DOCUMENTARY LANGUAGES APPLIED TO INFORMATION RETRIEVAL IN LIBRARIES: a review of EBSCO Discovery Service System

Linguagens documentárias aplicadas à recuperação de informação em bibliotecas: uma revisão do EBSCO Discovery Service

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Abstract

This paper provides an overview of documentary languages applied to the information discovery service called EBSCO Discovery Service (EDS), created and maintained by EBSCO (United States of America). The focus of the present paper is exclusively to evaluate EDS discovery system and how it adopts documentary languages. The goal of a discovery system is to provide a unified retrieval of descriptive bibliographic records from different sources of physical collections - print documents and physical media - and electronic collections - digital documents in the online format. Briefly, through a bibliographic survey in Information Science, it addresses the evolution of information search and retrieval methods: public access catalogs, metasearch systems and discovery services. It compares them and illustrates the advantages of incorporating subject indexing, controlled vocabularies, knowledge graphs, and concept maps in information retrieval tools. We conclude that using documentary languages in the EBSCO discovery service provides a greater capacity for information retrieval for end users, as well as new possibilities for obtaining documents and information in different knowledge domains.

Keywords: Information retrieval; Access to information; Indexing; Discovery services; Search engines.

Resumo

Este trabalho fornece uma visão geral da aplicação de linguagens documentárias no serviço de descoberta de informação EBSCO Discovery Service (EDS), criado e mantido pela empresa EBSCO (Estados Unidos). O foco desse estudo é exclusivamente avaliar o sistema de descoberta EDS e como ele adota linguagens documentárias. O objetivo de um sistema de descoberta é proporcionar a recuperação unificada de registros bibliográficos descritivos de diferentes fontes de coleções físicas (documentos impressos e em mídia física) e coleções eletrônicas (documentos digitais em formato on-line). Aborda, através de levantamento

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bibliográfico da área da Ciência da Informação, a evolução dos métodos de busca e recuperação da informação – catálogo de acesso público, sistemas de metabusca e serviço de descoberta, realizando uma comparação entre os mesmos e indicando as vantagens da incorporação de índices de assunto, grafo de conhecimento, mapas de conceitos, vocabulários controlados e tesauros nas ferramentas de recuperação da informação. Este artigo conclui que a adoção de linguagens documentárias no serviço de descoberta da EBSCO proporciona maior capacidade para busca e recuperação de informações para os usuários finais, assim como proporciona novas possibilidades de obtenção de documentos e informações em diferentes domínios de conhecimento.

Palavras-chave: Recuperação de informação; Acesso a informação; Indexação; Serviços de descoberta; Mecanismos de busca.

1 Introduction

The idea of "information retrieval" is in the genesis of Information Science itself. Retrieving information means providing a person searching for information with the capacity to find it after it is organized, regardless of its nature or medium, in order to transform and to have the ability to transform society. The information retrieval process relies on techniques and tools for both physical and electronic information retrieval. Regardless of whether the search tool is physical or digital, its purpose is to enable users to search and retrieve the primary information that is described, using patterns of descriptive and thematic representation, relying heavily on documentary languages. Such documentary languages can be considered as standardized languages, constructed with specific terms from an area of expertise, functioning as terminological instruments that allow understanding that knowledge field and its development. In this sense, there can be a variety of documentary languages, from controlled lists of terms and descriptors called "controlled vocabularies", to thesauri – with stipulated logical-semantic relationships, ontologies, concept maps, among many others. The Documentary Language / Terminology intersection occurs at a time when "technical-scientific terms are used as descriptors, units that support the so-called Documentary Language that provides information retrieval systems" (Krieger & Finatto, 2004, p. 59). Therefore, the triad connection between Documentary Language, Terminology and Information Retrieval, proposed in this paper to improve information search and retrieval, becomes evident.

Henning Spang-Hanssen (1970, p. 6) reinforces the importance of "information", "information retrieval" and "documentation work" for the image of library, and librarians' work.

Users can retrieve information by accessing it directly or through its representation (metadata) in traditional catalogs or in systems based on information and communication technologies. In this sense, Gernot Wersig (1993, p. 230) points out that:

> libraries and retrieval systems only are different solutions to a basically identical problem which is not questioned any more. Consequently, new technologies arising in the same field could easily be adapted to similar solutions and promise an expanded field of information science based on that same assumption-expert systems, multimedia systems.

Therefore, from this point of view, new technologies are expected to be continuously developed and applied to information retrieval, with the goal of broadening the reach of libraries and Information Science itself.

In the field of information, terminology and documentary languages provide users with the capacity to obtain a uniform representation of terms and concepts and to improve information retrieval, because they use verbal patterns that allow referring terms (subjects) from preferred to non-preferred and vice versa, in the same unified list, streamlining and rationalizing the entire process to optimize information retrieval, in that case, in different databases. Retrieving information is much more than retrieving "text". Buckland (1991) claims that

> Traditionally information storage and retrieval systems have emphasized text and text-like records such as numbers and lists of names. The present interest in image-handling serves to remind us that not all phenomena of interest in information science are textual or text-like, or are even communications. We are reminded, in particular, that information storage and retrieval needs to be considered in relation to any phenomena that someone may wish to observe: events, processes, images, and objects as well as texts. (Buckland, 1991, p. 586).

Therefore, Information Science and the tools created for information search and retrieval also need to consider representations in the form of images, beyond text, as pointed out by Buckland (1991). In this article, the topic of textual and visual tools, like concept maps, for example, is addressed and how it can be used by libraries to support information search and retrieval in catalogs and other tools based on information technology.

