

Abstract: Digitization is a disruptive element in the relationship between institutions and researchers, reshaping the interaction with collections and promoting a new dynamic of communication, as well as favoring preservation and access for future generations. This research investigates the description of rare materials and their representation in digital environments from the perspective of Linked Data. The research is justified by the incompatibility of traditional cataloging rules with the requirements of interoperability, access, use and reuse of rare material data in digital environments. This research is based on an approach that integrates a Systematic Literature Review and a subsequent empirical study. In the data extraction phase, according to the established criteria, it was found that the topic was addressed in 76.32% of the selected articles.

Keywords: Descriptive cataloging; Linked data; Rare materials; Systematic literature review.

Resumo: A digitalização se apresenta como um elemento disruptivo na relação entre instituições e pesquisadores, remodelando a interação com os acervos e promovendo uma nova dinâmica de comunicação, além de favorecer a preservação e o acesso às futuras gerações. Esta pesquisa investiga a descrição de materiais raros e sua representação em ambientes digitais, na perspectiva do Linked Data. A investigação se justifica pela incompatibilidade das regras de catalogação tradicionais diante das demandas de interoperabilidade, acesso, uso e reuso de dados de materiais raros em ambientes digitais. Trata-se de uma pesquisa pautada em uma abordagem que integra revisão sistemática da literatura e um subsequente estudo empírico. Na etapa de extração dos dados, conforme os critérios estabelecidos, verificou-se que a temática foi abordada em 76,32% dos artigos selecionados.

Palavras-chave: Catalogação descritiva; *Linked data*; Materiais raros; Revisão sistemática da literatura.

Introduction

The notion of digital libraries (DL) has the potential to broaden the scope of information science by virtue of its multidisciplinary approach, which manifests itself at the intersection of two major areas of knowledge: exact sciences and applied social sciences. This intersection encompasses the sub-areas of library science, computer science, and network technologies (SAYÃO and MARCONDES, 2008). Despite the extensive discourse surrounding the conceptualization of DL from diverse vantage points, a prevailing consensus emerges regarding the nature of these entities. DL are recognized as systems that inherently integrate digital technology, encompassing computers, storage, and communication components, along with software components, as articulated by Gladney *et al.* (1994). In this context, DL can be understood as a convergence of the disciplinary competencies of description in Library Science, data structure in Computer Science, and communication protocols in Network Technologies. These disciplines have adapted instruments and tools to process, access, and disseminate data. In this system, the

relationship between humans and machines is particularly salient. According to Buckland (1991), communication and interaction occur, messages are transmitted, and signals are interpreted. Singer (2009:117) emphasizes that the Linked Data movement is an approach to organizing information on the Web, with the objective of structuring data in a manner that ensures its reusability and comprehensibility to both humans and computer systems.

Development

As Luro and Borges (2022) have demonstrated, the digitization process is a transformative factor in communication between institutions and their researchers, reconfiguring the very nature of interaction with collections. By transcending the limitations imposed by traditional media, digitization amplifies the potential for accessing, manipulating, and reinterpreting information resources. In this regard, the preservation of digitized materials is paramount, ensuring their integrity and longevity for posterity. Moreover, the digitization process fosters the “creation of new digital and physical products that captivate audiences and promote the cultural heritage of institutions” (LURO and BORGES, 2022:51).

Despite the advancements brought about by digital technologies in terms of access to and dissemination of information, the preservation and organization of digital data for future generations remains a pressing challenge and a primary focus of research in the field of Information Science. In the context of contemporary DL, the physical nature of information supports, even in their digital representation, directly influences strategies for organizing, preserving, and retrieving information, as highlighted by Buckland (1991) and Le Coadic (1996). Werthein (2000) has noted that the information technology paradigm has led to a transformation in record formats, with physical media being replaced by digital formats such as texts, images, and databases. This observation underscores the enduring significance of preserving and organizing recorded knowledge, irrespective of technological advancements, to ensure the continuity of access to information.

In this sense, the decision to make cultural heritage collections available in digital environments is a strategic one for institutions, as it transcends the physical and geographical limits inherent in traditional collections and has an impact on expanding access and the physical preservation of these materials. Nevertheless, the absence of a coherent structure and the lack of internationally recognized standards for integrating heterogeneous data resulting from digitization can lead to the availability of these collections in digital environments becoming isolated silos. This fragmentation hinders the ability to conduct research and establish connections between diverse collections, thereby diminishing the potential for exploration and discovery that is intrinsic to the process of digitizing cultural heritage.

