried out in *Revista Arrudea*, edited and published since 2015. Its Latinized name is a tribute to the Carmelite friar Manuel Arruda Câmara (1752-1810), considered one of the great Brazilian botanists of the late 18th century (*Revista Arrudea*, 2019).

Research developed with an emphasis on scientific dissemination on digital platforms has attracted a lot of attention in the scientific literature, in which the contributions of Castro Manso (2012) stand out, which explores the need to promote more interaction between science and the environment external to it, as a result, among other factors, the emergence of a sharing, globalized and networked society, which aims to overcome historical problems of access to information on everything related to science and technology (S&T); Mateus and Gonçalves (2017), who seek to reflect and identify the relationships between scientific dissemination and discourse, the Internet and other topics related to the popularization of contemporary Science in the Information Age or 'Network Society', in order to highlight its potential for socializing scientific knowledge with the lay public; and Conceição and Chagas (2020), who, in the context of an empirical research regarding researchers and scientific dissemination, concluded that researchers' understandings about Science shape the ways used to produce knowledge and support behaviors related to scientific dissemination. Furthermore, giving visibility to Cyberculture and the context of artificial intelligence, as a space-time for the socialization of knowledge and collective action, contributes to bringing researchers and society closer to science and culture.

In this work, we investigated how the social media Instagram is used by the Recife Botanical Garden and by the visiting public, from the perspective of Critical Museology, from a perspective that values the confluence of cultures and the construction of multiple learning.

The Recife Botanical Garden has not received attention from the so-called traditional media (TV, radio, newspaper, etc.). To fill this gap, the space's social communications team uses digital media support. In this research, it was noticed that Instagram and Facebook were used. However, JBR's use of Facebook was still very incipient and did not show that it could progress. On the other hand, Instagram showed a trend of increasing acceptance by visitors and indicated the path through which interaction was effectively taking place between JBR and its audience. These trends, in fact, still persist, indicating that the most correct option was made when choosing Instagram. In view of the above, the study aimed to understand how JBR (communications team) and the visiting public use the social media Instagram of that space.

The idea of using Instagram followed a contemporary trend, because it is a social network with a great visual focus and which is currently highly valued by cultural institutions, curators and researchers who seek, through this media (and others), reach new audiences. In addition to using a less formal language, close to reality, especially among younger people, Instagram manages to attract the attention of a more heterogeneous audience and promotes more dynamic communication, as it is a tool with which users can share knowledge, search for information through hashtags and 'repost' actions and capturing particular aspects of exhibitions or activities and explaining their own interpretations of the new knowledge and perceptions acquired (Jarreau, Dahmen, & Jones, 2019). In this context, it is clear that the Instagram tool is multifaceted and can bring simultaneous contributions to cultural institutions and their users.

Considering the above, it can be concluded that this study is relevant, because it aligns with current demands that involve non-formal learning spaces, the role of cultural institutions and new communication models. In the context presented, this research aims to answer the following question: How does the Recife Botanical Garden use Instagram to communicate with its audience?

This research was based on these questions: How does the Recife Botanical Garden (JBR) use Instagram to communicate with its audience? How does your audience interact with this media? Can this interaction solve the problem of visitor engagement in relation to JBR? From this perspective, its general objective was to investigate the use of the social media Instagram by the Recife Botanical Garden team. To this end, the following specific objectives were listed: i) Identify, based on the mapping of posts on Instagram, the strategies of

the JBR communication team; ii) Understand how the public engages on JBR's Instagram; and iii) Point out guidelines that could enhance the use of the social media Instagram by the JBR communications team.

Regarding the structure, this article is structured as follows: the next section presents the theoretical foundation of the research on Instagram and how it is used by cultural institutions, considerations about JBR and critical museology and how JBR fits into the context of critical museology. The following section presents the research methodology, the characterization of Instagram and the activities presented in the posts, the instruments used to collect the data, the structuring of the research and the data analysis. Then, the results and discussion are presented. At the end, final considerations about the research and future perspectives are presented.

Theoretical reference

According to Kenski (2018), the term culture has different meanings, depending on the context in which it is considered. However, one of these concepts refers, more broadly, to culture as the sum of knowledge, values and practices experienced by a group at a given time and, not necessarily, the same space. This conception, according to the author, is the meaning expressed to understand the term digital culture. The word digital originated from the Latin term *digitus*. Therefore, digital technologies are those that transmit data through the sequence of numbers 0 and 1 (binary number system). Data (texts, photos, figures, recorded sounds, animations) written in digital language can be quantified and stored or transmitted and decoded.

The term digital, integrated with the term culture, resulted in Digital Culture. This junction is related, as Kenski (2018) describes, to the particular moment in humanity, in which the use of digital means of information and communication expanded. This process began in the last century and, today, permeates broad processes and procedures in all sectors of society. The author also adds that the expression 'Digital Culture' integrates different perspectives linked to incorporation, innovations and advances in knowledge provided by the use of digital technologies and network connections to carry out new types of interaction, communication, sharing and action in society.

The transformations caused by the development of Digital Information and Communication Technologies (TDICs) have been promoting a reconfiguration in the way of being, being and thinking in the most diverse social contexts. In this new process of digital culture, when these technologies become part of people's daily lives, they change habits, customs and their way of dealing with the world. This movement enables substantial changes in the most diverse forms of communication, expression and information and means that TDICs are used for the most diverse purposes. At this juncture, digitalization makes it possible to break the linearity or unilaterality of traditional communication processes. The media, in a reality shaped by TDICs, provide the adoption of different paths based on the technological nature of the media.

Taking this scenario as a reference, we can see that thinking about the process of digitizing contexts does not mean attributing autonomy to TDICs and/or the most diverse media, but in a reality that proposes to social subjects the adoption of a new stance, in which they can go beyond the traditional processes of disseminating information and knowledge and modifying their sociocultural practices.

In the context of Digital Culture, the concept of cyberspace emerges, which Monteiro (2007) defines as a virtual world because it is potentially present and is a deterritorializing space. According to the authors,

[...] this world is not tangible, but it exists in another form, another reality. Cyberspace exists in an undefined, unknown place, full of becoming and possibilities. We cannot even say that cyberspace is present in computers, nor in networks, after all, where is cyberspace? Where does this whole 'world' go when we turn off our computers? It is this fluid character of cyberspace that makes it virtual (Monteiro, 2007, p. 1-2, emphasis added).

This term comes from the English expression cyberspace. The prefix *cyber*, which comes from the Greek, means control. In scientific literature, this term was introduced by physicist Norbert Wiener, in the 1940s, who, according to Monteiro (2007, p. 3), defined cybernetics as the science of control and communication between living beings and machines. From then on, the prefix '*cyber*' started to reference several terms related to the domain of computing and 'intelligent machines' (Cascais, 2001).

Monteiro (2007) explain that, in scientific literature, it is possible to find other definitions of cyberspace. Lévy (2000, p. 92), for example, defines it as a "[...] communication space opened by the global interconnection of computers and computer memories". The author further states:

This definition includes the set of electronic communication systems (including classical radio and telephone network sets), which transmit information from digital sources or intended for digitization. I insist on digital coding,

because it conditions the plastic, fluid and precisely calculable and tractable in real time, hypertextual, interactive and, in short, virtual character of the information that is, it seems to me, the distinctive mark of cyberspace. This new medium has the vocation of synergizing and interfacing all information creation, recording, communication and simulation devices. The prospect of the general digitalization of information will probably make cyberspace humanity's main channel of communication and memory support from the next century onwards (Lévy, 2000, p. 92-93).

Furthermore, as Monteiro (2007, p. 5) comments, Lévy considers that this term "[...]" specifies not only the material infrastructure of digital communication, but also the entire universe of information that it houses, as well as the beings' humans who navigate and feed this universe." For Machado (2019), the action of cultural practices in the global environment, through the mediation of digital technologies, suggests the creation of opportunities for the full experience of digital culture. However, this experience does not imply a new form of culture, but, in fact, how the various existing cultural manifestations now appropriate a new space/scenario, called digital, to express themselves. Agreeing with this reasoning, Cordeiro (2017, p. 1131) argues:

We understand that digital culture results from all those social and human practices that develop from digitalization processes. The moment digital comes into existence and becomes part of practitioners' daily lives, they invent ways of taking advantage of this technology, creating and recreating artifacts, objects, ways of producing, knowing, doing, thinking, relating, generating other techniques and technologies.

In this sense, digital culture is configured as the domain of communication and information through digital technology, providing more interactivity, interconnection and interrelationship between individuals, information and machines. This allows us to perceive it as a representative of a phase of contemporary times permeated by technology, based on the ever-increasing use of technological artifacts and "[...]" marked by the popularity of virtual networks; for connectivity and instantaneity; the growth of personal and institutional websites; by the expansion of social networks and all types of relationships that people have with all of this" (Machado, 2019, p. 26).

From this perspective, it is inferred that the use of TDICs "[...]" is characterized by a reinterpretation of the way of creating content and communicating with a view to media production" (Silva, 2017, p. 63). The media, therefore, subsidizes experiences that favor production, communication and socialization, with increasingly multidimensional and non-linear profiles. This characteristic is due to the complexity of the convergence of being constantly changing, according to how a certain technology is inserted into the culture of a certain group.

The possibility of interactivity in the media is amplified in the context of digital culture and the action of convergence, which signals a reconfiguration in the dynamics based on content senders and receivers. In this context, media users can assume the position of mediators and centralize the flow of content in the interaction itself, in mediation between interacting subjects.

In addition to the perspectives highlighted for using the media in interacting with the public, other objectives such as informal education and engagement with scientific education stand out (Kelly, 2010). However, apparently, museums still use hybrid models, sometimes promoting their activities through so-called traditional media (Bandelli & Konijn, 2013), sometimes using web 2.0 tools. Even so, several authors see this model as an apparent underutilization or inappropriate use of these social networks (Fletcher & Lee, 2012; Lazzeretti, Sartori & Innocenti, 2015).

