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Article

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Mapping communities and scientific dissemination collections in digital repositories: descriptive analysis of the Brazilian scenario

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ABSTRACT

Introduction: The democratization of access to scientific knowledge must be a fundamental activity for universities and institutions that carry out scientific research. Open access digital repositories have emerged as powerful tools in this context. With this in mind, what elements characterize communities and collections in digital repositories aimed at scientific outreach? Objective: The aim of this article is to map scientific outreach communities and collections in digital repositories in Brazil, to suggest guidelines for the development of collections with these characteristics. Methodology: This is a descriptive qualitative approach, which used documentary research with the aim of establishing a mapping of digital repositories of public institutions in Brazil (public universities and public scientific research institutions), identifying elements that can verify their commitment to scientific outreach through their repositories. Results: The analyses indicate that the majority of digital repositories do not prioritize scientific outreach to the public, with few explicit and systematized initiatives, revealing a significant gap between the availability of materials and the effective democratization of scientific knowledge. Conclusion: Open access digital repositories can be an effective strategy for disseminating the knowledge produced by research institutions and universities, facilitating access to scientific information for a wide audience. However, the scenario revealed shows few initiatives that are consistent with the panorama of scientific outreach. With this in mind, guidelines are suggested for the implementation of good scientific outreach practices on these platforms, with the aim of democratizing knowledge for society as a whole.

KEY WORDS

Digital repositories. Scientific dissemination. Scientific communication.

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Mapeamento de comunidades e coleções de divulgação científica em repositórios digitais: análise descritiva do cenário brasileiro

RESUMO

Introdução: A democratização do acesso ao conhecimento científico deve ser uma atividade fundamental para universidades e instituições que desenvolvem pesquisas científicas. Nesse contexto, repositórios digitais de acesso aberto surgem como potentes ferramentas. Diante disso, questiona-se quais elementos caracterizam comunidades e coleções em repositórios digitais voltados para a divulgação científica? Objetivo: A finalidade deste artigo é mapear comunidades e coleções de divulgação científica em repositórios digitais do Brasil, a fim de sugerir

orientações para o desenvolvimento de coleções com essas características. Metodologia: Trata-se de uma abordagem qualitativa descritiva, que utilizou a pesquisa documental para estabelecer um mapeamento de repositórios digitais de instituições públicas no Brasil (universidades públicas e instituições de pesquisa científica públicas), identificando elementos que permitam verificar seu compromisso com a divulgação científica por meio de seus repositórios. Resultados: As análises indicam que a maioria dos repositórios digitais não prioriza a divulgação científica para o público geral, com poucas iniciativas explícitas e sistematizadas, revelando uma lacuna significativa entre a disponibilidade de materiais e a efetiva democratização do conhecimento científico. Conclusão: Repositórios digitais de acesso aberto podem ser uma estratégia eficaz para disseminar o conhecimento produzido por instituições de pesquisa e universidades, facilitando o acesso à informação científica por um público amplo. Entretanto, o cenário apresentado mostra poucas iniciativas contundentes com o panorama da divulgação científica. Com isso, são sugeridas diretrizes para a implementação de boas práticas de divulgação científica nessas plataformas visando democratizar o conhecimento para toda a sociedade.

PALAVRAS-CHAVE
Repositórios digitais. Divulgação científica. Comunicação científica.

CRediT

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1 INTRODUCTION

Improving scientific research has been one of the most important drivers of social change. Scientific knowledge has the potential to affect people's lives and produce surprising results. Sharing this knowledge can help create a more informed population capable of making evidence-based decisions. The majority of scientific research in Brazil is carried out by a network of universities and public institutions dedicated to scientific research (Groupo, 2019). These organizations have an important social responsibility by conducting in-depth studies and producing quality knowledge in different fields (Borges, 2016). One of the ways of fulfilling this social responsibility is the constant concern of these institutions to share the knowledge produced in their premises with society.

In this context, scientific outreach stands out, as it is fundamental for the spreading of this knowledge to the community. According to Massola, Crochík and Svartman (2015, p. 310), science outreach "the transmission of scientific knowledge to a lay audience".

In a scenario increasingly characterized by digitization, it is essential to understand how Information and Communication Technologies (ICTs) affect this outreach of science. According to Anderson (2010), ICTs can be understood as electronic and technological tools that are used to create, collect, store, and transmit information, allowing the exchange of data between individuals. These tools thus promote the democratization of research by involving an audience of specialists and non-specialists.