Dunkin (1973) proposes a differentiation between the cataloging procedures applied to conventional bibliographic materials and those considered rare. In the case of common bibliographic materials, the cataloging process is straightforward and oriented towards location and content. However, the nature of rare materials necessitates a more detailed cataloging process that extends beyond mere location and content identification. This enhanced cataloging involves the precise description of their physical characteristics, distinguishing them from conventional items, and underscoring their material nature.

Confronted with the particular requirements associated with describing rare materials, acknowledging their distinctiveness and historical significance to cultural heritage institutions, it becomes evident that conventional cataloging codes may not adequately address the necessary criteria for the appropriate management of these collections.

In accordance with the guidelines established by the Rare Books and Manuscripts Section (ASSOCIATION..., 2023) of the Association of College and Research Libraries (ACRL) and the Federation of Library Associations and Institutions (INTERNATIONAL..., 2023), it is imperative to acknowledge the significance of comprehending specific coding systems, such as the Descriptive Cataloging of Rare Books (DCRM), in addition to possessing competencies encompassing the history of the book, book arts, paleography, philology, codicology, and proficiency in the historical content, utilization, provenance of materials, and production techniques.

It is therefore imperative to ensure that institutions, both public and private, entrusted with safeguarding cultural heritage collections, enable access to rare materials on the Web through the use of detailed and standardized descriptions, combined with structured digital technologies that guarantee access, use, and reuse of these information resources.

This ongoing study proposes a Systematic Literature Review (SLR) to address the following research question: What has been the treatment of rare materials in digital libraries, which possess Linked Data characteristics, in the scientific literature of Information Science?

The overarching objective of this research is to examine initiatives that focus on the description of rare materials in digital information environments from the perspective of Linked Data. This examination is informed by an analysis of scientific production in the field of Information Science.

The specific objectives of this study include the following: an analysis of the state of the art on the description of rare materials in digital libraries with Linked Data characteristics; a presentation and identification of description standards and their characteristics; an examination of cases of description of these materials; an identification of similarities and differences in the structuring and representation of catalogs of rare materials; a mapping of description standards, instruments, and initiatives and their characteristics.

In conceptual terms, a SLR is a data collection method that seeks to ensure the verifiability and replicability of results obtained by other researchers. To this end, the method requires a detailed presentation of the search protocol, specifying the databases consulted, the search strategies used in each one, including keywords, Boolean operators, and specific syntaxes. Additionally, the document selection process is formally documented, with the inclusion and exclusion criteria applied at each stage of the study made explicit (GALVÃO and RICARTE, 2019).

As a support tool for conducting a SLR, we elected to utilize software specifically designed to assist researchers throughout all the stages of an SLR, called State of the Art Through Systematic Review (StArt)¹. As Felizardo *et al.* (2017:21) notes, StArt software is distinguished by its comprehensiveness and functionality, encompassing all the stages

¹StArt download: <https://www.lapes.ufscar.br/resources/tools-1/start-1>. Available: 23 nov. 2024.

inherent to the SLR method. The author emphasizes that the tool offers support “[...] from the planning phase, through the activities of selecting primary studies and extracting data from these studies in the conduction phase, to the data summarization phase”. The StArt software, developed at the Laboratório de Pesquisa em Engenharia de Software (LaPES) of the Universidade Federal de São Carlos (UFSCar), necessitates the prior definition of an initial protocol.

Felizardo *et al.* (2017) posits that the protocol constitutes the document that formalizes and guides the execution of the study in its entirety. Its scope encompasses all aspects of the study, from the delineation of research questions and search strategies to the formulation of guidelines for the preparation of the final report. This ensures systematicity, transparency, and replicability of the study.

It is hypothesized that this study will generate significant contributions in three main areas: academic, professional, and social. These contributions pertain to the description of rare materials in digital libraries. Within the academic domain, the research endeavors to enhance the theoretical understanding of the description of rare materials and the implementation of Linked Data. In the professional sphere, the objective is to provide support for description practices and for the adoption of standards and technologies that optimize data organization, access, and interoperability. Finally, in the social sphere, the research endeavors to facilitate the discovery and utilization of rare materials by a broader public, thereby promoting the preservation of cultural memory and fostering research and the generation of knowledge based on these collections.

Methodological procedures

The present study is characterized as exploratory and descriptive. According to Gil (2002), the objective of this classification is to provide a more comprehensive understanding of the problem under discussion and to facilitate the development of new hypotheses. Regarding the descriptive aspect, the objective was to establish relationships between variables, based on data collection carried out using standardized techniques.