Some recent studies have investigated the path to establishing channels for visitors to cultural organizations to participate in social media in a more interactive way that encourages engagement. Russo, Watkins, Kelly, and Chan (2008), for example, investigated the effect of social media on museum communication in 2006. This initial research established important knowledge about the desire to participate and the meaning-making experiences that are part of engagement of the public with cultural institutions through social media (Russo et al. 2008). This involvement encouraged museums to cultivate "[...] knowledge sharing networks, in which users share images, information and experiences throughout the entire process" (Russo et al. 2008, p. 28). Furthermore, the results of this research led to questions about the one-way communication pattern (museums - audiences) that had been established by institutions when these media were adopted. From then on, the visitor's communicative power was stimulated as a means of activating the sharing and creation of knowledge. This new framework changed the centrality of authority in the institution, which began to involve, serve and attract communities close to its location.

The results of this new framework were fundamental in transforming thinking, which has extended to current times and has been expanded over the years, due to the increased use of social media by the entire population in general. Much of this is due to the considerable number of portable devices, such as

smartphones and tablets, which became popular, initially, in first world countries and, later, in different nations around the world.

The use of social media in this process brings even more meaning to the ways in which museums interact with their public. Henning (2011), for example, emphasizes the changed role and position of the museum visitor, the museum's relationship with the public, and the way in which technology, history, politics, and economics are intertwined. Henning's (2011) ideas are relevant to this study because of the connections to curiosity and meaning-making that occur through the use of social media platforms.

It is necessary, however, to emphasize that, according to Lemos (2021), what characterizes current digital culture is a tripod formed by the platformization of society, datafication processes and the algorithmic performativity of platforms (PDPA). In this regard, the author makes a criticism by stating that this tripod goes against the ideas of emancipation, freedom and knowledge that were part of the origin of cyberculture. Today, data, information, software and algorithms act in a way that induces the user to take actions that should be free. Among these actions, the systems induce the individual to know, buy and use and interact with them, that is, they place society in a hostage position to digital platforms, especially the Big Five: Google, Amazon, Facebook, Apple and Microsoft (Gafam).

Lemos (2021) defines the current digital culture as a broad algocratic governance system, which manages, through the PDPA, the way in which society transforms as a whole. In this sense, decision-making based on the performance of algorithms through the broad datafication and platformization of society is considered algocracy. Thus, events such as bubbles on social networks, fake news, the wide range of tracking, collection and processing of social life and digital platforms are some examples, according to the author, of the platformization of society.

Digital platforms are a set of hardware and software that, in connection, are capable of generating a structure of products and services that operationalize the monetization of datafication. In this role, the 'seller' and the 'consumer' are connected online in an interaction that not only 'sells' products, but also leisure, entertainment, knowledge, social relationships, among other possibilities in cyberspace. Examples of digital platforms widely used in Brazil are Amazon, YouTube and Meta (which includes Facebook, WhatsApp and Instagram). According to D'Andréa (2020, p. 13),

[...] throughout the 2010s, the so-called Big Five – Alphabet-Google, Amazon, Apple, Facebook and Microsoft – were consolidated as infrastructural services and today increasingly centralize daily and strategic activities. Influences on electoral processes, unrestricted use of personal data for commercial purposes and the use of algorithms and databases to perpetuate prejudices and inequalities are some of the issues that increasingly concern governments, companies and civil society. The revelation, in 2018, of the abusive use of data from Facebook by the company Cambridge Analytica can be seen as a milestone amid a succession of scandals and uncertainties led by online platforms.

Another factor to consider is that, despite this, according to D'Andréa (2020), not all users will appropriate the available functionalities of a digital platform in the same way. There are many possible tactical, playful or political uses on different platforms. Therefore, the author continues, the possibilities and limitations proposed in interfaces and services must be seen in association with the platforms' business models.

Instagram

Instagram was launched in October 2010. The company that developed the application was opened by Kevin Systrom and Mike Krieger, also developers of the software, with an investment of US\$500 thousand raised by Kevin (Vilicic, 2015). Currently, Instagram is part of the Facebook portfolio, which acquired its rights since 2012. In the fight for the market, Instagram had to compete with an application, Vine, owned by Twitter. In 2013, Vine became the leading app for moving images. Reacting to the growth in popularity of Vine, Instagram, in response, added a short video posting feature to its features (Holt, 2013). Comparing the two, while Vine allows recordings of up to 6.5s, Instagram allows up to 60s. Furthermore, Instagram has a feature called IGTV, a video application, through which longer videos (lasting longer than 1 minute) can be produced than those conventionally produced. As an additional advantage, it can be said that videos produced on Instagram are more editable and have dozens of filters that make it possible to improve the quality of the films produced (Velloso, 2013).

Instagram is a tool that can be used by professionals who are behind the preparation of exhibitions and other activities characteristic of contemporary museums that support the digital interaction present in the

objects and exhibitions of museums and the public. Thus, the use of this social media allows the public to interact and engage and, consequently, encourage them to have an experience that also includes learning.

In addition to using a less formal language, close to reality, especially among younger people, Instagram manages to attract the attention of a more heterogeneous audience and promotes more dynamic communication, as it is a tool with which users can share knowledge, search for information through hashtags and 'repost' actions, capture particular aspects of exhibitions or activities and explain one's own interpretations of the new knowledge and perceptions acquired (Jarreau et al., 2019). Thus, it is clear that the Instagram tool is multifaceted and can bring simultaneous contributions to cultural institutions and their users.

The option for Instagram was due to its importance as a way of appropriating the space's expository discourses by the visiting public. In the digital age, communication has taken a dominant direction. Dijck (2008, p. 62-63) observed that some communities now "[...] articulate their identity as social beings by participating in community photographic exchanges that mark their identity as interactive producers and consumers of culture". Instead of being objects of value, photographs are used on social media as ephemeral moments of communication and, mainly, to share experiences (Budge, 2018). Particularly in the case of Instagram, where the image is a primary element, users are able to instantly transform photos captured by their mobile devices into visually appealing images that can be easily shared across available networks.

The images produced by Instagram are compatible with various social media, such as Facebook, Twitter or Flickr. Weilenmann, Hillman and Jungselius (2013) explain that, due to these features, Instagram caught the attention of museums, their employees, curators and researchers. According to the authors, they saw in this device the possibility of reaching new audiences. Furthermore, used in an appropriate context, Instagram can serve as a tool to educate and engage audiences who only occasionally visit museums in person. However, Instagram's dominance over similar media is also due to its ability to adapt to evolving needs. Thus, Instagram allows museums to reach a potentially more differentiated audience compared to other social media platforms (Duggan, 2015), with good visual quality and engaging content.

As is well accepted by the general population, Instagram wields great power and attracts attention from a variety of industries and sectors. For example, Digiday (2016) describes how the use of Instagram drives decision-making in the fashion industry. The strength of the application is largely due to the emergence of visual culture and the screen in cultural life (Evans & Giroux, 2015). The use of social networks, such as Instagram, in this context, is of fundamental importance, as it encourages a new public perspective on non-formal spaces, such as, for example, the Recife Botanical Garden.

Critical museology

The so-called traditional museology saw museums as having functions only to exhibit, educate and store the acquired heritage. After the middle of the 20th century, a movement emerged that conceived the museum as a more open institution, with functions that went beyond those mentioned above (Pineda, 2008). In 1971, ICOM (International Council of Museums) met to discuss the theme 'The museum at the service of man today and tomorrow'. According to Pineda (2008), the traditional functions of museums include social service, with emphasis on the educational nature, and direct participation in the life of the community in which they are immersed. In the following year, in which it became known as the Declaration of Santiago de Chile, the starting point for the so-called New Museology, the museum began to be seen by ICOM as an instrument that must directly serve society and social development (Pineda, 2008).

With this new vision of the functions of museums, these institutions were imbued with returning the ownership of the heritage preserved in museums to its legitimate owner, society (Iniesta, 1994). Therefore, it is necessary to connect the institution, its functionalities and its audience. This trend was strongly prevalent in the 1990s. However, according to Pineda (2008), New Museology suffered attacks from both sides. On the one hand, defenders of traditionalist trends, who oppose the changes advocated by New Museology and, on the other, staunch critics, who view it as a timid trend and demand more significant advances in the evolution of the concept.

It was in this confrontation that a new trend emerged in the United States based on the position of those who demanded a more ambitious transformation in relation to New Museology: Critical Museology. According to Pineda (2008), its defenders promote a museum paradigm that surpasses the institutional space and evolves into a space of confluences of cultures and subcultures in which visitors are seen as learning communities. In opposition to the way museums communicate with their visitors (vertical communication), they argue that they should encourage more critical citizenship and not simply view the visitor as a passive consumer.

Critical Museology or postmuseum implies more intertwined relationships between culture, communication, learning and identity and provides a new way of approaching the audience in museums, seeking equal promotion and a fairer society (Hooper-Greenhill, 2007). Still in this sense, it requires an acceptance that culture works to represent, reproduce and constitute self-identities and that this requires ethical and social responsibility.

Since the beginning of this century, one can notice the effort that museums have made to renew themselves through new ideas and practices, which are being reevaluated, and their philosophies (thoughts) modified (Hooper-Greenhill, 2007). New ideas about culture and society and a new approach to initiatives modernize museums and lead their curators to rethink their proposals and purposes, in order to improve the performance and pedagogical appearance of the cultural facilities they manage.

Furthermore, museums have been protagonists of several projects and achievements that support cultural modernity. In this sense, according to Hooper-Greenhill (2007), it is worth reflecting on the public that interacts in the universe of social media, which confirms the dynamic nature of the relationship between museums and the public and the interaction of the museum collection as necessarily priority elements in the contemporary context. In accordance with this thought, some characteristics of contemporary museums can be summarized, as follows:

- Stop being symbols of repressive and authoritarian institutions and develop an updated identity, thanks to the tendency to provide a meaningful response to the desires of post-modernity. Fluid creative imagination and new design thinking of the museum's identity are the intrinsic characteristics of the postmuseum (Hooper-Greenhill, 2007).

- One of the strengths that shape the emergence of the postmuseum is a more sophisticated complex relationship involving culture, communication, learning and identity, on which the museum's approach to the contemporary public is based (Hooper-Greenhill, 2007).