With the goal of enabling an integrated search of these different sources of information, currently, libraries can use integrated search tools called "discovery services". According to Santana:

> Os serviços de descoberta são sistemas de busca, com a função de integrar conteúdos informacionais de variadas fontes de dados, sejam elas remotas, como aquelas disponíveis em plataformas de editores ou agregadores, ou fontes locais como os sistemas de gerenciamento de bibliotecas, bibliotecas digitais, repositórios institucionais, dentre outras (Santana, 2014, p. 2) [Discovery services are search systems with the purpose of integrating informational content from a variety of data sources, whether they are remote, such as those available on editor or aggregator platforms, or local sources such as library management systems, digital libraries, institutional repositories, among others].

One important feature that characterizes a discovery system is its capacity to create a central index of metadata for unified search and retrieval:

> These [discovery] services harvest content from local and remotely hosted repositories and create a vastly comprehensive centralized index – to the article level – based on a normalized schema across content types, well suited for rapid search and retrieval of results ranked by relevancy. Content is enabled through the harvesting of local library resources, combined with brokered agreements with publishers and aggregators allowing access to their metadata and/or full-text content for indexing purposes (Vaughan, 2011, p. 6).

Therefore, according to Vaughan (2011), discovery systems increase the capacity to search and retrieve sources of information, since they include records from local and remote sources, enabling the user to "discover" more sources of information in a single search.

The goal of the present paper is to determine how the use of documentary languages (considered as remissive terminological standards) can expand and improve information retrieval through discovery systems, specifically in the case of the EBSCO Discovery Service by EBSCO, including three methods for searching and retrieving information records: an online catalog, a metasearch tool and a discovery service. Next, specific characteristics and features of the EBSCO Discovery Service™ (EDS), the focus of this paper, are presented. Finally is presented an analysis of how documentary languages are applied by the EBSCO Discovery Service.

The methodology used in the present paper was a bibliographic literature review in the area of Library and Information Science with respect to information retrieval, discovery services and documentary languages, including publications by the EBSCO service company regarding the EBSCO Discovery Service. This methodology is descriptive and exploratory with an exclusive analysis of how EBSCO Discovery Service implements documentary languages.

2 Tools for information search and retrieval

Online catalogs were one of the first systems based on information technology, created to optimize the information search and retrieval process for libraries using technology. It was an evolution from catalogs based on card catalogs arranged in alphabetical order in drawers of physical cabinets. Morgan (1999) points out that

> In many ways the card catalog was also an innovation. First of all, since it was located in a public space, the catalog became a tool available to anybody, not just librarians. Second, by organizing its contents by subjects as well as organizing the collection by subject, the catalog, in many ways, mirrored the contents of library shelves (Morgan, 1999, p. 38).

When online catalogs based on computer systems emerged, there was one more innovation, which began to allow remote consultation of the catalog, outside of the library's space: "Electronic card catalogs removed some of the problems of physical card catalogs [...]. It was now possible to search a library's collection from a distance beyond the walls of the library" (Morgan, 1999, p. 38). These new online catalogs began to promote a greater capacity to search and retrieve, without having to know the subjects beforehand: "Keyword and freetext searching functions reduced the need to know (or discover) controlled vocabulary terms used to describe a catalog's content" (Morgan, 1999, p. 38).

After the advent of online catalogs, created to substitute printed card catalogs as cited by Morgan (1999), and with the emergence of editor databases, first a technology was developed that simultaneously carried out distributed and real-time searches directly in these databases. This technology was called a "federated search" or "metasearch", and its purpose was to retrieve bibliographic records by sending multiple consultations to remote information resources simultaneously. However, these "metasearch" systems have some limitations due to their "distributed" architecture, as pointed out in 2005 by Marshall Breeding:

> The "distributed search" architecture behind the current generation of metasearch products involves real-time queries cast to multiple remote resources. This model depends on live connections to multiple remote resources that use some type of search and retrieve protocol. The metasearch application receives the results from each remote resource, parses and processes the records returned, and displays the results to the searcher. This real-time distributed search model suffers from a number of inherent limitations. For one thing, the number of live connections that

> can be sustained simultaneously is limited. Also, the slowest-performing remote service defines the best performance of the overall search transaction (Breeding, 2005, p. 28).

According to the points highlighted by Marshall Breeding (2005), metasearch systems have limitations that led him to believe that a new approach was needed in order to provide an integrated search in different bases and catalogs: “Simpler, faster search and retrieve protocols will help increase the efficiency of the current metasearch products, but I'm convinced that an entirely new approach is needed” (Breeding, 2005, p. 28) and this is why he claims that “the emergence of Google Scholar demonstrates that creating a centralized search service of library-oriented scholarly resources may be more attainable than previously expected” (Breeding, 2005, p. 29), since such systems rely on search systems based on central indexes created from a prior collection of metadata: “Google's general Web search service indexes more than 8 billion items, sustains thousands of requests per second, and still delivers almost-instant responses” (Breeding, 2005, p. 28). Breeding concludes that in order to search in a large number of sources, indexes built in advance must be used:

> Searching on the scale of the Web could not possibly function in a distributed search model. Could you imagine a search service that depended on a dynamic query sent to all known Web servers? It just wouldn't work. Searching a large number of targets demands pre-built indexes (Breeding, 2005, p. 28).