Another strategy for sharing scholarly content is the movement to support open archives and free access to information. This movement emerged as a response to the challenges facing the global scientific community in terms of access to information. With the open access movement, various subsidies have been created for the development of digital repositories with the aim of broadening access to scientific knowledge (Ibict, 2005).

According to Viana and Arellano (2006, p.2), "a digital repository is a way of storing digital objects that has the capacity to maintain and manage material over long periods of time and provide appropriate access.

It makes various scientific publications and digital objects available free of charge with the aim of improving the development of scientific knowledge. It also increases the visibility and impact of research by facilitating access to the results for a wider audience (Ibict, 2005).

Given the importance of this tool for communicating scientific knowledge to the public, it is relevant to ask what elements characterize communities and collections in digital repositories aimed at scientific outreach. The aim of this article is to map science outreach communities and collections in digital repositories of public scientific research institutions in Brazil and to propose guidelines for the development of collections with these characteristics.

It is hoped that this work will contribute to a greater democratization of scientific knowledge and help to build guidelines for better scientific outreach practices in open access digital repositories.

2 LITERATURE REVIEW

To better understand the question and the objective proposed in this research, a literature review is presented with a conceptual bibliographical approach that clarifies the concepts of scientific communication and outreach. This approximation and distinction aims to clarify the defining elements of communication and knowledge outreach actions in their ultimate intentions to reach different audiences. Science communication seeks to engage in dialogue within a technical academic field, while science outreach broadens communication formats to reach audiences with knowledge and socio-cultural practices that are different from the academic field of origin of the digital objects produced. This is followed by a contextualization

of open access digital repositories. These tools can provide accessible spaces for organizing, preserving, and disseminating scientific knowledge free, thereby extending the reach of scientific research beyond the academic community.

2.1 Scientific communication and science outreach

Science outreach and science communication are relevant topics in the academic context, with direct implications for the way knowledge is shared with society. Although these terms are generally used interchangeably, they are distinct processes and it is interesting to consider their differences in the context of science. In the following, we will present some definitions with the aim of clarifying a little more the function of each of these tools for the transmission of scientific knowledge.

Scientific communication, according to Bueno (2010, p. 2), "concerns the transfer of scientific and technological information or information related to innovations, and is directed to specialists in certain fields of knowledge".

Thus, according to Queiroz and Araujo (2020), scientific communication plays an essential role in the spreading of knowledge, allowing scientists, researchers, and scholars to share their contributions with the academic community.

Meadows (1999) states that scientific communication is essential for the advancement of science. It is essential to the conduct of research because the peer review process gives legitimacy to the results. Peer review is a process of critical evaluation that consists of sending scientific work to experts in the field, but who were not involved in the work. This process guarantees the scientific quality of the research and its suitability for publication in journals or presentation at academic events (Pedri; Araujo, 2021).

Regarding the target audience of scientific communication, according to Bueno (p. 2, 2010), it is made up of "specialists, i.e., people who because of their specific training, are familiar with the issues, concepts, and the very process of production in science and technology (S&T)". The author adds that there are two levels of science and technology communication:

> **Intra-peer** communication refers to the sharing of scientific, technological, and innovation information among specialists in a field or related fields [...] characterized by 1) a specialized audience; 2) specific content; and 3) closed code [...]. **Extra-peer** communication refers to transmitting scientific and technological information to specialists who are not exclusively located, by training or specific activity, in the field that is the subject of the dissemination. In this case, there is also a specialized audience, although not necessarily in a specific field (Bueno, 2009, pp. 160 and 161, emphasis added).

Regarding the transmission channel of scientific communication, according to Mueller (2006), indexed journals are the main way of disseminating science. However, in addition to scientific journals, there are several accessible channels of scientific communication. Some of the most common ones are proceedings of events, scientific books, scientific blogs, scientific podcasts, as well as social networks (Príncipe, 2013).

Regarding science outreach or the popularization of science, Bueno (1985, p. 1421) states that it "involves the use of resources, techniques, and processes to convey scientific and technological information to the general public".

According to Bueno (2010), the target audience for science outreach is very diverse and includes a wide range of people, many of whom do not have a technical-scientific background. This audience is mainly made up of individuals who are not familiar with technical terminology, which makes it difficult to interpret technical jargon and understand the concepts that underpin the process of disseminating technical information.