- Another fundamental element is the promotion of greater social equality, generating an acceptance that culture aims to represent, reproduce and constitute society's self-identity, which requires social and ethical responsibility (Hooper-Greenhill, 2007). As museums have renewed philosophies and practices, they have come to play a central role in society (Hooper-Greenhill, 2007). This can be seen in events such as the so-called 'Cultural Turn'. Society is becoming more aware of the representation of meanings and the power of symbols to carry those meanings, signal identity, and invoke social and cultural alignment. Increased awareness of the culture of empowerment has opened questions about consumption, subjectivity, meaning and identity, active in shaping knowledge.

Through exhibition and interpretation activities, using objects, paintings, photographs, models and texts, museums produce paths for learning, using interpretative processes, which involve attribution of meaning (Hooper-Greenhill, 2007).

Theory and practice in education have undergone intense changes in this century, especially with regard to growing trends in terms of recognition of non-formal learning. Active methodologies, which shift the focus from the teacher to the student, value both face-to-face teaching and distance learning, boost the multidisciplinary character, integrate knowledge and create more reflective learning habits that are very important in this context. As museums do not follow the school curriculum, each of them presents a different view of a specific problem. Therefore, learning in museums is potentially more open, individual, unpredictable and susceptible to interaction needs.

Currently, the concept of 'learning' is not used simply to refer to knowledge or wisdom, but also to learning processes that can occur on different occasions, locations, including online, and in various ways, obtaining different results. In this sense, 'learning' is understood as a multidimensional concept that lasts a lifetime. Evidently, language is extremely important for learning and it is through it that thoughts can be developed and articulated. However, just talking does not mean understanding. For the concept to be complete, there must be learning experiences. It is at this point that, according to several educational theorists, experiential or tacit learning comes into play as a powerful element in the process of knowledge construction.

The Recife Botanical Garden in the context of Critical Museology

At the end of the 18th century, learning in botanical and zoological gardens was described and classified into rational taxonomies, following the binomial method of classifying plants and animals by Linnaeus and Buffon (Hooper-Greenhill, 2007). Because of this, the exhibition collections in Botanical Gardens, for

example, were arranged in such a way that the visuality demonstrated structural principles of each field of disciplinary knowledge. In other words, the fundamental task of the so-called exhibition museum was to transmit the 'truth' of the structures of science, history and art history (Hooper-Greenhill, 2007), and the subject should appropriate not only this knowledge, but also the very logic of your organization at a glance (learning at glance). This perspective of learning in museums, with its emphasis on an abstract view, contrasts sharply with more modern, performative and immersive perspectives, which contemplate visitors' experiences. In the context of Critical Museology, this passive look is no longer acceptable, and communication and interaction must be part of the visitor's experience.

Nowadays, as argued by Parreiras (2003, p. 36), Botanical Gardens perform, in addition to their primary tasks of systematic and scientific study, aiming to preserve biodiversity, "[...] functions in ex situ conservation, mainly of vulnerable or rare species, threatened with extinction or even extinct from the natural environment, and direct their actions towards conservation problems, at the interface between in situ and ex situ conservation". Furthermore, in the context of Critical Museology, these institutions seek to implement strategies and political actions aiming to bring visitors closer and encourage more effective engagement.

In an institution that aims to preserve and educate society about the importance of developing conservation practices and preservation of biological diversity, particularly flora, "[...] implementing conservation strategies implies combining policies, actions and diverse knowledge, as well as in an institutional structuring capable of sustaining this implementation" (Parreiras, 2003, p. 36).

The strengthening of Critical Museology occurred during a period in which the world realized the cause-and-effect relationship "[...] between economic growth and the deterioration of the environment and the depletion of natural resources" (Parreiras, 2003, p. 36). Thus, dialogue with society requires a transformation in the way in which Botanical Gardens exercise their role of scientific education in order to preserve the environment. It is necessary to have feedback on actions and understand how the public engages in actions arising from public policies implemented by the Botanical Gardens which, like other museums, are seeking to respond to considerable changes that have occurred both in their social and educational functions. , such as, for example, an approach to social media, mainly so that they can get closer to the public, especially younger people, digital natives, who identify with digital technologies in the same way that digital immigrants identified with traditional media.

Methodology

The research presents a primarily qualitative approach, although there is an intention to use some percentage data to clarify trends, but nothing that involves the use of sophisticated statistical treatment (Alves-Mazzotti & Gewandsznajder, 2002). As the initial procedure consisted of mapping the posts from the perspective of the Recife Botanical Garden and the visiting public, it is considered pertinent to clarify the option for mapping. The term mapping refers to a concept that initially derives from geographic sciences. It is the "[...] act or effect of delineating geographic space, or transferring, classifying and ordering data based on its spatial distribution in a static way" (Biembengut, 2007, p. 292-293). However, in a dynamic way, as a research methodological principle, it mainly means, according to the author, "[...] understanding the structure and the entities inserted in it, the organization and the representation or map of data in a context" (Biembengut, 2007, pp. 292-293).

In the epistemological sense of research, mapping makes it possible to "[...] establish images of reality and give meaning to various information, capturing relevant characteristics and representing them through intelligible means to those who may be interested" (Biembengut, 2007, p. 294). In this way, the importance of using mapping as a methodological principle for the research developed here is justified. In this study, mapping post trends from the perspective of the Recife Botanical Garden and the visiting public is not simply collecting data, but also carrying out a survey with an emphasis on understanding and representing this data, aiming to make it a reference matrix to obtain relevant information associated with our proposal.

In addition to using mapping as a methodological principle, this research was also carried out based on a methodological path classified in the context of descriptive research (Alves-Mazzotti & Gewandsznajder, 2002), since the type of posts made on JBR's Instagram were described by the space's communications team and the visiting public. It is also based on the netnographic methodological proposal. Kozinets (2002) defines netnography (virtual ethnography or online ethnography) as a research method derived from the ethnographic technique developed in the field of Anthropology. According to Christine Hine (2005),

netnography is a scientific methodology used to observe communities present on the internet, regarding their influence on the lives of their members. However, according to Ferro (2015), just as the ethnographer is not “simply a voyeur or a disengaged observer, but rather an active participant, who shares some of the concerns, emotions and commitments of the researched subjects”, the netnographer researcher must also follow this guidance.

The approach used in this investigation is netnographic in nature and comes from the fact that observations in the virtual environment were used as a methodological component, demonstrating the relevance of appreciating cyberspace. Rocha and Montardo (2005) justify this possibility by saying that, due to the deterritorialized nature of cyberspace, the netnographic approach is an accessible way of carrying out participant observation at a distance.

The mapping of JBR posts on Instagram was carried out considering the criteria described by Jarreau et al. (2019), as can be seen in the infographic (Figure 1).

The images posted by the JBR communications team were selected and captured in seven moments. In the first, a qualitative mapping of the content (textual and visual) of JBR's Instagram posts was carried out, from November 24, 2016 (date of the first posts) to March 15, 2020, when 766 were counted. posts and 25,400 followers. All stages were organized, along with their respective descriptions, likes, comments and captions, which gave rise to image notebooks with the following categorizations: i) educational activities; ii) scientific contents; iii) sustainability; iv) articles from JBR Revista; v) commemorative day of each profession and/or other commemoration; vi) human elements; and vii) visiting public according to the layout (Figure 1).

To conclude, we investigated how the visiting public engages with posts made by the JBR communications team and on the space's social media, based on JBR's tagging in posts made on personal accounts. It is expected, from these two routes, to understand the process of engagement of the visiting public.

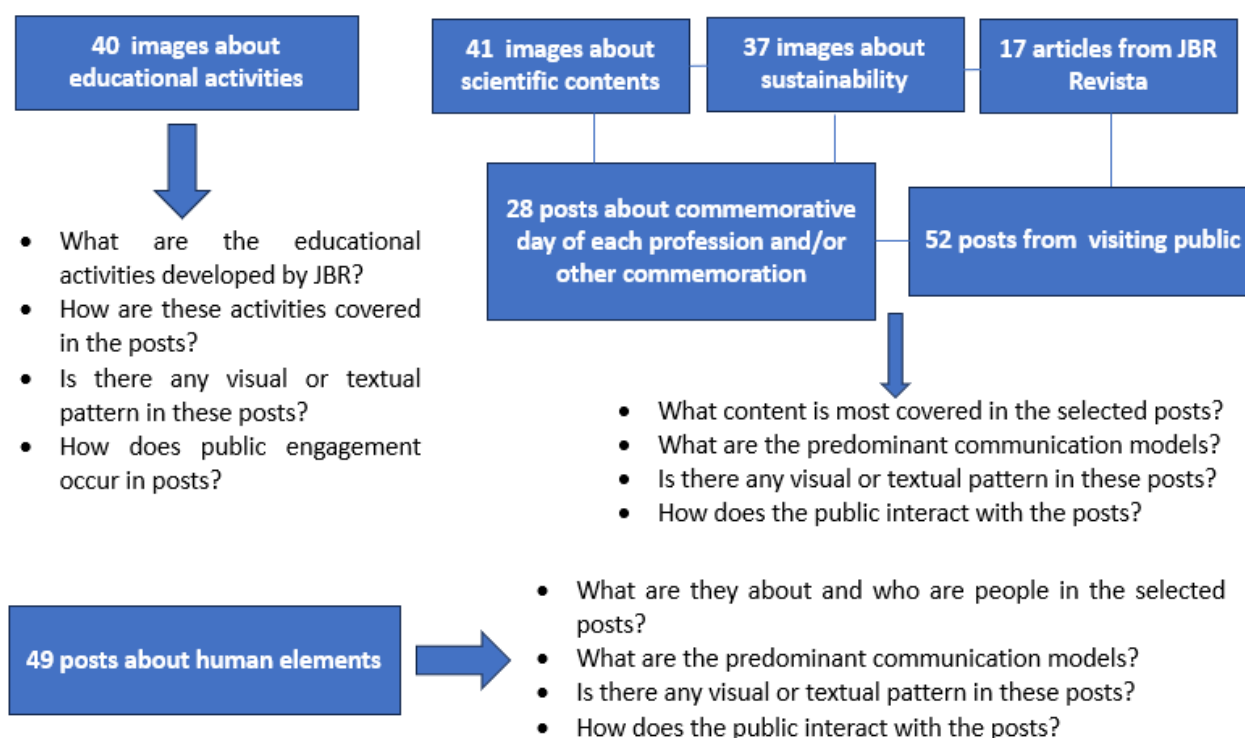


Figure 1. Schematization of the stages of mapping the methodological design.