Marshall Breeding then highlights the advantages of centralized search indexes, such as those used by Google Scholar, in comparison with metasearch tools, which execute multiple, simultaneous and “real-time” searches in different databases:

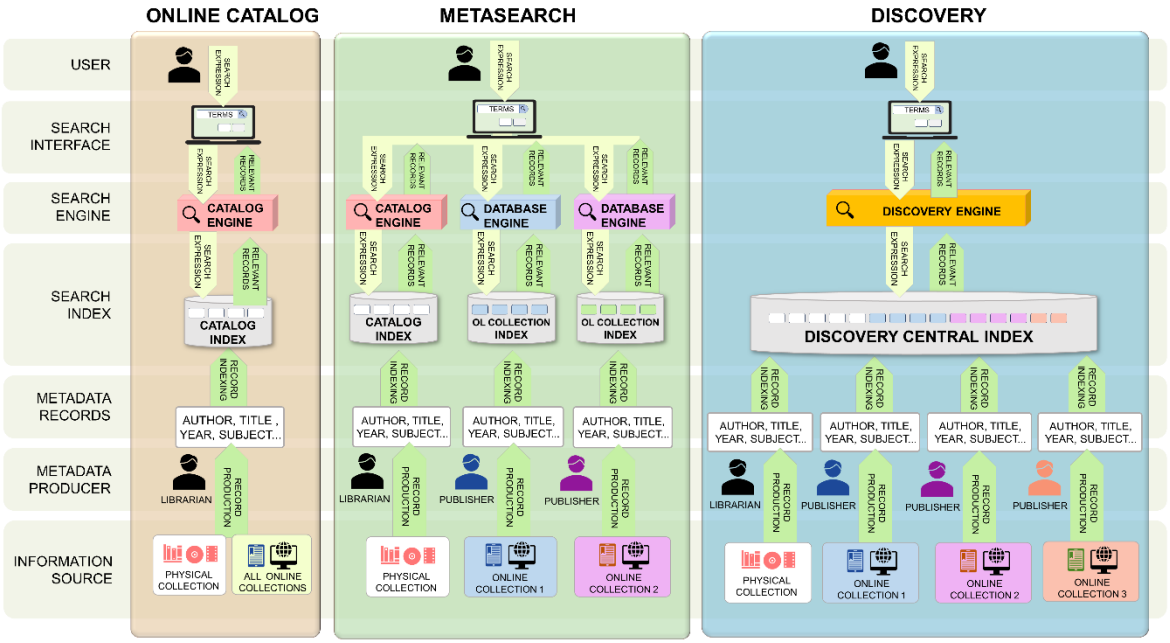
> It now seems clear to me that the current strategy of metasearch that depends on live connections casting queries to multiple remote information sources cannot stand up to search systems based on centralized indexes that were created in advance based on harvested content. I think of these competing approaches as "distributed search" and "centralized search," respectively (Breeding, 2005, p. 27).

Metasearch tools were developed and used by libraries for a period in the 2000s, but due to their limitations, in 2009, “library discovery services” were created, which allowed for the unified retrieval of bibliographic records from a previously indexed central index of metadata.

Considering that discovery services rely on a central index of metadata, different sources of information can be indexed, such as library catalogs, open access bases, commercial bases and digital libraries of documents created in the institution itself. In sum, any resource can be described in the form of metadata.

With discovery tools, users continue to use the method of entering keywords into a single search box, but now retrieval is done by multiple sources that were previously indexed in a central index. Figure 1 presents a logical comparison of how the three aforementioned technologies operate.

Figure 1 - A logical comparative schematic between the online catalog, metasearch tool and discovery system to search and retrieve records from informational resources in libraries



Source: Created by the authors (2024)

Upon comparing the three search and retrieval technologies, one can see that in the online catalog, users retrieve records only described by the librarian; in the metasearch, they retrieve them from sources described by the librarian and from other sources, but in parallel and in “real time”; and in discovery, they retrieve them from all sources in a unified manner from a previously indexed central index. In the comparative analysis, one can see that discovery has a greater capacity of

sources and records to be indexed, since it does not depend on live connections, thus greatly broadening the capacity for search and retrieval.

When he elaborates on the first concepts of this new technology called "discovery", Marshall Breeding (2010) claims that

> Initially, these new tools were called *next-generation library catalogs*, but now I prefer to call them discovery interfaces. They aim to provide access to all aspects of library collections, not just those managed in the traditional library catalog, which is limited to the content managed by the integrated library system. It's all about helping users discover library content in all formats, regardless of whether it resides within the physical library or among its collections of electronic content, spanning both locally owned materials and those accessed remotely through subscriptions (Breeding, 2010, p. 1).

Novaes (2011) mentions the importance of information search tools, which combine the sciences of documentary linguistics and computer science for information retrieval:

> Na atualidade, grande parte das diferentes formas de organização de bancos de dados na informática visa a armazenar material – muitos deles, linguísticos – e disponibilizá-lo ao usuário/autor, a fim de que tenha uma gama de recursos para suas produções na constituição do seu discurso (Novaes, 2011, p. 97-98) [Currently, a large part of the different ways to organize databases in computer science aims to store materials – many of them, linguistic – and make them available to the user / author, in order for them to have a range of resources for their productions in the developing their discourse].

Denise Novaes (2011) also states how language has the capacity to improve search systems: "Acreditamos, a partir de uma compreensão mais competente da estrutura e do funcionamento da linguagem, e do conhecimento de suas possibilidades, que seja possível um melhor ajuste de instrumentos de busca e de editoração" (Novaes, 2011, p. 98) [We believe, based on a more competent understanding of the structure and function of language, and on the knowledge of its possibilities, that a better adjustment of search and editing instruments is possible].

In the next section, the characteristics and features of the EBSCO Discovery Service (EDS) tool are described and, also, it is described how EDS uses different documentary languages with the goal of improving the search for information, and how the results of information retrieval are presented to end users in its user interface.

3 EBSCO Discovery Service™ (EDS) system

The EBSCO Discovery Service (or "EDS") is developed and maintained by EBSCO Information Services (https://www.ebsco.com), provided in the SaaS ("Software as a Service") model for online access through a web browser, mobile application and API. As stated by the company, the EBSCO Discovery Service "supports integrated searching of content from full-text databases, citation databases, and local content collections such as library catalogs and other locally managed digital collections" (EBSCO Discovery Service (EDS) - Information Sheet, 2020) Moreover, according to EBSCO, its discovery service uses an index that pre-indexes the metadata of heterogeneous sources: "The integrated search experience is achieved by compiling and indexing metadata from a variety of content sources into a unified pre-indexed search platform" (EBSCO Discovery Service (EDS) - Information Sheet, 2020).