Bueno (2010) adds that, due to the diversity of the target audience, the outreach of scientific and technological information to this group necessarily requires the adaptation or

reformulation of technical language. This involves the use of tools such as metaphors, illustrations, or infographics, which, although they facilitate understanding, may compromise the accuracy of the information.

Science outreach is fundamental because it democratizes the knowledge produced and contributes to what is known as scientific literacy. The divulgation makes science clearer and more understandable to people, thereby increasing public interest and participation in science and engaging citizens in discourses on specialized topics (Bueno, 2010).

Science outreach encompasses various means of communication, such as publications in books, journalistic texts, magazines, radio, exhibitions, and events, but also

extends to social media, science blogs, audiovisual productions such as videos and documentaries, animations, podcasts, infographics, interviews, and debates. It also includes

interaction with the press, online courses and lectures, the development of educational materials, university outreach programs, comics, and even television programs. Science outreach encompasses a wide range of expressions with the aim of making science accessible to different audiences, using various media and formats (Bueno, 1985, 2009,2010, 2018; Jiménez de Las Heras, 2023).

Scientific communication and science outreach are important for different reasons and play different roles in the process of producing and disseminating scientific knowledge. However, they are complementary and play a fundamental role in the spreading and democratization of knowledge produced in the scientific community.

The following section provides a brief contextualization of digital repositories, spaces that will be mapped in this research, to understand their role as a place for storing and disseminating digital objects of science outreach.

2.2 Open Access Digital Repositories

In order to improve access to scientific information, a series of open access initiatives emerged in the 1990s, advocating, among other things, that the results of government-funded research should be freely accessible (Kuramoto, 2006).

As Costa and Moreira (2003) point out, these initiatives are immersed in an "open philosophy" characterized by the adoption of tools, strategies, and methodologies that represent a new model for an equally innovative process of scientific communication.

According to Costa (2006), this approach not only shapes this new model, but also serves as the basis for its interpretation. This philosophy encompasses various issues, including the use of open software in the development of computer applications, the use of open files to ensure global interoperability, and open access, which aims at the broad and unrestricted dissemination of the results of scientific research.

As Costa (2006) points out, this milestone was followed by events aimed at promoting open access, including a meeting in Budapest organized by the Open Society Institute (OSI), which established two main strategies, both based on the use of the Open Archives Initiative - Protocol for Metadata Harvesting (OAI-PMH) protocol. The first is called the "Green Road" and the second the "Golden Road".

According to Kuramoto (2007), the green road is associated with authors self-archiving a copy of their work in an open access repository. The golden road is associated with the publication of articles in open access scholarly journals.

According to Baptista et al. (2007), the Budapest meeting resulted in one of the most important documents of the Open Access movement, known as the Budapest Open Access Initiative (BOAI). It defined Open Access as

> By “open access” to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or

> use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited. (Budapest *Open Access Initiative*, 2002).

Valério (2012, p. 158) clarifies the terminological distinction between free access and open access, "[...] the latter requires interoperability or the use of open files, as well as a set of services, but not free of charge. On the other hand, free access, as the name implies, is access without cost or barriers to permission to use".

According to Santos Junior (2010), this movement represents a form of return on the investment that society makes in funding research carried out in public scientific research institutions.

In this scenario, there has been a major change in the availability of information, and it has systematically favored the creation of repositories, as shown in the *Brazilian Manifesto in Support of Free Access to Scientific Information of the Brazilian Institute of Information in Science and Technology*.

> The *Open Archives Initiative* is therefore a milestone in the area of information processing and divulging in general and in the area of scientific communication in particular. This initiative has led to the construction and maintenance of various book access repositories, as well as the emergence of various *software* tools for the construction and maintenance of repositories, such as *E-Prints*, *Open Journal Systems* (OJS), *DSPACE*, among others (Ibict, 2005).

According to Leite (2009, p.19), digital repositories, in the context of open access, are

> [...] the various types of data provider applications that are designed to manage scientific information, necessarily constituting alternative means of scientific communication. Each type of digital repository has specific functions and applications geared to the environment in which it will be used.

Leite (2009) categorizes digital repositories as follows:

- Institutional repositories: focused on the intellectual output of an institution, especially universities and research institutes.
- Thematic or disciplinary repositories: aimed at specific scientific communities, they focus on the intellectual production of specific areas of knowledge.
- Thesis and dissertation repositories dedicated exclusively to storing these works.