Source: Prepared by the authors (2020).

Research context

Currently, Recife Botanical Garden's Instagram has 25,400 followers, whose interest is concentrated in just 264 of the 766 publications posted. Unfortunately, at the moment (July 2020), you can read, on the official profile of the Recife Botanical Garden, that it is closed due to the COVID 19 pandemic.

The new feature that appeared on Instagram consisted of allowing the public to highlight photos and videos published in stories (called Highlight), as they are only visible for 24 hours. Highlights give JBR's audience the opportunity to review stories and extend the length of the video.

On the profile of the Recife Botanical Garden, there is a diversity of posts, such as, for example, dissemination of educational activities (workshops, experiences and experiences), environmental awareness posts, content of specific scientific specimens and dissemination of articles from the JBR network. You can also see posts listing curiosities about sustainable development, specific days of celebration, local publications such as calls to the public and alerts to courses offered.

The communications team at the Recife Botanical Garden, in the historical context in which this investigation was carried out, only had two journalists. In their activities on the various information and communication platforms, they work with the aim of promoting the institution's communication in an ethical, transparent and safe manner, to guarantee a good image of JBR with credible information and, at the same time, promote and stimulate the visit and enjoyment of the JBR and the activities it provides to the population of Recife and its visitors.

Instruments for data collection

According to Oliveira (2011, p. 43, emphasis added), “[...] to collect data, it is necessary to select appropriate instruments that meet the requirements of ‘validity’, ‘reliability’ and ‘accuracy’”. From this perspective, image selection and capture should be the most appropriate instruments for collecting data. Table 1 specifies the instruments used in each stage of the research. In accordance with the specific objectives of this research, it points out the necessary path to identify the strategies that the Botanical Garden communication team uses in its posts and how the public engages.

Table 1. Instruments for data collection.

Specific research objectives	Instruments for data collection
Carry out a mapping of the posts published by the communication team of the Recife Botanical Garden on <i>Instagram</i> .	Mapping of the <i>Botanical Garden's</i> Instagram posts from the selection and capture of images by the communication team.
Investigate how the public engages the Recife Botanical Garden's posts on <i>Instagram</i> .	Mapping of <i>the</i> Botanical Garden's Instagram posts through the selection and capture of images posted by the visiting public to better understand their engagement.
Indicate guidelines that could improve the use of Instagram social media by the communication team of the Recife Botanical Garden.	Mapping of <i>the</i> Botanical Garden's Instagram posts through the selection and capture of images posted by the communication team and the visiting public to better understand their engagement.

Source: Prepared by the authors (2020).

Once the most appropriate instruments to collect the data were chosen, in these six stages, the selection and capture of images were adopted from November 24, 2016 (date of the first posts) until the suspension of activities, which occurred due to of the new coronavirus pandemic, in March 2020. This stage was during a period in which the aim was to have a more general view of the data in the context of the investigation and to get to know the posts with their respective content, such as educational activities, specific content, questions about sustainability, commemorative days, human elements and/or items from the Recife Botanical Garden.

After choosing the most appropriate instruments to collect the data, the seventh stage of the research consisted of selecting and capturing images from November 24, 2016 (date of the first posts) until the suspension of activities, due to the new coronavirus pandemic in March 2020. This stage was during a period in which the investigation made it possible to discover the posts that the visiting public made by marking the Recife Botanical Garden's Instagram profile.

Procedure for processing and analyzing data

Jarreau et al. (2019) recognized the importance of using Instagram in non-formal learning spaces in promoting scientific literacy, but realized that there was still a certain distance between the information that can be transmitted to the visiting public and what they actually assimilated. To do this, they studied a way of analyzing the space's posts in order to understand how the visiting public interacts with the posts in order to evaluate the engagement of this public. This is a way to get coherent feedback on public engagement.

The proposed idea is that Instagram is also seen as an environment that can bring the public closer to science, and researchers can, in some way, evaluate the public's engagement in this regard. Thus, Jarreau et al. (2019) presented criteria that will be used in this research. Table 2 presents the criteria they established to analyze Instagram posts.

Initially, the variables proposed by Jarreau et al. were considered. (2019) to analyze the images posted on JBR's Instagram, although other variables may eventually be necessary. Tables 3 and 4 explain the variables used in the mappings carried out.

To analyze engagement between the public and the institution (JBR), we initially considered what Marandino et al. (2018, p. 9) call it an interaction indicator, which “[...] makes it possible to identify the modes and formats of public interaction with actions, seeking to understand the potential of interactions from a physical, aesthetic-affective and cognitive skills to promote Scientific Literacy (CA)”.

Marandino et al. (2018) present three types of interaction that can be included in an engagement measure: physical, aesthetic-affective and cognitive. Along these lines, physical interaction is characterized by the possibility of touching and manipulating the public (hands-on), basically through the action of “[...] knowing and experiencing scientific phenomena through demonstration and experimentation” (Marandino et al., 2018, p. 9). However, the authors criticize this interactivity, mainly due to the fact that it can lead to 'experimentalist reductionism' and become a simple mechanical manipulation, devoid of meaning in the context of CA, and leave aside educational objectives that aim to implement the cognitive (minds-on) and aesthetic-affective (hearts-on) interactions.

Table 2. Criteria proposed by Jarreau et al. (2019).

Visual Content Variables	Instagram posts were coded on a variety of content variables. The posts in the final sample were coded for presence (as the primary or an important aspect of the visual) of a number of content elements that emerged as common elements/themes in an initial coding of over 100 test images. These included (a) a completed museum exhibit or part of the exhibit on display in a museum, behind the scenes of (b) museum research, curation, collections work (e.g. visuals of scientific research in progress), or (c) museum activities NOT related to research, curation or collections, (d) a science demonstration or hands-on science activity involving museum visitors, (e) other museum activity, (f) identified or (g) unidentified scientific specimen(s) or natural object(s), and (h) a (scientific) technology. Posts were also coded on content variables including primary scientific topic or field of science portrayed, and setting.
Instagram post communication approach variables	Based on the overall appeal of an Instagram post, coders designated the extent to which each post (including both the visual and caption) contained content characterized by the following communication approaches: 1) Informational (educates and/or spreads scientific information or facts), 2) Entertainment-driven (entertaining in nature), 3) Promotional (promotes a museum exhibit, facility, activity, etc.), 4) Mobilizing (content that calls to action). Each post was coded as being dominated, somewhat dominated or not at all dominated by each of the above approaches.
Format Variable	Instagram posts were coded on format variables including color (color or black and white) and type of visual. Other format variables included the scale of the visual (normal or what the human eye could see, microscope-scale, telescope-scale, or a mix) and the distance to the primary subject in the visual (extreme close-up, close-up, full shot, landscape, or a mix).
Caption variables	Posts were coded on presence of hashtag and type of hashtag variables. Coders noted whether post hashtags were science-related or not, museum or campaign branded or not, and inspirational/comical or not. Finally, the captions were coded on scientific content, e.g., whether or not they contained substantial scientific content, operationalized as more than just a one-liner description of the content of the visual.
Source variables	Instagram visuals were coded as either published directly by the museum or re-posted from another Instagram account. If re-posted from another account, the posts were coded on account source (a museum visitor, a museum staff member, a science professional, or other).
Popularity variables	Instagram posts were coded on popularity variables evaluated at the time of coding. These variables included number of likes (for photos) or views (for videos), and number of comments for all posts.
Research communication and Science as a process variables	Posts were also coded for whether they presented information related to a new (within the last year) research finding or discovery, and whether or not they depicted science as a process versus a product.
Public engagement with science	Posts were coded for whether they depicted meaningful public engagement with science. This variable was operationalized as non-scientists talking to scientists, engaging in hands-on / citizen science activities or meaningfully interacting with science via museum exhibits. Visuals that depicted museum visitors as passive viewers of exhibits, that depicted visitors engaging in fun activities only loosely connected with scientific discovery, or that did not include any human elements, were coded as not depicting public engagement with science.
Instagram post appeal variable	Instagram posts were coded on both tonality (positive, negative or neutral) and overall emotional appeal (wonder/awe/excitement, humor/funny, anger, anxiety/fear, sadness, nostalgia, no emotional appeal or other), taking into account both aspects of the post visuals as well as captions.
Human element and portrayal of scientists variables	Instagram posts were coded on presence of a human element and type of human element portrayed. If at least one individual was portrayed in the visual, coders designated whether or not the post portrayed individuals identified or clearly depicted as science professionals, historical science figures, other museum staff/volunteers, children, news media professionals, celebrities, policymakers/public figures and/or technicians/IT. If the post

portrayed any science professionals, coders designated the gender and race of each science professional when identifiable, and coded the context in which the science professional(s) were shown, e.g., either a research context, other professional context (giving a science talk, doing non-research museum work, etc.), a private context (engaging in hobbies or private matters, etc.), or other context.

Source: Created based on Jarreau et al. (2019).

Table 3. Criteria for analyzing educational activities.

Visual Content Variables	i) Activities that contemplate the JBR in general or only specific parts or collections; ii) activities and workshops of a practical and concrete nature aimed at the construction and manipulation of objects; iii) experiential activities or workshops; iv) activities and workshops related to the research developed at JBR and are not related to curatorial work or collections; v) activities related to curatorial work and collections; and vi) activities and workshops related to specific scientific specimens.
Instagram post communication approach variables	i) Informative (instructs and/or disseminates scientific information or facts); ii) Entertainment (nature for being fun); iii) Promotional (promotes a museum exhibition, facility, activity, etc.; and iv) Mobilization (content that calls to action).
Format Variable	i) Visual type (font, color, layout); and ii) distance from the primary object in the visual (extreme close-up, close-up, full shot, landscape, or a mix).
Engagement variables	i) The <i>Instagram</i> posts were also coded considering the popular elements, the number of likes (per photos) and the comments on the posts.
Caption variables	i) The coders looked at whether the <i>hashtags</i> of the posts were science-related or not, museum or campaign branded or unbranded, and inspirational/comedic or not, and the captions were hardcoded into scientific content to know whether or not they contained substantial scientific content, operationalized as more than just a line of description of the visual's content.