Next, it will be presented how the EBSCO Discovery Service indexes bibliographic content and what are its main features for search and retrieval.

3.1 Indexed content on the EBSCO Discovery Service

According to information from the company, the central index of metadata from the EBSCO Discovery Service has a collection of around 4 billion bibliographic records, obtained from different sources and updated dynamically based on metadata sent by different editors and content providers:

> The EDS index represents a comprehensive collection of more than 3.7 billion records from the world's top publishers and information providers. EDS features searchable full text from approximately 11,000 different publishers through the index, many of which also include full text for searching [...] The agreements EBSCO has in place publishers and other content providers emphasize partnerships where rich metadata is provided (e.g., author-supplied abstracts, author-supplied keywords, author affiliations, etc.) (EBSCO Discovery Service (EDS) - Information Sheet, 2020).

The index of the EBSCO Discovery Service is fed by records sent periodically and in advance by information publishers and providers. Moreover, libraries can also include in the index bibliographic records from their own sources of information, such as "customized catalogs", including their online public access catalog (OPAC), their institutional repository, their journal

portal or even a collection of digital documents, such as e-books or theses in different record formats, such as MARC21, MARCXML, UNIMARC, Dublin Core or other formats of compatible metadata (EBSCO Discovery Service (EDS) Custom Catalog Questionnaire, 2022). As for the delivery method, records can be uploaded to the FTP server from EBSCO or, if supported by the provider, through the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) (Using OAI-PMH to Create and Maintain Records, 2020).

3.2 Features of the EBSCO Discovery Service

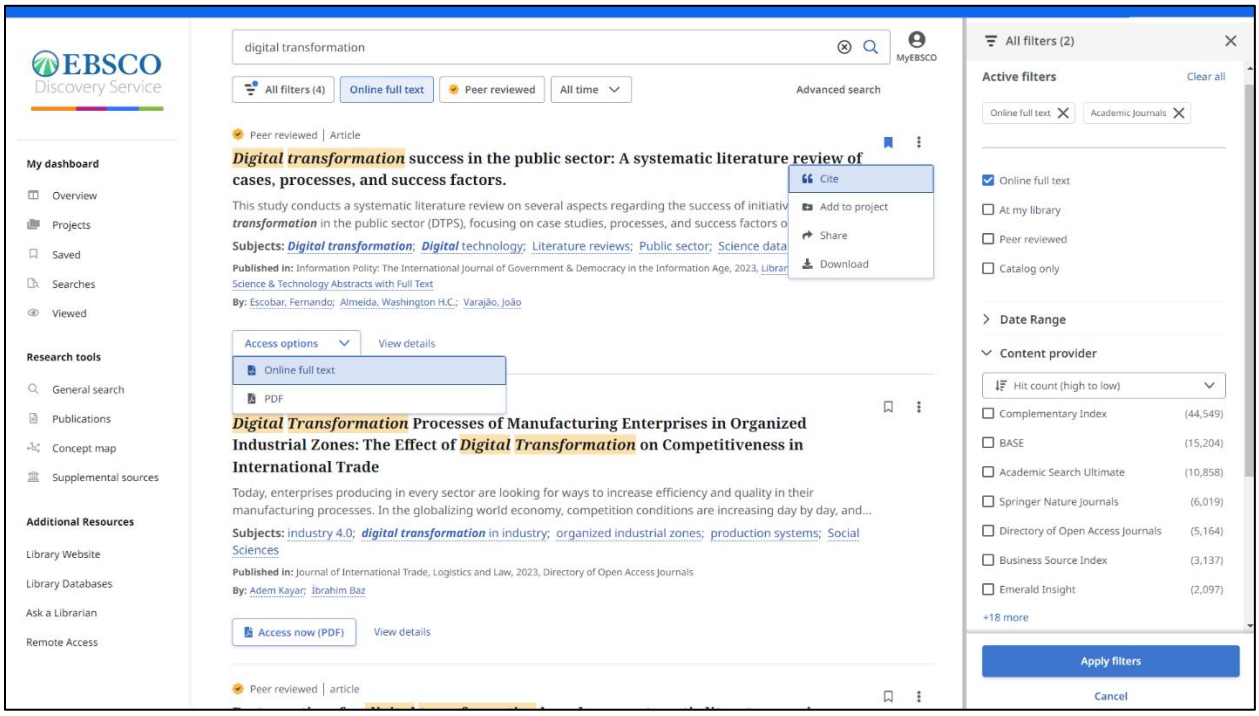
EDS discovery service provides end users with a search interface so that they can enter terms and retrieve relevant records from the unified index of metadata.

In 2020, EBSCO launched a new version of its discovery service, called the "New EBSCO Discovery Service™". With this new version, EBSCO stated that the service fulfills a "user journey" by providing the actions of accessing, searching, choosing and using to modernize the features of its discovery tool:

> Access. Search. Choose. Use. These are the stages of the library user's journey. However, users take similar journeys with Netflix, Amazon, Spotify or Google, and their experiences with the personalized dashboards, sharing options, and recommendation capabilities on these platforms have shaped their user interface expectations. Rather than reinvent the wheel when it comes to upgrading discovery tools, the new version of EBSCO Discovery Service™ (EDS) combines the popular features of these commercial websites with the functionalities necessary for libraries (Learning to Search/Searching to Learn, 2020).

As a basic feature of the EBSCO Discovery Service, users enter the terms/words in a search box, activate the search (by clicking/touching the magnifying glass icon or pressing ENTER on the keyboard) and then the tool lists the results on the screen, as illustrated in Figure 2. One can see results obtained from different sources, their descriptive metadata, different options for limiting or filtering the results, full-text access options and tools:

Figure 2 – Screen with partial list of search results from the EBSCO Discovery Service interface



Source: EBSCO Discovery Service user interface (2024).