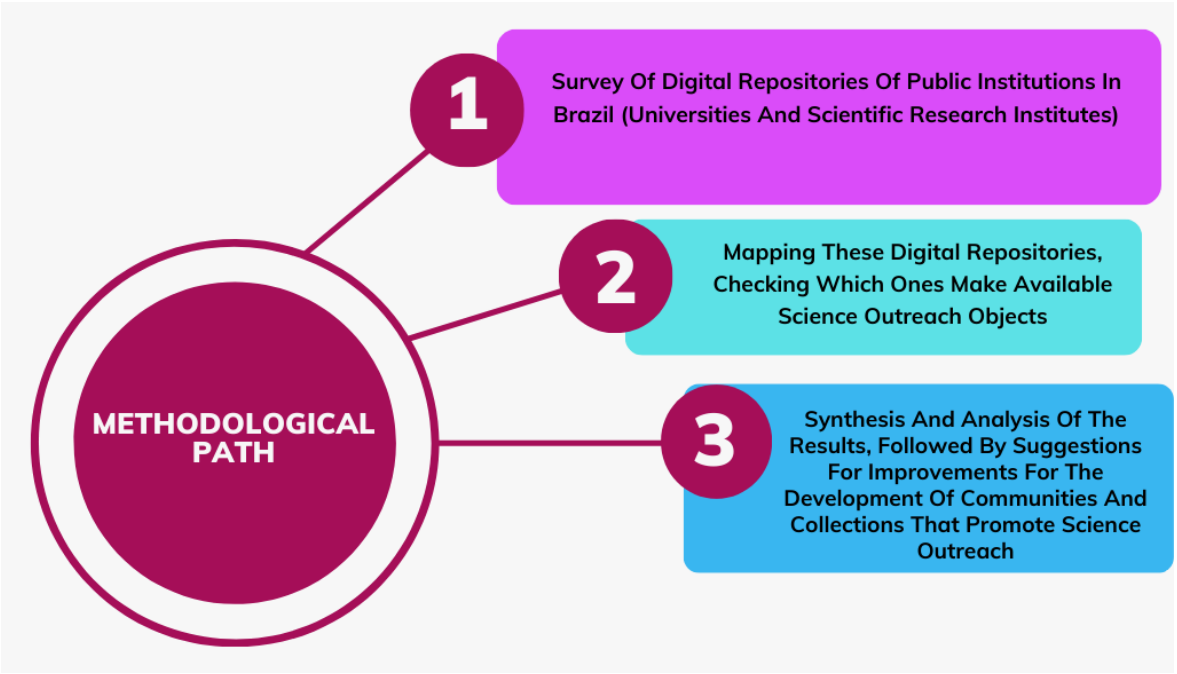
As such, these repositories represent innovative tools, being oriented towards the scientific environment, and adding the task of disseminating and communicating scientific results to the entire population.

3 METHODOLOGY

According to Minayo (2013, p. 14), methodology is the "way of thinking and the practice of approaching reality." It guides the investigative process and provides a framework for collecting, analyzing, and interpreting data. This article is defined as descriptive qualitative research because, according to Gil (2022), it "aims to describe the characteristics of a particular population or phenomenon".

In this sense, the following is the methodological path that presents the stages of this research:

Figure 1. Methodological path



Source: The authors

To develop the methodological approach, documentary research was used, which, according to Gil (2022), involves the analysis and interpretation of a wide variety of existing documents produced for different purposes and in different contexts. This research was used to map the digital repositories of public institutions in Brazil (public universities and public scientific research institutions), identifying elements that would make it possible to verify their commitment to scientific outreach through their digital repositories.

For this purpose, the website of the Brazilian Institute of Information on Science and Technology (Ibict) to identify which repositories contribute to the practice of science outreach. This tool was used because one of the missions of Ibict (2012) is to "absorb and adapt new technologies and transfer them to other entities interested in capturing, distributing, and preserving scientific and technological intellectual production." On this website, you can find a list of Brazilian open access repositories with scientific material.

A list of 112 digital repositories was found on the Ibict website (2012). It was found that the listed repositories belong to different organizations, so in accordance with the aim of this research, those maintained by public universities and public scientific research institutions were selected for analysis. Thus, 71 repositories were selected.

Next, each of these 71 repositories was checked to see if it had the following digital objects: journalistic texts, magazines or articles promoting science, radio programs, exhibitions and events social media, blogs specialized in science, audiovisual productions such as videos and documentaries, animations, podcasts, infographics, interviews, debates, online courses and lectures, teaching materials (brochures, folders, and pamphlets), university extension programs, comics, and television programs. The choice of such objects, according to the literature, configures the means of scientific outreach (Bueno, 1985, 2009, 2010, 2018; Jiménez de Las Heras, 2023).