Source: Prepared by the authors (2019).

Table 4. The analysis criteria related to specific content, sustainability, JBR articles, specific days of each celebration, human elements and visiting public.

Visual Content Variables	i) Content that includes specific scientific collections or specimens; ii) contents of research carried out at JBR; iii) contents of research not developed in the JBR; (iv) scientific demonstration, process or activity; and v) the area of science to which the scientific content belongs.
Instagram post communication approach variables	i) Informative (instructs and/or disseminates scientific information or facts); ii) Entertainment (nature for being fun); iii) Promotional (promotes a museum exhibition, facility, activity, etc.; and iv) Mobilization (content that calls to action).
Format Variable	i) Visual type (font, color, layout); and ii) distance from the primary object in the visual (extreme close-up, close-up, full shot, landscape, or a mix).
Engagement variables	i) The <i>Instagram</i> posts were also coded considering the popular elements, the number of likes (per photos) and the comments on the posts.
Caption variables	i) The coders looked at whether the <i>hashtags</i> of the posts were science-related or not, museum or campaign branded or unbranded, and inspirational/comedic or not, and the captions were hardcoded into scientific content to know whether or not they contained substantial scientific content, operationalized as more than just a line of description of the visual's content.

Source: Prepared by the authors (2019).

Results and discussion

Analysis of mappings of educational activities

In general terms, a great diversity of educational activities proposed by JBR was observed. Some tend to occur regularly throughout the week, and others are restricted to weekends and can be experienced without prior scheduling, covering the visiting public who go to the place for visitation or leisure. There are also specific activities for school holidays and weekends, when the number of visitors increases, and the possibility of making appointments during the week for specific groups, whether school or not.

A section of the multiple educational activities offered by JBR is presented, accompanied by their respective image, description, likes, comments and captions from the public related to each post, as well as a number. The posts were organized according to the criteria of visual content, communicational approach, format, popularity and caption variables.

Educational Storytelling activities and a Literary Creation workshop can be seen, which share elements of language (spoken or written) to address themes related to the JBR universe; others aim to integrate sport and environmental awareness and a more accurate look at specific specimens, whether local flora or fauna. There are activities, also present in the posts, that explicitly involve walks, which can cover the entire JB, specific collections and which develop from a more playful and experiential perspective.

Some activities represent the group of workshops of a practical and concrete nature that aim at the construction and manipulation of objects, such as artistic workshops (woodcuts, stamps), use of PET bottles, musical workshops, cooking workshops and construction of toys and objects with solid waste. They are occasionally developed in conjunction with other activities. As seen in studies by Nascimento, Arruda and Santos (2017), this association produces positive results and can be considered a positive point in interaction with the public.

There are workshops that involve the concrete manipulation of specimens, aimed at a more adult audience. The posts refer to workshops aimed at the management of medicinal plants and the production of herbal medicines, covering aspects of research developed or under development at JBR.

Considering the communicational approach criterion, which makes it possible to infer how educational activities are approached in Instagram posts, the focus that predominates in the images is promotional, which consists of publicizing the activity, signaling the date and time. The subtitles have a diverse perspective. In addition to the promotional bias, which was already expected, there is an entertainment nature. In this way, educational activities in a promotional and entertainment form at the Recife Botanical Garden come as a way of popularizing and valuing the space, to awaken a critical look at environmental issues in a playful way (Vendrasco, Cerati & Rabinovici, 2013). The perspective of mobilization is not observed, when there is an invitation to action and engagement in different actions. In Figure 2, only a small sample of the cut is presented.



Figure 2. Mapping of JBR's educational activities (some examples): (a) promotional communication variable, showing, through narration, how it is possible to take care of the forest and animals using the character from Brazilian folklore; (b) This post stands out in popularity, with a large number of likes; (c) communicational variable that is also promotional, showing planting and cultivation techniques necessary to create a vegetable garden at home; (d) format variable.

In relation to the third question, which deals with the textual or image patterns of the posts, the criterion of the format variable is used, which can be perceived based on the type of photo (visual distance from the primary object) and the type of visual (letter, color), as described in the methodology.

As for the type of photo, hiking posts usually feature images of a section of the forest, some with human elements, others without. In the photos of the workshops, two main patterns are seen: photos with groups of people involved in carrying out the activity or presenting the productions carried out and close-up photos of specific elements of the workshops.

Regarding the type of visual of the posts, it is observed that, in most images, there is an overlay of digital lettering in white, highlighting the title of the educational activity (in larger size) and the date and time of its realization (in smaller size). The visual type of images can communicate what words cannot describe, such as emotions. This approach produces narratives to describe existing connections between individuals and mediation with the social media Instagram (Serafinelli, 2017).

The engagement variable was analyzed based on the number of likes (per photos) and comments that address educational activities in the selected posts. It was also noticed that the comments on the posts demonstrate curiosity about the information shared. Furthermore, in many posts, there were suggestions from many visitors for other people to participate in the activities (who marked the activity in their comments).

Despite the potential of Instagram for an online network, public engagement and the public visibility of scientists, it is highlighted, in most posts about educational activities on JBR's Instagram profile, that he uses Instagram to promote his exhibitions and public-facing activities and lack of opportunities to raise awareness about the inner workings of the Recife Botanical Garden (Jarreau et al., 2019). This corroborates the studies by Fletcher and Lee (2012) and Lazzeretti et al. (2015), according to which museums are using social media tools for promotional messages, but in a traditional unilateral way.

In general, the comments on educational activities are dense and with a lot of public interaction in the posts. It is also noted that some comments received feedback from the JBR social communications team, which was seen as something close to a dialogue. Finally, it is worth highlighting how important this interaction between the communications team and the public is.

The blocks address the caption variables, in which the hashtags of posts related to science or not, museum or campaign, branded or unbranded and inspirational/comical or not were observed. Captions were coded for scientific content to determine whether or not they contained substantial scientific content. In this sense, hashtags related to educational activities (fun, nature, environmental education, creativity, cardboard and children) stood out.

Analysis of specific content mappings

A reasonable variety of specific content was found in the posts made by the JBR communications team. A section of the content covered in the published posts is presented, including the image and description related to each post, as well as its numbering, number of likes, comments and captions that can be understood as public engagement with the content. disclosed. Figure 3 shows a small section of this picture.



Figure 3. Mapping of JBR's specific contents (some examples): (a) format variable, characterized by extreme close-up; (b) post that became popular with a large number of likes; (c) informative communication variable, in which the dissemination of information predominates; (d) caption variable, with emphasis on the visual aspect.

In the posts, most are related to the area of Botany, followed by the areas of Zoology and Mycology. The specific contents essentially deal with fauna, flora, biodiversity and ecological relationships. Information is presented on the scientific names of the species, the families to which they belong, morphological descriptions, geographic origin, various uses and functions in their respective habitats. Furthermore, the informative communicational approach predominates, that is, it instructs and/or disseminates information

or scientific facts. As for the format variable, which can be seen in the type of photo and visual, as mentioned in the methodology, it is noted that, in general, posts related to specific content are composed of close-up photos, extreme close-up and landscapes.

Considering the type of visual of the posts, it is observed that, in the three images, a white digital lettering is superimposed, in which the title of the specific content stands out (in larger size) and a seal with a background white and black letter, in the middle of the photo, which indicates the type of content.

The engagement variable was analyzed based on the number of likes (per photos) and comments, looking at the specific content in the selected posts. The post that stood out was the one with 400 likes, and the one with the fewest likes had 71. Regarding comments on specific content, many posts stood out. Generally speaking, comments on specific content are scarce. At no point are there comments from the public accompanied by feedback from JBR, in the sense of what would be seen as something close to a dialogue. Thus, posts gain more popularity much more because of the beauty of the photos than because of the content linked to them. However, despite the high popularity, the low frequency of comments does not characterize real engagement.

In posts related to scientific content, hashtags stood out (passion fruit, pollination, passionflower, bromeliad and pau flower).

Analysis of mappings on curiosities about sustainability and nature

The group of posts grouped in this section was separated from those in which only the content was distinguished because, despite being also specific, they are presented in a different format. In addition to the informative focus, these posts encourage engagement, because they present an invitation to action, in an approach that encourages responsibility in environmental issues. In this sense, they not only inform, but also mobilize the public towards ecologically responsible actions.

A selection of the multiple posts on environmental issues that aim to raise awareness among the visiting public through the work of the JBR communications team is presented. The posts were organized according to the visual content criterion, with the number of likes, comments and caption variables that can be understood as public engagement in relation to the published content. The color blocks signal the grouping of posts that share the same content. In Figure 4, a small section stands out.



Figure 4. Mapping about sustainability and nature (some examples). This is an approach that aims to raise awareness, invite action and mobilize the public in relation to environmental issues: (a) engagement variable: this post stood out in popularity, with a large number of likes; (b) caption variable guiding security measures; (c) informative communication variable, in which the dissemination of information predominates; (d) format variable, in which the visual aspect of the photo (visual distance from the primary object) and the type of visual (letter, color) stand out.

During the image selection and capture process, it was possible to distinguish posts related to concepts linked to sustainability. The JBR team's intention with these posts is to instruct the public, so that they can expand their knowledge about the proposed concepts and build their knowledge based on the directions given by the posts. This is a way of putting knowledge into practice, when visiting the place, and enabling theory to be supported by practice, improving your learning, with the perspective of taking the protagonist's place in the process.

In the posts, it was clear that there was an intention to show information about the concept of green consumers and the importance of this stance for our planet and the presence of trees in cities, how a tree could be requested to be listed and this procedure would be carried out. There is also an awareness of the need to follow rules, such as turning off the tap when not using it, when taking a shower and not leaving the shower running straight on, in other words, creating sustainable habits to preserve nature.

There is also talk about the importance of reducing the consumption of meat and products of animal origin, the limits of noise emission permitted on public roads and values relating to fines applied to people in cases where they exceed these limits are presented, encouraging conscious consumption and awareness of a conscious life and precaution against possible risks. Also highlighted are posts that question plastic consumption and encourage the use of renewable energy and environmental preservation.