Each individual result returned also enables users to access the respective detailed record, by clicking on the title of the resource or the link “View Details”. Additionally, users can use tools that allow them to save the record as a favorite (Bookmark), copy the record citation (Cite), add the record to a project (Add to project), share it in the cloud or by email (Share), or even download the full text or the metadata of the retrieved result (Download).

Some additional characteristics and features noted by the company about the EBSCO Discovery Service include: “Relevance ranking [...], Value ranking [...], Enhanced subject precision [...], Query Term Adjacency [...], Intuitive search [...], Subject-specific profiles [...], Research Starters [...], Journal Discovery [...], Access to full text [...], ILS Integrations […]” (EBSCO Discovery Service (EDS) - Information Sheet, 2020).

The application of documentary languages aims to provide terminological consistency, increase the reach of the search, increase its thematic precision and improve the capacity to retrieve

from heterogeneous sources. In the following section it will be highlighted which documentary languages are applied to the EBSCO Discovery Service to meet these goals.

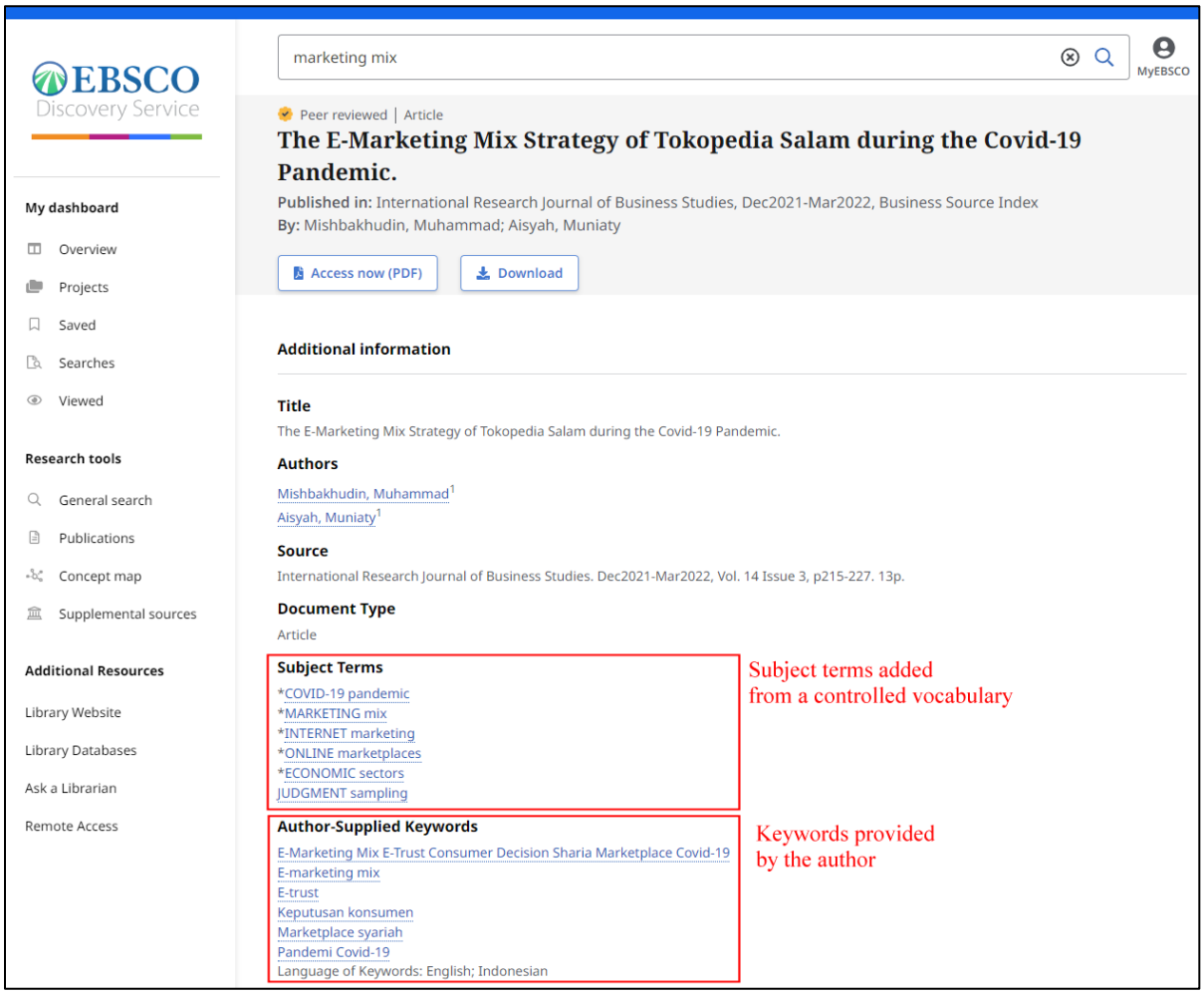
4 Documentary languages applied to the EBSCO Discovery Service

4.1 Subject descriptor terms

As previously indicated in this paper, documentary languages are part of the representative scope of instruments applied to information that standardize terms and make their retrieval more dynamic and optimized. In that regard, and with the aim of providing updated and specialized information for public users, the basic documentary language that the EBSCO Discovery Service uses is controlled thematic representation, in the form of subject descriptors which accompany descriptive records. The EBSCO Discovery Service enables retrieval based on metadata, including subject terms, whether provided by the author, or included in the records by the editors themselves, or added by the EBSCO team.

Figure 3 shows an example of a record returned in the discovery tool, containing subject descriptors informed by the author (Author-Supplied Keywords) and those included by the EBSCO team (Subject Terms), based on the controlled vocabulary of terms.

Figure 3 – Example of a bibliographic record from a database in the EBSCO Discovery Service with thematic subject descriptors from the controlled vocabulary added to the record by EBSCO, and keywords provided by the author



Source: EBSCO Discovery Service user interface (2024).