Relevant sections, such as "Communities and Collections," were analyzed to identify those that stood out for scientific outreach or for promoting the popularization of science. In addition, we analyzed whether the repositories provided adequate metadata to identify content related to science outreach, including titles, keywords, and types of documents. The available

search field was also used to search for topics related to science outreach, such as videos, comics, newspapers, etc.

Repositories whose purpose is to provide materials primarily for educational purposes were excluded from the research, as such content supports the educational process and does not necessarily disseminate scientific knowledge to the general public. Repositories that store digital objects for the sole purpose of preserving historical records rather than effectively disseminating of science to the general public were also excluded. Repositories that didn't provide explicit information about science outreach objects, or that didn't allow searching by type of material, communities, and collections related to science communication, were also excluded.

In this way, 10 repositories were selected that provide science communication materials. The list of selected repositories is detailed in chart 1 in the next section. The following sections also summarize and analyze the results, followed by suggestions for improvements in the development of digital object collections that promote science outreach.

It is hoped that this research will provide a comprehensive understanding of the role of digital repositories in promoting science outreach, and that its results can serve as a basis for future research and the implementation of best practices in the management of digital repositories.

4 RESULTS

To improve our understanding of the phenomenon under study and to provide a basis for subsequent analysis, we present below the results of the data collection and analysis process carried out through documentary research. The main objective of this mapping was to identify digital repositories of Brazilian public institutions, including universities and scientific research institutes that provide materials related to science outreach. This initiative seeks to highlight the commitment of these institutions to democratize access to scientific knowledge.

To this end, we looked at the presence of specific communities and/or collections focused on science outreach, as well as search and access options for digital objects that are characteristic of science popularization. The chart below lists the 10 repositories identified that offer some science outreach materials.

Chart 1. Digital Repositories/Scientific Outreach

List of selected repositories	
Digital Collection of Universidade Federal do Paraná	Infoteca-e - Technological Information on Agriculture (Embrapa)
Inmetro's Digital Collection	Lume - Digital Repository of Universidade Federal do Rio Grande do Sul
ALICE - Embrapa's Open Access to Scientific Information Repository	MineralisRepositório
Arca - Institutional Repository of Fundação Oswaldo Cruz	Institutional Repository of Universidade Federal Fluminense
CBPF Index	Institutional Repository ofUniversidade Federal do Sergipe

Source: Ibict (2012)

Below is a check of the digital repositories listed, as well as some examples of objects that, according to the literature consulted, are science outreach media. For better illustration, we have included charts showing the name of the repository, the communities and/or collections

where the digital science outreach objects were found, the title of these objects, and the web address where the material is hosted. These examples were chosen to illustrate at least one of the possibilities offered by each of the Science Outreach materials present in the repositories. It is important to note that these are just a few examples and that there are other materials related to the objects that can be explored.

Digital Collection of the Universidade Federal do Paraná – UFPR

The Digital Collection of the Universidade Federal do Paraná (UFPR) is an environment that stores various digital libraries that make up the digital repository. The following are examples of objects that could be Science Outreach materials (Universidade Federal do Paraná, [201-?]).

Chart 2. Digital Collection of the Universidade Federal do Paraná

Collections and/or Communities	Science Outreach objects	Title	E-mail address
Synthetic models in veterinary medicine	Animation	Burnout syndrome and the impact on the mental health of health professionals during the Covid-19 pandemic	hdl.handle.net/1884/72687
Videos	Video	Champions of life: children's wheelchair basketball	hdl.handle.net/1884/75723
TV UFPR	Television program	Integrated marketing	hdl.handle.net/1884/34265

Source: Universidade Federal do Paraná ([201-?])

The search in this repository did not locate any communities or collections dedicated specifically to science outreach. However, it did find some objects that are characteristic of science outreach, using the document type search option. Even so, most of the communities and collections do not offer objects that contain characteristics voted for the popularization of science.

Inmetro's Digital Collection

Inmetro's Digital Collection is a portal that facilitates access to digital collections of documents produced by the institution, with the aim of increasing the visibility of its intellectual production (Inmetro, ([201-?]).

The search in the repository is divided into the following options: subject areas, date, author, title, subject, and type of document. Below are examples of the materials found.