It can be concluded that, with these actions, JBR takes action to become not just a physical place, but to become an environment in which the teaching and learning process takes place and thereby disseminates collaborative information, virtually improving accessibility. The literature reports that in a post-sustainability period, ecological systems are changing to dystopian scenarios, and the ecological footprint must be minimized (Jickling & Sterling, 2017; Santana, Pereira & Silva, 2020; Santana, Silva & Lima, 2021).

As already highlighted, the approach used in the posts presented constitutes a perspective beyond the informational, as they seek to raise awareness, invite action and mobilize the public in relation to environmental issues. In this way, they are linked to public engagement. As for the textual or image patterns of the posts, the criterion of the format variable is used, which can be perceived based on the type of photo (visual distance from the primary object) and the type of visual (letter, color), as mentioned in methodology.

Regarding the type of photo, the study showed that the posts usually contain images with extreme close-up along with some information about the content. In most images, digital lettering in different colors is superimposed on the posts, highlighting the title of the content (in larger size) and the information (in smaller size) with a background of another color.

The engagement variable was analyzed based on the number of likes (per photos) and comments, focusing on environmental issues in the selected posts. The post that stood out had 587 likes, but only two comments were made about the photo about the content. The post that had the fewest likes had 50 and no comments were made about it.

In some posts, there was interaction, but not enough for greater engagement, and the caption variables are addressed. Hashtags were observed in Instagram posts that encourage the public to become aware of the need to follow rules that result in a sustainable life. For Jarreau et al. (2019), Instagram is an ideal platform to launch visual campaigns with the aim of humanizing the media -using public, such as the #JulhoSemPlástico movement, guided by awareness and reducing the ecological footprint (Hoekstra, 2009; Wackernagel & Beyers, 2019; Galli et al., 2020). This is an opportunity for JBR to be empowered in scientific dissemination related to socio-environmental issues.

According to Barros and Sousa Júnior (2012, p. 11), "[...] social networks on the Internet are channels for disseminating different services and products, as they find a diverse audience". In the opinion of these authors, social networks, such as Instagram, present a great prospect of inserting scientific dissemination and increasing interaction between the academic world and society. However, they advise that, to obtain results and achieve specific objectives with the use of social networks for scientific dissemination, one must consider the audience they want to reach and which tools to use.

Analysis of mappings on the publications of JBR articles in Instagram posts

In this mapping, a reasonable variety of articles from the JBR Revista was observed in the posts made by the JBR communications team. A selection of the multiple posts on content covering specific scientific collections or specimens is presented; contents of research carried out at JBR and research not carried out at JBR; scientific demonstration, process or activity; and area of science to which the specific scientific content

belongs, according to the methodology. The posts were organized according to the criteria of visual content, communicational approach, format, popularity and caption variables. Figure 5 shows a small section of this picture.



Figure 5. Mapping of JBR articles (some examples): (a) engagement variable; this post stood out in popularity, with a large number of likes; (b) informative communication variable, in which the dissemination of information predominates; (c) caption variable; (d) format variable.

Posts related to content covering specific scientific collections or specimens, research content not developed at JBR and demonstration, process or scientific activity were identified. In the analysis, it was possible to differentiate them from posts about the contents of research carried out on JBR.

From the results presented, it was observed that the majority of posts are related to the area of Botany, followed by the areas of Zoology, Mycology, Microbiology and Biochemistry. The specific contents essentially deal with fauna, flora, biodiversity and ecological relationships and information is presented on the scientific names of the species, families to which they belong, morphological descriptions, geographic origin, various uses and functions in their respective habitats.

The communicational focus that prevailed in the posts was informative. The informative perspective was identified in almost all captions. As for the textual or image patterns of the posts, we used the criterion of the format variable, which can be perceived in the type of photo (visual distance from the primary object) and visual (letter, color), as referred to in the methodology, standing out the posts as close-up. Regarding the type of photo, the study showed that the posts usually contained images with extreme close-up and some information about the proposed content. In most of the images, green digital lettering is superimposed on the posts, highlighting the title of the content (in larger size) and the information (in smaller size) with a white background and drawn details.

The engagement variable was analyzed based on the number of likes (per photos) and comments on the content exposed above in the selected posts. The posts that stood out with the most likes had 77, and the one that had the fewest likes had 21.

In the comments made on the posts, it was noted that the public was only interested in some information, such as, for example, the quality, how it is published, whether only the Recife Botanical Garden staff could publish it, that is, nothing about it. the content of the articles. There was little interaction and it was not enough to identify engagement.

Posts that address lichens as bioindicators of air quality and the production of *Xylopiia frutescens* Aubl seedlings stood out.

Analysis of mappings on posts on commemorative dates

In this mapping, a variety of posts about commemorative days made by the JBR communications team were observed. A section of these events is presented in the published posts, including the image and caption related to each post, as well as their number, the number of likes, comments and captions that can be understood as public engagement with the published content. The posts were organized according to the criteria of visual content, format, communicational approach, popularity and caption variables. The color blocks signal the grouping of posts with the same meaning of information.

The posts presented covered various commemorative dates, such as, for example, Professions Day, International Biodiversity Day, River Day, National Bee Day, Mangrove Day, Forest Protection Day, Atlantic Forest, International Biodiversity Day, National Caatinga Day and International Human Rights Day. The results presented indicated that most commemorative days are essentially about biodiversity, ecological relations, historical facts, conscious consumption and event programming. In Figure 6, a small section stands out.

Considering the communicational approach criterion, the communicational focus that is established in the posts (images and captions) is informative. The informative perspective appears in practically all subtitles. As for the textual or image patterns of the posts, the format variable criterion is used, which can be perceived based on the type of photo (visual distance to the primary object) and visual (letter, color), as described in methodology. Regarding the type of photo, it was possible to observe that the posts usually contain images of a section of the forest, some with human elements, others with animals.



Figure 6. Mapping posts about commemorative days (some examples). (a) informative communication variable; (b) engagement variable: this post stood out in popularity, with a large number of likes; (c) caption variable, hashtags that were related to JBR, without scientific content and describe only the visual content of the image illustrated in the post; (d) format variable. This variable can be perceived based on the type of photo (visual distance from the primary object) and the type of visual (letter, color).

In the photos of the posts, two major patterns were noticed: photos with a single person involved in carrying out the activity or presenting the productions carried out and close-up photos of specific elements of the commemorative days. In posts that address specific specimens, only eight images were close-up photos of the animals and plants. Images with landscapes were also observed in the posts showing excerpts of biodiversity.

When considering the type of visual of the posts, it is seen that, in most of the images, digital lettering is superimposed highlighting the title of the commemorative date (in larger size) and a stamp with white, pink, green, brown and white backgrounds. orange.

The engagement variable was analyzed based on the number of likes (per photos) and comments, looking at the content exposed above in the selected posts. The post that stood out with the most likes had 378, with comments asking if the event was free and at what time it would take place. The post that had the fewest likes had 33. In this case, there was engagement in the comments with interaction from the JBR Team. However, few comments demonstrated adequate interaction.

In the posts, the caption variables are discussed. We observed hashtags that were related to JBR, without scientific content, and that only describe the visual content of the image illustrated in the Instagram post, such as posts that refer to the celebration of International Biodiversity Day and the Pau Brazil Declaration as national tree.

Analysis of mappings on human element posts

In this mapping, posts made by the JBR communications team about human elements were observed. A selection of published posts is presented, with numbering associated with the respective image. In addition, captions related to each post and the number of likes and comments are presented, which can be understood as public engagement with the published content. The posts were organized based on the criteria of visual content, format, communicational approach, popularity and caption variables.

The posts of the communication approach variable were covered across a broad spectrum in this mapping: informative, entertainment, promotional and mobilization. The informative approach, according to Grillo (2013), occurs as a result of the dialogical interaction between the educational, scientific and journalistic spheres, which are dependent on the analyzes of readers from different areas of human activity. This type of scientific dissemination, which can be classified as hybrid, makes it possible to broadly mobilize a social network. Some posts portrayed human promoting elements, which are already part of the public dissemination medium, such as, for example, the participation of reporter Clarissa Góes (Rede Globo Nordeste) in promoting EcoFérias and the child presenter of Health Kids, on the program Health life.

Communication, as a source of entertainment, reflects the appreciation of leisure, which distances itself from the mechanistic culture imposed by industrial and technological growth reflected in human work (Santini, 1993). The development of recreational activities, such as outdoor classes, associated with leisure, can be a fundamental factor in the teaching-learning of students, as they become an instrument for developing the imagination, creativity, awareness and self-esteem of participants (Huizinga, 2001).

Promotional communication, which promotes exposure of JBR and its activities, was also observed. For Fayard (1999), with the practice of communication, so-called scientific science ceased to be an isolated activity and began to disseminate scientific knowledge to the community, contributing to the popularization of science and technology through educational activities in gardens and museums. natural Sciences. These spaces are considered various objects of education, leisure and social inclusion (D'Alambert & Monteiro, 1990).

Some posts presented the mobilization communication approach, highlighting content that caught the attention of the public participating in Instagram JBR. The use of the mobilization of society for scientific education produces a movement of changes and seeks, through this type of communication approach, to raise awareness in society about the importance of preserving the environment and promoting a sensitized society that can deal with its problems. and are capable of solving them with their own efforts (Telles, 1999). For Peruzzo (2004), the challenge of communication, when mobilizing, is to raise awareness among people, without manipulation. This communication requires the assistance of information channels like Instagram.

Analyzing the posts grouped in the format variable, which were classified by the type of visual, it was investigated whether the posts were directed to the subject covered in the descriptions, through complete photos of the associated subjects, with the presence only of landscapes, or whether they had a mix of participants with the landscape. For Jarreau et al. (2019), format variables can be coded through the color presented, the type of visual, the scale of the visual (whether seen with the naked eye or using scale instruments) and the interaction of the visual of the images posted with the subject main topic covered in the comments.