The use of terminology aims to improve record retrieval in library and information systems. Cabré (2010) points out that:

> En efecto, en el caso de la documentación, la terminología es un elemento clave para representar el contenido de los documentos y para acceder a ellos. Los thesaurus y las clasificaciones son básicamente inventarios terminológicos organizados temáticamente y controlados formalmente (Cabré, 1995, p. 12) [in the case of documentation, terminology is a key element to representing the content of documents and accessing them. Thesauri and classifications are basically terminological inventories organized thematically and controlled formally].

Therefore, one can argue that retrieval tools operate more efficiently to deliver results to users when they use terminologies. Wersig and Neveling (1976) state that a thesauri is "a controlled and dynamic documentary language containing semantically and generically terms, which comprehensively covers a specific domain of knowledge" (Wersig & Neveling, 1976, p. 118). Therefore, incorporating terms from a thesauri in discovery systems improves indexing and search consistency, captures hierarchical and associative relationships, and increases precision and recall in retrieving relevant records. These benefits contribute to a better search experience and information discovery on the part of users.

In addition to records cataloged by librarians, discovery systems include metadata records produced by editors. According to Vaughan (2011):

> Publisher agreements can permit these discovery services to index their content and provide access to citation-level metadata within the central index to all customers regardless of whether the local library itself has a licensing agreement with that publisher and has purchased access to this content. [...] In addition, each of these discovery services includes a huge amount of open-access content (Vaughan, 2011, p. 10).

By allowing discovery services to index their content and make metadata available at the citation level, editor contracts expand the reach and visibility of academic knowledge even more, promoting the wide and effective dissemination of research and scientific discoveries that are part of their publications.

4.2 Controlled vocabularies, thesauri and knowledge graphs

Controlled vocabularies and thesauri (considered as types of documentary languages) provide greater precision for information search and retrieval when they are incorporated into online catalogs, discovery services or the databases that contain them. According to Lima (2010):

> Para garantir uma adequada representação e recuperação da informação, em quaisquer bases de dados, utiliza-se uma linguagem documentária, isto é, um vocabulário controlado ou um tesauro, para controlar sinonímia, ambiguidades e as relações entre os descritores utilizados no processo de indexação, seja ele manual ou automático (Lima, 2010, p. 3) [In order to guarantee adequate representation and retrieval of information, in any database, a documentary language is used, that is, a controlled vocabulary or a thesauri, in order to control

> synonymy, ambiguities and the relations between descriptors used in the indexing process, whether manual or automatic].

By adopting controlled vocabularies and thesauri, information search and retrieval systems aim to improve the precision and relevance of results and provide greater thematic consistency of resources. EBSCO reports that it uses thesauri and controlled vocabularies to search and retrieve information in its databases indexed in the central index of the EBSCO Discovery Service, in which two or more vocabulary subject headings from the Comprehensive Subject Index are added by EBSCO to each article:

> In order to enable the most powerful searching of these databases, EBSCO has created a thesaurus of terms known as the Comprehensive Subject Index (CSI). Each article indexed by EBSCO is associated with two or more subject headings from this vocabulary which describe the specific content of that article. The use of a controlled list of subject headings allows every article on a given subject to be indexed with the same terms, regardless of the synonyms or circumlocutions used in the article itself. Use of the CSI also ensures that subjects are indexed at an appropriate level of detail (What is EBSCO's Controlled Vocabulary?, 2018).

Additionally, EBSCO states that it performs terminology mapping between subject indexes, in order to improve search and retrieval: "Subject indexes contain controlled vocabularies, which link concepts with different terminology. EBSCO Discovery Service (EDS) includes complex mapping technology to leverage and connect these for improved search results" (Quality Data & Precision Search, 2023). The subject thesauri and vocabularies used by EBSCO to enrich the records from their central index include: the American Medical Association Complete Medical Encyclopedia, APA PsycInfo − Thesauri, Blackwell Encyclopedia of Management Library − Subject Terms, ERIC − Thesauri, FSTA - Food Science and Technology Abstracts − Thesauri, GLBT Thesauri, Library, Information Science & Technology Thesauri, MEDLINE − Medical Subject Headings – MeSH, MLA International Bibliography − Terms Thesauri, Petroleum Abstracts Thesauri, Political Science Thesauri, Psychology and Behavioral Sciences Collection – Subjects, Sports Thesauri, among dozens of others (Which EBSCOhost database authorities, 2020).

Another tool used by EBSCO is "Enhanced Subject Precision", which performs terminology equivalence mapping between different vocabularies and thesauri":

> Enhanced Subject Precision utilizes mapped vocabulary terms from multiple sources and uses natural language to add precision for topical searches. When a user's search term matches a known concept, records about the concept receive an additional relevance boost. Multilingual search queries are also mapped to increase opportunities for concept matching (How is relevance ranking determined, 2020).

According to Lima (2010), using terminology in an information system provides knowledge transfer between whomever registers the information and whomever consumes the registered information:

> Ao utilizar a terminologia de um domínio, na construção de uma linguagem documentária em um sistema de informação, possibilita-se a transferência do conhecimento, pois as informações documentárias produzidas com um referencial terminológico garantem o consenso entre os interlocutores de uma área (Lima, 2010, p. 22) [When using the terminology of a domain to build a documentary language in an information system, knowledge transfer is possible, since documentary information produced with a terminological reference guarantees consensus between the interlocutors of an area].

A terminological description can be in one knowledge domain or interdisciplinary. However, concepts in practical life are related to one another even between different domains and areas of knowledge. As such, one must start thinking not only about descriptor terms for isolated subjects within an area of knowledge, but about how to represent relationships that exist between concepts, including between different knowledge domains, taking advantage of the full potential of linked data and semantic relationships. The next section will discuss how knowledge graphs and linked data can improve user experience in information search and retrieval in libraries.