Chart 3. Inmetro's Digital Collection

Collections and/or Communities	Objects Science Outreach	Title	E-mail address
Conformity assessment consumer education and guidance	Article	Brief notes on good shopping	repositorios.inmetro.gov.br/handle/10926/1992

Education in Metrology and Conformity Assessment	Brochure	Light	repositorios.inmetro.gov.br/handle/10926/1369
Conformity assessment consumer education and guidance	Comics	Child safety: tips for safe play	repositorios.inmetro.gov.br/handle/10926/989

Source: Inmetro ([201-?])

The search of this repository did not identify any community or collection specifically focused on science outreach. As it turned out, this repository does contain some initiatives related to science outreach. The document type search option was used to locate these materials. However, it was observed that these initiatives are isolated without a clear organization into collections or communities aimed at this purpose.

ALICE - Embrapa's Open Access to Scientific Information Repository

Embrapa's Alice Repository is a platform that collects, organizes, stores, and disseminates complete scientific information, helping to increase the impact of research results. The repository organizes digital publications into communities representing Embrapa units throughout Brazil (Embrapa ([2011] a).

The system also allows you to browse its platform by year of publication, author, editor, title, subject, and type. Below are some examples of collections that contain materials considered science outreach, which is the object of interest of this work.

Chart 4. Alice Repository for Open Access to Embrapa Scientific Information

Collections and/or Communities	Objects Science Outreach	Title	E-mail address
Embrapa Clima Temperado	Media article	The importance of pre-improvement in the development of potato cultivars	www.alice.cnptia.embrapa.br/alice/handle/doc/1140893
Embrapa Hortaliças	Films	Implementation and monitoring of the quality system in the plant's active germplasm bankcapsicum	www.alice.cnptia.embrapa.br/alice/handle/doc/1082365

Source: Embrapa ([2011])

The analysis of this repository did not reveal any communities or collections dedicated exclusively to the science outreach. To identify the objects, a search was performed using the "type of material" option. Materials such as media articles and movies were found, indicating that the repository contains some items related to science popularization.

Arca Institutional Repository of the Oswaldo Cruz Foundation

Arca - The Institutional Repository of the Oswaldo Cruz Foundation (Fiocruz) has the function of consolidating, housing, making available and promoting the visibility of the intellectual production of the institution (Fiocruz, [2011]). Below are some examples of collections that contain materials that are considered science outreach.

Chart 5 . Oswaldo Cruz Foundation Institutional Repository Ark

Collections and/or Communities	Objects Science Outreach	Title	E-mail address
Presidency Fiocruz	Audio / podcast	Coronafatos: #03 – máscara	arca.fiocruz.br/handle/icict/46064
Institute for Scientific and Technological Communication and Information in Health	Image	Tuberculosis is curable! [Calendar]	arca.fiocruz.br/handle/icict/26652
Institute for Scientific and Technological Communication and Information in Health	Infographic	COVID-19: Pay attention to how long the new coronavirus is active on each surface	arca.fiocruz.br/handle/icict/41216
Fiocruz Presidency - REA - Video	Video	Acupuncture	arca.fiocruz.br/handle/icict/16291

Source: Fundação Oswaldo Cruz, ([2011])

As shown in the chart, some materials focused on science outreach were identified. A search by type of document was used to locate these materials. It can be seen that the initiatives located occur in isolation, without a clear structure in collections or communities dedicated to science outreach.

Brazilian Center for Physics Research - CBPF INDEX

The CBPF INDEX repository is a system for monitoring the scientific and technological output of the Brazilian Center for Physics Research (CBPF). The collections that can be searched in this repository are CBPF Projects, Publications, and Events (Brazilian Center for Physics Research, 2004).

Within each theme, the organization is done by type of document. In the "Publications" theme, the type "science outreach article" was found. Below is an example of material considered as science outreach, which is the subject of this study.

Chart 6. CBPF INDEX repository

Collections and/or Communities	Objects Science Outreach	Title	E-mail address
Publication	Science outreach articles	On the effects of experience	artigoDeDivulgacaoCientifica_2019-06-21-10-33-17YXJoaWdvRGVEaXZ1bGdhY2FvQ2llbnRpZmljYQ==.pdf (cbpf.br)

Source: Centro Brasileiro de Pesquisas Físicas (2004)

Although it does not contain a specific community or collection of Science Outreach, this repository clearly offers a means of science outreach: “Science Outreach Article”. However, this repository still has limitations in terms of the scope and diversity of the types of documents that make up science outreach.