In analyzing this mapping with a focus on human elements, there were several posts on JBR's Instagram that featured human faces, especially those of science professionals, museums, journalists and politicians. This establishes a considerably high level of viewer engagement with visuals that include a human element, particularly faces (Serafinelli, 2017). Science museums have an opportunity to fill a gap in terms of marketing scientists and researchers as warm, relatable human beings (Serafinelli, 2017; Budge, 2017, 2018; Budge & Burness, 2018).

Medeiros, Mendonça, Souza and Oliveira (2011) assert that, to educate, it is necessary to express the desire to learn not only through reading and writing, but also through environmental education, which tends to awaken awareness of man's role in life in society, which contributes to forming citizens with the skills to decide on socio-environmental problems. The inclusion of the environment in teaching methods for elementary school children develops awareness that it is not just adults who must preserve the environment, as the act of preserving begins the moment children can experience educational actions that involve nature (Branco, 2007). Children's interaction with nature from an early age encourages them to take care of it and preserve it, so that they experience in practice what has long been observed in books and educational activities (Gadotti, 2000).

It was observed that the post that received the most likes had 816. For Jarreau et al. (2019), the engagement variables represent a significant interaction between the public and science, whether observing the nature around them or carrying out practical activities at JBR.

For Adorno (2002), likes can become a reward for the post made available and an indication that something in the post, whether visual, verbal or sound, caught the attention of a greater number of readers. When likes are recognized among post users, they tend to become symbolic capital, which is conceptualized by Bourdieu (2011) as fame, credibility, prestige and reputation. Based on Bourdieu's concept, the likes made by JBR's Instagram readers only increase the credibility and fame that this scientific-natural space promotes for visitors who enjoy direct contact with nature.

The involvement between the visiting public and science can be considered as an educational and communication approach through science, as it tends to understand the relationship between society and science, according to Marandino et al. (2018), as an indicator of social interface, since scientific literacy, through the comments proposed by the public visiting JBR's Instagram, exposes the understanding and expression of opinions about the social and scientific well-being that the natural space of JBR promotes this space to visitors and researchers.

As shown in the results, in the analysis of posts on JBR's Instagram, most of these devices make the most of the platform as a window into scientific life, for example, through researchers' resources, activity perspectives or behind-the-scenes highlights. of citizen science inside and outside the Botanical Garden. Publications that feature this content have the potential to inspire the public to engage in scientific activities in their daily lives. As seen in several posts that represented science as a process, representations of public engagement with science or interactions with scientists were equally rare, as were behind-the-scenes visuals of museum research, curation, or collections. Post content is an incredibly important component of the work of the JBR communications team (Jarreau et al., 2019).

As for the caption variables, hashtags that were related to JBR, without scientific content and that only describe the visual content of the image illustrated in Instagram posts, were observed.

According to research by Budge (2017) and Spear, Pauly and Kaiser (2017), in the posts, the opportunity to present the research carried out at JBR and to know who the researchers, monitors and curators who work in the space are is lost., highlighting the idea of science as a social construction. Behind-the-scenes images, interviews and captions that invite action and engagement are important strategies for achieving bilateral and participatory communication models in scientific dissemination that could be part of the posts and which, unfortunately, were not identified in this research.

Analysis of the mapping of visiting public posts

In this mapping, posts were observed in which the visiting public marked the profile of the Recife Botanical Garden. A selection of the published posts is presented, including the image and caption related to each one, as well as their number, the number of likes, comments and captions that can be understood as public engagement with the published content. The posts were organized according to the criteria of visual content, format, communicational approach, popularity and caption variables.

According to Cerati (2014) and Marandino et al. (2018), visual content, used as a scientific literacy method, portrays the institutional indicator associated with scientific dissemination to a wide audience, not only reaching the group of researchers, but also individuals who seek, in environmental activities, clarification and resolutions of doubts.

The communication approach variables were presented as follows: informative – seeks to disseminate scientific information; entertainment – portrays how nature is fun; promotional – promotes activities and facilitates participation; and mobilization – which highlights content that attracts the attention of the general public.

Regarding format variables, the layout of the posts was considered and it was verified whether the visuals of the images were related to the description of the post and the dissemination of science. As a result, credibility was found to come from the public's trust in associating the posts with a scientific nature, which is not restricted to common sense, but to academia and other areas of knowledge (Chalmers, 1993).

The need to propagate science and technology enables public interaction in scientific events, which can be seen as an intermediary between the visiting public and the authorities. At this point, the importance of engagement stands out, because decisions are made with the help of people from different areas and are not focused solely on the opinion of experts or researchers (Vogt, 2006). The post that received the most likes got 782.

The relationship between science and the public visiting spaces that involve nature is an educational teaching method and mode of communication whose focus is the relationship between man and nature, which, according to Marandino et al. (2018), is an indicator of social interface, in which scientific teaching acts as a literacy teacher. Through the opinions of the JBR visiting public, it is possible to understand how nature can be an important ally in the development of a more balanced and emotionally stable life. The physical, aesthetic-affective and cognitive indicators can be identified by aspects that arouse emotion, observations and sensations and are directly linked to the learning process, promoting man's performance in the social environment where he is present and through interpersonal relationships with the environment. environment that surrounds it (Cerati, 2014; Marandino et al., 2018).

From the analysis of the mapping of posts from the visiting public, it was found that the aspect that stood out most was the aesthetic-affective attribute. Little was noticed about interaction in the cognitive aspect. The majority of posts did not include aspects linked to the scientific dimension, remaining only in the contemplative attribute.

In the analysis of caption variables, we investigated whether hashtags were related to science or were merely informative, with or without scientific content. All posts of this type are related to JBR, as they describe the flora and fauna present in the garden. The use of educational activities in natural spaces links cultural and scientific collections used as learning elements, with more spaces for the role of disseminating knowledge in a constant process of construction (Marandino et al., 2018). The educational role, in nature environments, promotes the growth of relationships with the community and awakens the curiosity of its visiting public.

An individual who understands the processes and products of science is considered scientifically literate, so that they can use their critical and reflective sense to express their opinions. The knowledge production indicator deals with issues of a scientific nature, with the presentation of concepts, terms and advances in science, in order to build knowledge in the individual (Cerati, 2014; Marandino et al., 2018). In this aspect, it was noticed that the potential that could be expected from the analysis carried out, based on the mapping, was not achieved. However, despite the expectation that the contribution of the interaction would be modest, the posts did not demonstrate efforts to reach minimally reasonable levels.

With regard to this mapping, it is important to highlight that some markings made by the public referred to JBR, however, they were other locations, such as, for example, the Porto Botanical Garden (Portugal), the Rio de Janeiro Botanical Garden and the Curitiba Botanical Garden. Furthermore, some posts referred to weddings, modeling books or posts about pregnant women.

To describe the mappings presented here in more detail, we recommend reading the work of Lima (2021).

General discussion

Science Teaching is allied to the preservation of environmental diversity. This connection becomes evident when one notices the use of non-formal spaces for learning Science. This study contributes to Science Teaching by investigating the association between learning and a non-formal learning space accessible to the public and capable of encouraging, especially young people, to enjoy studying Science.

The Recife Botanical Garden, some time ago, stopped being a mere physical space for static exhibitions. Such cultural organizations have evolved and are currently collaborative spaces for learning, information, leisure, scientific and cultural production. These actions find support in interactions occurring on social media, which make up a scenario that brings institutions closer to people, as it places a cyberspace on a screen that is accessible both synchronously and asynchronously.

Social media, as can be seen daily, are very relevant communication tools. In them, cultural institutions can manage their communication more easily with their audiences quickly, effectively, relatively cheaply and with a very comprehensive reach (Lopes, 2018). Furthermore, Artificial Intelligence (AI) tools contribute to this experience being successful, because it is important for institutions to continuously analyze the impact of social media on followers, so that they have a quick perception of what is being accepted by the public and of which is not yet offering an adequate answer. This way, you can identify if there are flaws in the communication strategy and better adapt to the needs of your audiences (Remelgado, 2014).

In this way, it can be seen that, just as social media has a wide diversity of users, communication must adapt to different audiences or choose those that are most suited to its institutional mission perspective. Therefore, social media has different objectives and different approaches. Therefore, taking into account which audience the communication is intended for, social media that are so different in terms of their

approaches, objectives and audiences, it is essential that communication is adjusted to them, whether in terms of the tone of the message, themes to be broadcast and even shared visual content (Lopes, 2018).

Instagram has proven to be a compatible and harmonious platform in relation to JBR's accessibility proposal to new audiences, contributing to the fulfillment of its institutional mission. The reach of Instagram, especially among younger audiences, who spend a larger fraction of their time on social media, offers the possibility of expanding the reach of their activities and disseminating knowledge and training and engaging visitors and cyber visitors. Therefore, collections, specimens and the production of knowledge, which were previously restricted to the JBR's in-person audience, can be the object of viewing, learning and knowledge construction in a digital environment, which lacks online mediation.

It should be made clear that the analyzes carried out in this investigation show that public engagement occurs mainly around exhibition pieces (in general, specimens). This particularity is in line with Budge and Burness (2018), for example, who perceive an analogy between social media as communication tools and a window into users' everyday lives. According to these authors, an Instagram post can be used to illustrate how content manifests itself through the visitor's vision. Probably the most visual feature of Instagram is responsible for this situation. The analogy made by Budge and Burness (2018) can explain scarce engagement when social media is not adequately explored.

At this point, this investigation found an opportunity to improve the interaction of JBR's social communication with cyber visitors. Mediation was little observed, however, before making a criticism, it should be clarified that this lack of mediation is not exclusive to JBR. Studies by Fletcher and Lee (2012), Lazzeretti et al. (2015), for example, demonstrated that many museums were using social media tools in a limited way (mainly to display traditional one-sided promotional messages).

In research carried out in some cultural institutions in Portugal, Lopes (2018) also identified difficulties in managing social media and realized that, although, as with JBR media, communication on digital media was satisfactory, much could still be accomplished in order to improve it. The point she indicated is similar to what is perceived in JBR: the lack of more reach and more interaction.