4.3 Knowledge graphs

While before, concepts resided within only one area of knowledge, now, sciences are increasingly interdisciplinary and pluridisciplinary. Wersig predicted in 1993 that Information Science would have to invent some way to enable navigation between related concepts:

> Since everything is connected with everything somehow information science would have to develop some kind of conceptual navigation system (which perhaps develops into the postmodern form of theory). This is the difference between the information scientist and the weaving bird: The latter already has its plans provided by evolution. In our case the next step of evolution in science waits to be done, by whomever (Wersig, 1993, p. 239).

The first researchers to introduce the idea of structuring knowledge in the form of a semantic relations graph were Stokman and Vries in 1988. The base of knowledge graphs starts with descriptions between concepts within the same discipline and between different disciplines.

> We will refer to conceptual knowledge as a declarative representation. Furthermore, the core of conceptual knowledge consists of explicitly defined types of relations between concepts. Various types can be distinguished, e.g., they can express definitional as well as empirical relations between concepts (Stokman & Vries, 1988, p. 188).

Knowledge graphs emerged as an option to interlink concepts, joining different domains by linking terms and concepts, using semantic relations and enabling search beyond the text, as Buckland (1991) had predicted.

Regarding knowledge graphs, authors Zamini, Reza and Rabiei (2022) describe it as a documentary language tool that represents interlinked entities, relations and semantic descriptions of entities:

> A knowledge graph (KG), also known as a knowledge base, is a structured representation of facts that describes a collection of interlinked descriptions of entities, relationships, and semantic descriptions of entities. KGs, as a compelling abstraction, help organize structured knowledge by linking them from multiple sources. The difference between the knowledge base and knowledge graphs is the assumption of being less rigidly defined, structured, homogeneous, and stable schema breaks which empower knowledge graphs to be more scalable. The advantage of KG is the better representation of heterogeneous objects using a unified space to connect them (Zamini et al, 2022, p. 1).

Knowledge graphs are based on ontologies (specification) and concepts (an abstract idea). According to Gruber (1993), the term “ontology” in the context of knowledge sharing is related to the descriptions themselves of concepts, their representation and relations:

> An ontology is an explicit specification of a conceptualization. The term is borrowed from philosophy, where an ontology is a systematic account of Existence. For knowledge-based systems, what "exists" is exactly that which can be represented. When the knowledge of a domain is represented in a declarative formalism, the set of objects that can be represented is called the universe of discourse. This set of objects, and the formalized relationships among them, are reflected in the representational vocabulary with which a knowledge-based program represents knowledge. Thus, we can describe the ontology of a program by defining a set of representational terms. In such an ontology, definitions associate the names of entities in the universe of discourse (e.g. classes, relations,

> functions, or other objects) with human-readable text describing what the names are meant to denote, and formal axioms that constrain the interpretation and well-formed use of these terms (Gruber, 1993, p. 199).

The main idea behind the Knowledge Graph is to use semantic relationships of ontologies. One of the standard ways to specify relationship statements is with the Resource Description Framework (RDF). According to the *Guia de Web Semântica* ("Guide to the Semantic Web"), by Carlos Laufer (2015):

> O formato das afirmações é simples. Uma afirmação RDF consiste de três elementos (uma tripla) e tem a seguinte estrutura: <sujeito> <predicado> <objeto>. Uma afirmação RDF expressa uma relação entre dois recursos. O sujeito e o objeto representam os dois recursos sendo relacionados; o predicado representa a natureza desta relação, que é formulada de modo direcional (do sujeito para o objeto) e é chamada em RDF de propriedade. Um objeto pode também ser um literal, definindo uma propriedade para um recurso (Laufer, 2015) [The statement format is simple. An RDF statement consists of three elements (a triple) and has the following structure: <subject> <predicate> <object>. An RDF statement expresses a relation between two resources. The subject and object represent two resources being related; the predicate represents the nature of this relation, which is formulated in a directional way (from subject to object) and is called a property in RDF. An object can also be a literal, defining a property for a resource].

Combining terms from multiple vocabularies and thesauri, the discovery service from EBSCO created and maintains its Knowledge Graph (EDS Knowledge Graph) for subject searches based on synonyms, controlled vocabularies, natural language and mapping relations, through ontologies:

> A discovery service with a sophisticated Knowledge Graph (a digital database network that tags connections between concepts, subjects, and topics) can understand ideas independently of the words used to express them. This means that the patron doesn't have to know the "right" word for their search. Instead, the discovery service figures that out for them (Faith, 2021).

Using a knowledge graph helps its research on interlinking concepts in vocabularies, thesauri, natural language terms and synonyms to create a concept map in multiple languages. According to EBSCO:

> EDS is more than a discovery tool. It is also a learning environment in which users are guided toward improving their search terms and finding items they may have overlooked otherwise. […] The key to this learning environment is the EDS

> Knowledge Graph. Built with the help of a small army of subject matter experts drawing on numerous subject indexes, the Knowledge Graph ensures an excellent search that can turn even inadequate queries into quality results. Therefore, users don't need to start off as expert researchers to get expert information. The Knowledge Graph does this by mapping new datasets that incorporate natural language, extensive subject vocabularies, and a vast array of synonyms and concepts in more than 280 languages and dialects. Not only does this enhance search and relevance rankings for EBSCO*host* and EDS, but the multi-lingual capability allows people from around the world to enter search terms in their native tongue (The Evolution of the EBSCO Discovery Service, 2020).