Embrapa's Technological Information Repository (Infoteca-e)

The Agricultural Technology Information Service (Infoteca-e) compiles and makes available information on the technologies developed by Embrapa in the research areas of its units. Its collections consist of materials produced in-house, such as brochures, technology transfer books, radio and television programs, presented in a language adapted to facilitate the understanding of rural producers, extension workers, agricultural technicians, students, and professors from rural schools, cooperatives, and other sectors of agricultural production (Embrapa, [2011]b). Below are some examples of science outreach material included in the repository.

Chart 7. Embrapa's Technological Information Repository (Infoteca-e)

Collections and/or Communities	ObjectsScience Outreach	Title	E-mail address
Embrapa Acre	Media articles	Bovine leptospirosis: preventive care avoids damage and guarantees herd health.	www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/1132497
Embrapa Rondônia	Video	How to make a hanging rack for drying coffee	www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/1130937
Embrapa Amazônia Oriental	TV program	Breeding wild animals in captivity. Field day on TV	www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/373440
Embrapa Pantanal	Brochure	Brazilian meat and its competitiveness on the international market.	www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/1136957
Embrapa Unidades Centrais	Radio program/sound recording.	The right tree for the ILPF system: program 16: Midwest/Southeast	www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/1131576

Source: Embrapa ([2011]b).

Although there is no community or collection related to science outreach, a significant amount of material with potential for science outreach was identified. These were located using the search option by document type.

LUME Digital Repository of the Universidade Federal do Rio Grande do Sul

Lume - Digital Repository of the Universidade Federal do Rio Grande do Sul (UFRGS) is a portal that allows access to digital collections produced by the university and other relevant documents, whether due to their scope or historical significance, consolidating institutional preservation and dissemination (Universidade Federal do Rio Grande do Sul [2016]).

The repository allows searching by the following metadata: collections and communities, year, author, subject, and type. We searched by document type and here are some examples we found.

Chart 8. LUME Digital Repository of the Universidade Federal do Rio Grande do Sul

Collections and/or Communities	Objects Science Outreach	Title	E-mail address
Online editions/feature article	Journalistic texts	Post-climate denialism	hdl.handle.net/10183/275907

Radio UFRGS	Audio (radio program)	The Renaissance lute and the vihuela	hdl.handle.net/10183/270995
UFRGS TV	Video (TV program)	Carlo Ginzburg (Part I)	hdl.handle.net/10183/130667

Source: Universidade Federal do Rio Grande do Sul ([2016].

Analyzing the repository revealed the presence of some initiatives related to science communication. However, it can be seen that these initiatives are isolated, with no clear organization into collections or communities focused on science outreach.

Mineralis Institutional Repository of the Mineral Technology Center

The Mineralis repository is dedicated to the collection, preservation, and distribution of digital material from the Mineral Technology Center (CETEM) in accordance with the principles of information security (Mineral Technology Center, [201-?]). Below are some examples of identified materials that fall into the category of Science Outreach.

Chart 9. Mineralis Institutional Repository of the Mineral Technology Center

Collections and/or Communities	ObjectsScience Outreach	Title	E-mail address
Sustainable CETEM Bulletin	Article	CETEM Sustainable Bulletin, issue no. 9 - February 2020	mineralis.cetem.gov.br/handle/cetem/2585
CETEM - Videos	Videos	Technological characterization of the rocks and mortars of the Monastery of São Bento	mineralis.cetem.gov.br/handle/cetem/2111
Wandeca and what comes out of the mine - Comics	Comics	Wandeca and what comes out of the mine: the adventure with aluminum	mineralis.cetem.gov.br/handle/cetem/2725

Source: Centro de Tecnologia Mineral ([201-?])

As shown in the chart, some materials have been identified that are aimed at dissemination science. However, it can be seen that these initiatives take place in isolation, without a clear organization into specific collections or communities for the popularization of science.

Institutional Repository of the Universidade Federal Fluminense

The Institutional Repository of the Federal University of Fluminense (RIUFF) is a platform that aims to collect, store, preserve, disseminate, and guarantee access to the academic and scientific production of the University (Universidade Federal Fluminense, [201-?]).

The home page of the repository highlights the search options, which include communities and collections, document date, authors, titles, publication type, subjects, recent submissions, COVID-19, and e-books.

To investigate the existence of science outreach materials, the types of documents contained in the repository were examined. Below are some examples of materials that can be recognized as science outreach.