The data collection process employed the SLR method, a structured procedure that can be delineated into three primary stages, subdivided into six phases. The initial stage, designated as “Planning”, encompasses the “Inception” phase, wherein the research question and study objectives were defined, and the “Protocol Definition” phase, which delineates the inclusion and exclusion criteria, the databases to be consulted, and the search strategies. The second stage, entitled “Execution”, comprises two sub-phases: the first sub-phase is “Study identification”, in which search strategies are applied to the selected databases; the second sub-phase is “Document selection”, in which the previously defined inclusion and exclusion criteria are applied to filter out the relevant studies. Concurrently, the process of “Data extraction” occurred, entailing the systematic collection of pertinent information from the selected studies. The third stage, “Summarization”, entailed the analysis and synthesis of the extracted data, which was subsequently presented and discussed.

In the “Planning” stage, a preliminary exploratory analysis was conducted on the subject “Description of rare materials in digital libraries with Linked Data characteristics”. This preliminary investigation, conducted through a non-systematic literature review, sought to

refine the understanding of the subject matter and, consequently, adjust the search terms to be employed in the formal protocol of the SLR. This exploratory analysis yielded the identification of keywords, synonyms, and key concepts relevant to the formulation of search strategies pertinent to the proposed topic.

In order to broaden the scope of the research, terms in Portuguese, English, and Spanish were used in the searches. The following keywords were utilized: “Biblioteca digital”; “Catalogação”; “Catalogação descritiva”; “Cataloguing”; “Coleções especiais”; “Datos abiertos vinculados”; “Datos vinculados”; “Descriptive cataloging”; “Digital Library”; “Library Linked Data”; “Libro antiguo”; “Linked Open Data”; “Linked data”; “Livros raros”; “Materiais raros”; “Obras raras”; “Rare materials”; “Rare works”. For each database consulted, a specific string was created, adapted to its syntactic and functional particularities. The StArt tool facilitates the documentation of each string, inclusive of the corresponding database, the date of the search, and pertinent observations for interpreting the results.

The types of studies accepted for this review were limited to journal articles, with no restrictions on the period of publication. The following databases were utilized to identify relevant articles: Scopus; Library, Information Science & Technology Abstracts with Full Text (LISTA); Taylor & Francis; Google Scholar; and Base de Dados de Periódicos em Ciência da Informação (BRAPCI).

Inclusion and exclusion criteria were applied to filter the search results and align them with the research’s scope. The inclusion criteria were as follows: firstly, the study must address the description of rare materials in digital libraries; secondly, the study must address the description of rare materials in digital libraries with Linked Data characteristics; thirdly, the study must discuss initiatives and projects for the description of rare materials in digital libraries; lastly, the study must address the tools used in the description of rare materials in digital libraries. Conversely, the following exclusion criteria were defined: (E) the study is not in the established languages (Portuguese, English, or Spanish); (E) the study is not in the established format (journal article); (E) the study does not address the topic of interest or only mentions it superficially; (E) the full document is not available via the journal portal, institutional link with UFSCar, or cannot be located with free access in the Web environment.

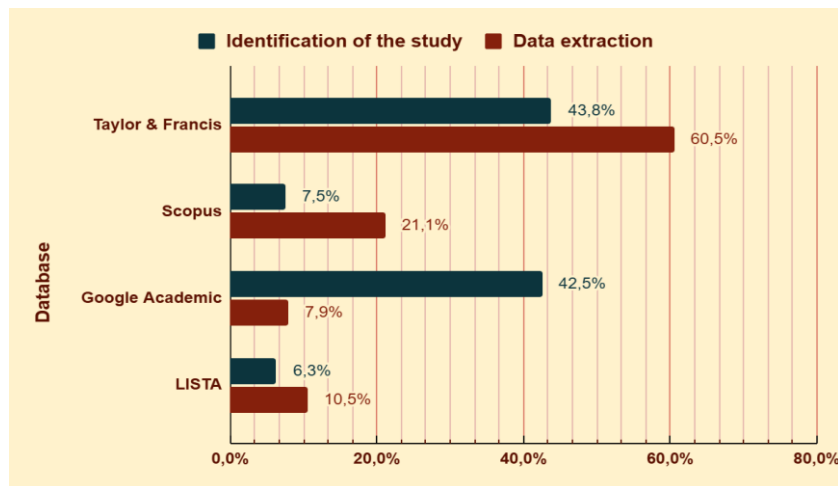
The project commenced with a SLR, the objective of which was to identify the description of rare materials in digital information environments from the perspective of linked data in the scientific literature of information science. After the completion of the aforementioned SLR, an empirical study will be conducted, encompassing four primary stages. The initial stage will entail the analysis of the catalogs of digital libraries that provide access to collections of rare materials, with the objective of identifying prevailing description practices. The subsequent stage will entail the identification of the standards, models, and description tools employed in these catalogs, with the objective of mapping the predominant approaches. The third stage will entail electronic communication with the professionals responsible for the digital libraries examined, with the objective of clarifying any uncertainties and acquiring further information regarding the practices employed. The final stage will entail the systematization of the findings in the form of a summary table, which will elucidate the patterns of representation identified and the initiatives adopted by the institutions, thereby providing a comparative perspective on the empirical study's outcomes.