The lack of more interaction with the public, in which feedback and greater engagement are stopped, can be considered a gap in communication, which leaves something to be desired when the aim, as an institutional mission, is to promote public engagement., through more effective interaction that can direct both the activities and management of social media according to the interests of JBR followers. Furthermore, JBR could follow its own path by innovating this relationship. Mediation could also take place in a more academic way, but within the limits of scientific dissemination, and present, on Instagram, for example, twice a month, lectures given by renowned researchers on accessible topics relating to environmental issues and their social consequences and economic for society.

Recent research indicates, however, that, although this position is potentially useful for promoting engagement and visibility of the institution and its researchers, many organizations have wasted this opportunity. This opportunity to use Instagram in mediation and citizen training, once provided by JBR, would be essential to fulfill its mission and a fundamental milestone, given that, as highlighted, several institutions did not adequately use this route, as the line of thought of critical museology suggests. In this regard, Jarreau et al. regret this loss. (2019), when they state that, in a content analysis of Instagram posts from 1,073 science and natural history museums, the majority of them were using this social media only to promote their exhibitions and public-facing activities, missing the opportunity to showcase the institution's internal scientific and cultural production and increase public awareness of the museum's mission.

Greater engagement with Instagram posts provides different perspectives on the same communication. Depending on the interests of JBR visitors, the story of the visit can be told from different angles and perspectives. Regarding this, Weilenmann et al. (2013) explain that by reorganizing exhibits on their own, visitors are actually curating the exhibits they share online. Museum visitor Instagram pages leverage engagement between visitors and museums. This is a practice, according to the authors, that goes beyond the Instagram app and social media and builds a cross-platform multimedia dialogue.

It is worth emphasizing that the small gaps found in communication on JBR's Instagram are common difficulties presented by numerous similar institutions, not only in Brazil, but also in the United States and European countries, as stated in the literature (Fisher, 2016; Lopes, 2018; Jarreau et al., 2019), for example). On the other hand, with regard to common posts, linked to exhibitions and activities developed by JBR, although without generating engagement, they leave nothing to be desired in relation to other

institutions. Although they do not explore the full range of possibilities offered by Instagram, the posts are those commonly presented in the 1,073 Science and Natural History museums mentioned by Jarreau et al. (2019).

When analyzing JBR's Instagram posts, there was little presence of the human element. This is not surprising, as research indicates that the majority of posts included by institutions also demonstrate this pattern. In this regard, we can mention the works of Bakhshi, Shamma and Gilbert (2014), Fiske and Dupree (2014) and Jarreau et al. (2019), for example, who have complained a lot about this situation and claim that the presence of human elements, especially scientists and/or professionals from the institution in the posts, would tend to increase public engagement.

Final considerations

In the analysis of the mapping of posts linked to educational activities, it was noticed, in general terms, that, regarding the criterion of communicational approach, it was a predominantly promotional approach in relation to images and, rarely, an informative perspective was noted. JBR used Instagram interacting in a traditional one-sided way, despite the public's comments being dense and frequent.

From an engagement point of view, it was clear that, at this stage, only a reasonable level was reached. In this aspect, there was no prospect of mobilization, although there is an invitation to action and engagement in various actions. As for the appearance of the posts, the majority presented an overlay of digital lettering, highlighting the title of the educational activity. However, the visual type of the images managed to communicate what words are unable to describe, such as emotions.

Regarding the content posted by JBR, it was observed that, in most posts, Botany, Zoology and Mycology predominate. The specific themes essentially deal with fauna, flora, biodiversity and ecological relationships and the informative communicational focus predominates, with photos preferably in close-up. At this stage, the JBR team's interaction with the public can be considered good, although far from ideal engagement. Furthermore, the comments presented by the public on the specific content are scarce and, at no time, was there any response from JBR in relation to the public's comments, resulting in a lack of dialogue.

In the analysis carried out, it was concluded that the scientific content presented in the images published on Instagram, in relation to the activities carried out at JBR, tended, despite the purely informational focus, to gain support from the visiting public. The perspective used was based on the assumption that cultural spaces that involve scientific research seek to reach a greater number of people, aiming to inform about scientific research and discoveries in a more accessible way.

The use of social media by JBR promoted public accessibility by incorporating participatory scientific and research activities, which provided more interaction between the visiting public and nature and contributed to raising awareness about the importance of preserving nature and their participation in man's life. However, as already mentioned, the lack of feedback on posts from the social communications team-imposed limits on the level of engagement achieved. Among the digital media tools used for this work, hashtags and Instagram likes contributed to strengthening the educational work of JBR and researchers and disseminating the relevance of scientific studies to the public.

As for the curiosities regarding the posts, they were not just in the informational focus. At this stage, there was greater public engagement. The posts presented, with very rare exceptions, images with extreme close-up along with some information about the proposed content and overlay of digital lettering highlighting the title of the content. Regarding engagement, there was interaction, but it was still incipient. Despite this, JBR made an effort to, through Instagram, start visual campaigns to humanize the public that uses this media, empowering itself in scientific dissemination related to socio-environmental issues.

The analysis of JBR publications (Revista Arrudea) made it clear that the communicational approach used was informative and that, in the posts, close-up images stood out. It was noticed that, unfortunately, according to the comments, the public's interest was only in seeking information such as, for example, the quality of the Journal, how it is published, whether only the staff at the Recife Botanical Garden could publish it, that is, nothing regarding the content of the articles.

With regard to posts related to commemorative dates, the communicational focus is also informative, promotional and there was no stronger interaction with the public. With regard to the human element, it was noticed that the communicational approach was more effective in relation to the interaction of the visiting public, being informative, entertaining, promotional and mobilization. There were several posts on JBR's

Instagram that featured human faces, especially those of science professionals, museums, journalists and politicians. Thus, for the first time, the analysis demonstrated more meaningful public interaction.

Regarding the mapping of the visiting public, the study showed that the visual content variable stood out due to the grouping of examples of Brazilian flora and fauna. Regarding the informative communication variables, posts describing scientific characteristics of species from the native flora of Pernambuco predominated. The entertainment communication variable aimed to combine fun activities with sustainability tips, mainly targeting children. In the promotional communication variable, it was possible to note the emphasis given to the educational activities carried out at JBR and the ease for the visiting public to participate in these activities. In general, a significant number of posts linked to scientific dissemination were noticed.

The engagement levels proposed by Pruulmann-Vengerfeldt and Runnel (2019) guided the classification of JBR's audience in relation to this variable. It is believed that engagement is more effective when interactions with the public are related to tasks, activities and configurations that are easy to assimilate and that correspond to the prior knowledge and experiences lived by visitors. In this sense, a more substantial audience engagement experience from JBR was expected. However, the mappings carried out showed that this level has not yet been reached.

It is known that social networks, for some time, have been an important field of information, as they transmit varied content quickly, allowing researchers and websites in areas of scientific content to use them for academic and scientific dissemination. Science spaces have become important means of scientific dissemination, which enables the development of Scientific Literacy (SL) and encourages the visiting public to develop their autonomy and an active cultural and social identity.

According to the analysis carried out based on the mappings carried out, it was possible to see that, apparently, the expected level of engagement (user or participant) was not reached for a cultural institution as relevant as JBR. Most interactions occurred at the visitor or spectator level. Therefore, the study showed that this relationship between JBR and its audience can improve. Successful strategies in other organizations could serve as an example, however, the sharing of information, in this case, has a promotional character not only for the institution itself, but also for the scientific production carried out and its dissemination. This task requires effort and dedication from a multidisciplinary team.

It should be noted that a fundamental reason why public engagement does not occur at expected levels is the insufficient number of members (only two people) in JBR's Social Communication. It is known that people who work in these media, such as YouTubers, bloggers, etc., individually, have more people on their support teams. The demands of an institution like JBR require the performance of a more adequate number of individuals on the team. This way, the interaction would be more effective.

In this investigation, it was noticed that, apparently, the level of engagement in the interaction between JBR and its audience through Instagram can improve and reach levels more appropriate to its institutional mission. The idea is to increase the relationship between the public and JBR with the goal of an interaction capable of solving the problem of visitor engagement in relation to JBR. Therefore, considering the situation described, to achieve interaction at a more satisfactory level, here are some suggestions that can serve as guidelines to enhance the use of the social media Instagram by the communication team at Recife Botanical Garden:

- More attention to mediation, which could direct interaction even after the physical or digital visit. For example, 'Quiz' sections could be created on social media (questions based on what is expected from learning after a visit or completion of an activity), 'Find out more' (indication of sources that the visitor, still lacking If you want to deepen your knowledge, you could consult) and 'Search here' (indicating spaces and activities developed at JBR that could stimulate scientific initiation), for example.

- Mediation could also take place in a more academic way, but safeguarding the limits of scientific dissemination, presenting on Instagram, for example, lectures given by renowned researchers on accessible topics relating to environmental issues and their social and economic consequences for society.

- The insertion of periodic sections on Instagram, entitled, for example, 'Ask the biologist', in which a scientist clarified an internet user's doubt, in videos lasting a maximum of five minutes, which could awaken the internet user to the habit of access JBR's Instagram, looking for news, or even encouraging him to develop his scientific curiosity.

- Value the human element in posts. The presence of scientists on JBR's Instagram and an emphasis on interaction with the institution's professionals can create a welcoming and multilateral communication environment, capable of increasing the engagement of JBR's public.

- Use the artifice of producing posts that allow behind-the-scenes access to exhibitions, preparation, conservation, decoration, among other situations that induce the public to virtually follow JBR's Instagram, generating engagement.

- Engagement could be increased by promoting opportunities for interaction both online and offline, for example, through competitions for photographs taken by visitors.

- Exhibitions such as those held in planetariums, developed by scientists specializing in the field, can induce the audience to form a strong connection with science. Organizing exhibitions like these could be an excellent opportunity to generate engagement.

The limitations presented in this research concern, initially, the fact that JBR, like most museums in the world, has not yet effectively mastered interaction with its public via Instagram in order to engage with the public much more.

The research completed here is not intended to cover the entire scope of the subject. A historical outline was highlighted within a particular context. Future investigations can be carried out on other aspects, such as, for example, a description of the interaction between the media and the JBR public during the pandemic period. We intend to take this analysis forward. However, it only makes sense to study this section when the pandemic passes or, at least, when it is possible to bring JBR's activities closer to the normality prior to this disastrous event.

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