Chart 10. Fluminense Federal University Institutional Repository

Collections and/or Communities	ObjectsScience Outreach	Title	E-mail address
PPECN - Comics - Niterói	Comics History	Animated comic, science in the pandemic: COVID19 tests	app.uff.br/riuff/handle/1/22332
COVID - 19 - Images	Image	Online psychological support for health workers at the UFF campus in Rio das Ostras	app.uff.br/riuff/handle/1/16421
COVID - 19 - Videos	Videos	Corona virus - COVID 19	app.uff.br/riuff/handle/1/15496
MNC - Interviews - Videos	Interviews	Girls in science - getting to know lorrayne	app.uff.br/riuff/handle/1/23534

Source:Universidade Federal Fluminense ([201-?]).

This repository contains initiatives related to science outreach. However, it was observed that these initiatives are isolated without a clear organization in collections or communities aimed at this purpose.

Institutional Repository of the Universidade Federal de Sergipe (RIUFS)

The Institutional Repository of the Universidade Federal Fluminense (RIUFF) is a platform that aims to gather, store, preserve, divulge and guarantee access to the university's academic and scientific production (Universidade Federal Fluminense, [201-?]).

The portal offers different search options, making it possible to locate information by communities and collections, authors, titles, subjects, postgraduate programs, and departments. When researching the presence of science outreach materials, the communities and collections available in the repository were analyzed, as well as the types of documents they contain. Below are some examples of materials that can be identified as science outreach.

Chart 11. Institutional Repository of the Universidade Federal Fluminense

Collections and/or Communities	ObjectsScience Outreach	Title	E-mail address
150 years of the Ateneu Sergipense Podcasts (Cemas)	Audio (radio program)	Atheneu College in "House of literary education"	ri.ufs.br/jspui/handle/riufs/13993
TV UFS	Audiovisual production	Olhares de Clio #02 | Massapê: audiovisual and academic production	ri.ufs.br/jspui/handle/riufs/12094
Agricultural Sciences Zootechnics (educational and technical resources)	Comics	Comic books	ri.ufs.br/jspui/handle/riufs/16250
Events - UFS	Audio (Podcasts)	Let's talk about health (PodcastEp. 1)	ri.ufs.br/jspui/handle/riufs/14650

Source:Universidade Federal Fluminense ([201-?]).

There is evidence of the existence of some materials related to science outreach, but these initiatives are isolated and not clearly organized into collections or communities focused on science outreach.

5 CONCLUSION

When we examined the digital repositories of public organizations that conduct scientific research, we found that most of these tools do not offer content aimed at scientific outreach to the public. Initiatives by digital repositories to promote scientific outreach objects in an explicit and systematic way are rare. While certain repositories do provide materials relevant to scientific outreach, they frequently lack a structured system to clarify, organize, and make this information accessible to both specialists and non-specialists.

Although there are some materials with these characteristics, the prevailing perception is that these resources seem to be geared more toward meeting institutional preservation needs and/or furthering the mission of teaching, rather than actually promoting the popularization of science for the general public.

It is notable, however, that some repositories are aware of the issue of democratizing their content for a wide audience. However, the information is not stored in a clear and intuitive way to serve this audience. There is a need for prior knowledge of advanced search strategies to locate a digital object that characterizes science outreach.

This suggests a significant gap between the availability of materials related to science outreach and the effective democratization of scientific knowledge through these digital platforms.

To overcome these obstacles, several issues need to be addressed to promote the democratization of science through repositories:

- Developing exclusive science outreach communities and collections: these sections must be easily located in repositories and organized in a way that attracts the attention of the public;
- Select metadata to identify digital objects that can serve as science outreach content;
- Accessible language: It is necessary to use clear and accessible language in science outreach objects, avoiding technical jargon that makes it difficult for non-specialist audiences to understand. Both in the description of the objects and in the assignment of keywords;
- Invest in training for those responsible for developing the repository: Invest in training for librarians and/or those responsible for the content of repositories so that they can identify, organize, and make available science outreach materials in more efficient and attractive ways;
- Invest in promoting the repository. Encourage actions to publicize the existence of repositories and attract the general public;
- Accessibility: ensuring that the materials available are accessible to all audiences.

Open access digital repositories have proven to be an effective strategy for disseminating the knowledge produced by research institutions and universities, allowing many people to have access to scientific information. It is therefore worthwhile to adopt good practices for scientific outreach on these platforms in order to contribute to the democratization of scientific knowledge for society as a whole.

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