Partial results

The search yielded a total of 160 documents, which are distributed across various databases as illustrated in Graph 1. Scopus contributed 7.5% (12 documents), Library, Information Science & Technology Abstracts with Full Text (LISTA) 6.3% (10 documents), Taylor & Francis 43.8% (70 documents), and Google Scholar 42.5% (68 documents). The Base de Dados de Periódicos em Ciência da Informação (BRAPCI), although initially selected, did not return any useful results due to technical limitations that prevented an advanced search from being carried out. The restrictions imposed included the inability to implement the complete search strategy, which necessitated the use of all the necessary Boolean operators. The search was further constrained to the utilization of the “AND” operator.

Following the preliminary document search, the selection criteria were implemented. At this stage, documents that were duplicates or did not meet the previously established inclusion and exclusion criteria were identified, resulting in the elimination of 120 documents. In the subsequent data extraction stage, the remaining documents were analyzed, which led to the exclusion of a further nine documents. The exclusion of these documents was substantiated by the observation that, upon examination of the abstract and selected sections of the text, it was determined that these documents did not align with the predetermined extraction categories outlined in the protocol. Consequently, their inclusion would not contribute to the attainment of the research objectives.

Graph 1 - Percentage of accepted articles and comparison of the efficacy of study identification versus data extraction



Source: Prepared by the authors (2024).

At the end of the selection stages, the set of documents to be analyzed comprised a total of 29 articles, representing 18.1% of the initial set of documents retrieved from the databases. This final set will be subjected to a detailed analysis, guided by the extraction categories previously defined in the protocol of the SLR. The number of documents defined can be seen in Table 1.

Table 1 – Data extraction, accepted articles

N.	Base	Author	Title	Year
1	Taylor & Francis	Martin, K. E.	Marrying local metadata needs with accepted standards: the creation of a data dictionary at the University of Illinois at Chicago	2011
2	LISTA	Gracy, Karen F.; Zeng, Marcia Lei; Skirvin, Laurence	Exploring methods to improve access to Music resources by aligning library Data with Linked Data: a report of methodologies and preliminary findings	2013
3	Taylor & Francis	Niu, Jinfang	Provenance: crossing boundaries	2013
4	LISTA	O'Dell, Allison Jai	RDA and the Description of Zines: metadata needs for alternative publications	2014
5	Taylor & Francis	Diao, Junli; Hernández, Mirtha A.	Transferring cataloging legacies into descriptive metadata creation in digital projects: catalogers' perspective	2014
6	Taylor & Francis	Arlitsch, Kenning	Being irrelevant: how library data interchange standards have kept us off the internet	2014
7	Taylor & Francis	Skinner, Julia	Metadata in archival and cultural heritage settings: a review of the literature	2014
8	LISTA	Mathews, Emilee; Smart, Laura J.	Piloting Linked Open Data on artists' books: a case study in interoperability and sustainability	2016
9	Taylor & Francis	Thompson, Timothy A.; Baxmeyer, Jennifer; Bell, Joyce; Green, Peter	From notes to annotations: dedications as data in the Library of Jacques Derrida at Princeton University	2016
10	Taylor & Francis	Farneth, David	How can we achieve GLAM? understanding and overcoming the challenges to integrating metadata across museums, archives, and libraries: Part 2	2016
11	Google Scholar	Almeida, Regina Oliveira de; Silva, Regiane Cristina Lopes da; Costa, Márcia Valéria da Silva de Brito	Coleção memória da enfermagem e nutrição da Biblioteca Setorial de Enfermagem e Nutrição (BSEN) da Universidade Federal do Estado do Rio de Janeiro (UNIRIO): preservação da memória na área de ciência da saúde	2017
12	Taylor & Francis	Buck, Tina Herman; Church, Melanie J.; Foster, Anita; McHugh, Elizabeth; Robertson, Jessica; Rodriguez, Michael; Shenk, Audrey	Serials spoken here: reports of conferences, institutes, and seminars	2017
13	LISTA	O'Keefe, Elizabeth; Wacker, Melanie; L'Ecuyer-Coelho, Marie-Chantal	The outcome of the artframe project: a domain-specific BIBFRAME exploration.	2019
14	Google Scholar	Wegner, Alia Levar; Hilles, Stefanie	Metadata obscura: reorientando las colecciones digitales a través de la perspectiva de la historia del arte	2019
15	Scopus	Darlington-Rielly, J.	Music ephemera within library collections: a review of the literature	2019
16	Taylor & Francis	Seymore, Sarah E.; Simic, Julia	Enhancing Opaquenamespace.org: Refinement of local name authority files and workflows	2019

17	Taylor & Francis	Mulrennan, Kirsten	Lessons in making the unique ubiquitous: diversifying the role of the special collections and archives department to enhance teaching and learning at the University of Limerick	2020
18	Taylor & Francis	Dragon, Patricia M.	Form and genre access to academic library digital collections	2020
19	Taylor & Francis	Apenite, Marite	Subject indexing at the National Library of Latvia: new approach, challenges, and benefits	2021
20	Taylor & Francis	Heng, Greta; Cole, Timothy W.; Tian, Tang (Cindy); Han, Myung-Ja	Rethinking authority reconciliation process	2022
21	Taylor & Francis	C. Klose, Annamarie; Goldstein, Scot; Levy, Morris S.	Numismatics & bibliographic description: how Rutgers University Libraries described coins with MODS	2022
22	Taylor & Francis	Zetty, Janelle; Plaisance, Heather C.	Cross-Departmental authority heading creation: a case study	2022
23	Scopus	Candela, G.	Towards a semantic approach in GLAM Labs: the case of the data foundry at the National Library of Scotland	2023
24	Scopus	Yamson, G.C.	Immediacy as a better service: analysis of limitations of the use of ChatGPT in library services	2023
25	Taylor & Francis	Seeman, Dean; Chan, Tiffan; Dykes, Karen	Implementation and maintenance of FAST as linked data in a digital collections platform at university of victoria libraries	2023
26	Taylor & Francis	Colucci, Emily M.	The music encoding initiative: facilitating open access for musical notation	2023
27	Scopus	Gaitanou, P.; Andreou, I.; Sicilia, M.-A.; Garoufallou, E.	Linked data for libraries: creating a global knowledge space, a systematic literature review	2024
28	Taylor & Francis	Luke, Stephanie M.; Han, Myung-Ja; Stratton, Trevor	Changes in digital collections and their metadata: a longitudinal study of UIUC Digital Library	2024
29	Taylor & Francis	Bertoldi, Hanna; Narlock, Mikala	For the people: how we make online LAM collections more democratized	2024

Source: Research data (2024).

The articles selected for analysis covered the languages defined in the research protocol (Portuguese, English and Spanish) and, although the search did not impose any time restrictions, the analysis of the distribution of the selected articles shows that the publications cover the period from 2011 to 2024.

After the execution phase, which included the search, study identification, document selection and data extraction phases, the resulting mass of documents was consolidated into 29 articles. The selected articles form the basis for the subsequent stages of the research, which will consist of summarizing the results obtained. This synthesis will be carried out in such a way as to allow a more exhaustive analysis of the extracted data, guided by the categories previously established in the search protocol. The results of the SLR will form the theoretical basis for the subsequent empirical study.

Concluding thoughts

Regarding the 29 articles selected in the data extraction phase, there is a temporal distribution covering the period from 2011 to 2024, as shown in Table 1. An analysis of the annual distribution shows that the years 2014, 2019 and 2023 have the highest concentration of publications, with four articles each. On the other hand, the years 2011 and 2021 have the lowest number of articles, with only one article published in each of these years.

The analysis of the frequency of articles per database shows a predominance of the Taylor & Francis database, which concentrates 18 of the 29 articles selected, corresponding to approximately 62% of the total. Next, the LISTA database stands out with 5 articles, representing about 17% of the set analysed. Scopus contributed 4 articles, or about 14% of the total, while Google Scholar had a smaller share, with only 2 articles, or about 7%.

Finally, the research aims to contribute to the field of information science by providing relevant theoretical, methodological and technological inputs for the description of rare materials in digital libraries. The emphasis on the description and structuring of metadata reaffirms its crucial role in transforming abstract data into tangible and manipulable resources, as highlighted in the literature. In this sense, description, as an intrinsic element of knowledge organisation and technology, is inextricably linked to the materiality of information resources, whether physical or digital. By enabling the location, retrieval, accessibility and comprehensibility of these resources, description plays a fundamental role in the preservation and dissemination of cultural heritage, especially in the context of digital libraries and linked data. It is hoped, therefore, that the results of this study can guide future research and professional practice, helping to improve the way in which rare materials are described, organised and made available in the digital environment.

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