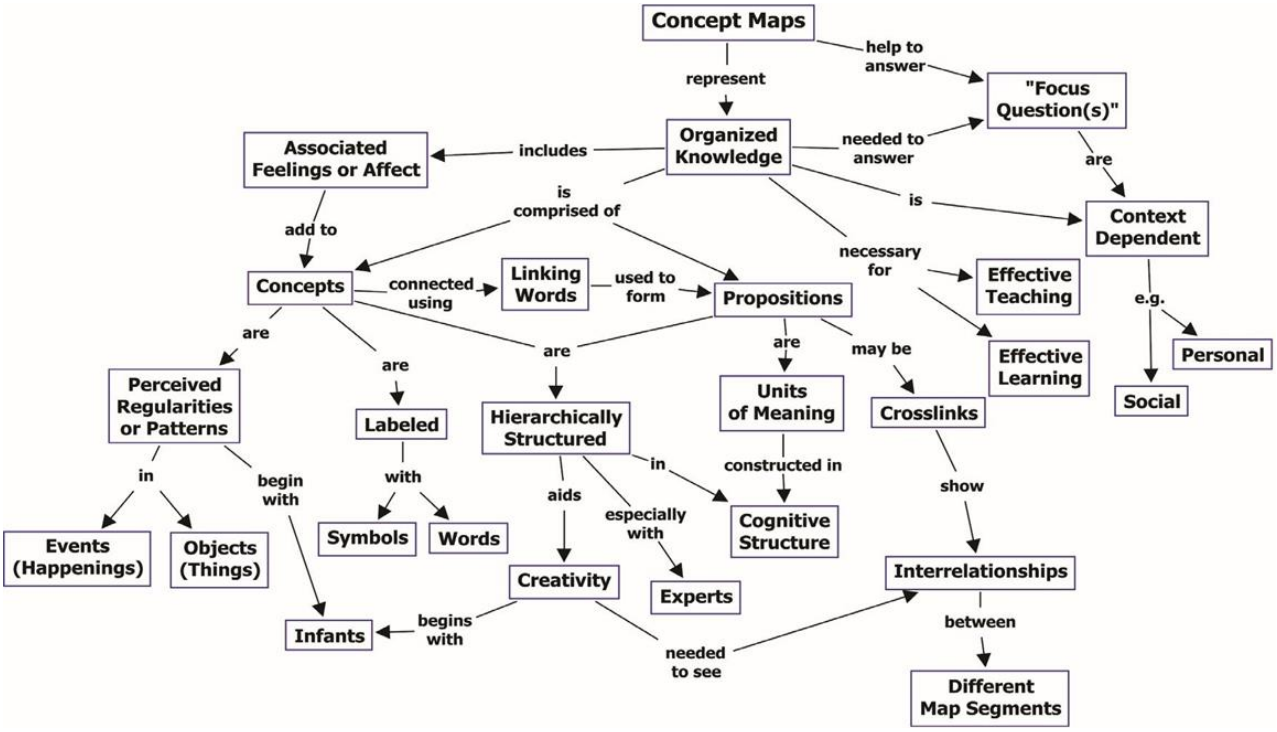
The Knowledge Graph developed by EBSCO aims to improve the capacity to search using documentary languages as a visual tool that enables greater precision and an additional search capacity, by connecting terms from different knowledge domains.

4.4 Concept Map

In order to search in the knowledge graph, EBSCO developed a tool called a *Concept Map*, which can be consulted by end users in the discovery system interface. The concept map implements primarily "Concept Map Theory" developed by researchers Joseph Novak and Alberto Cañas (1984), who define concept maps by relating terms through semantic relations between two concepts, creating an interconnected image:

> Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts. Words on the line, referred to as linking words or linking phrases, specify the relationship between the two concepts. We define concept as a perceived regularity in events or objects, or records of events or objects, designated by a label. The label for most concepts is a word, although sometimes we use symbols such as + or %, and sometimes more than one word is used. Propositions are statements about some object or event in the universe, either naturally occurring or constructed. Propositions contain two or more concepts connected using linking words or phrases to form a meaningful statement. Sometimes these are called semantic units, or units of meaning. Figure 4 shows an example of a concept map that describes the structure of concept maps and illustrates the above characteristics (Novak & Cañas, 1984, p. 1).

Figure 4 –A concept map showing the key features of concept maps.
Concept maps tend to be read top-down



Source: Novak & Cañas (1984)

Gercina Lima (2004) also describes concept maps as a tool that organizes knowledge aimed at representing the way in which subjects are mentally structured by humans:

> Uma ferramenta de organização do conhecimento, capaz de representar ideias ou conceitos na forma de um diagrama hierárquico escrito ou gráfico, capaz de indicar as relações entre os conceitos, procurando refletir a organização da estrutura cognitiva sobre um determinado assunto (Lima, 2004, p. 135) [A concept map is] a tool for organizing knowledge, capable of representing ideas or concepts in the form of a written or graphic hierarchical diagram, capable of indicating the relations between the concepts, with the purpose of reflecting the organization of the cognitive structure on a determined subject].

According to Lima (2004), concept maps as a tool for documentary language can collaborate towards obtaining information, transforming it into knowledge and supporting information retrieval systems by providing visual and interactive interfaces that are easy to use:

> Uma das principais funções da mente é interpretar o significado das informações adquiridas e transformá-las em conhecimento, o que se torna mais fácil quando são apresentadas em formato gráfico. O mapa conceitual pode ser um suporte

> apropriado para a arquitetura de sistemas de hipertexto por possibilitar uma interface atrativa, interativa e fácil de ser utilizada, facilitando a navegação em redes semânticas (Lima, 2004, p. 137) [One of the main functions of the mind is to interpret the meaning of information acquired and transform it into knowledge, which is made easier when it is represented in an image format. Concept maps can be an appropriate support for the hypertext system architecture, since they provide an attractive, interactive and user-friendly interface, facilitating navigation in semantic networks].

Therefore, as a visual documentary language tool, concept maps broaden thematic relations that need to be built mentally when they are acquired by the user based on purely textual documentary languages. Lima (2004) reinforces this view, when she argues that

> O mapa conceitual, com sua característica gráfica, é um instrumento poderoso para permitir a compreensão das relações entre os conceitos e do conhecimento no todo. Para o cientista da informação, que lida com a análise de assunto para a estruturação de uma certa área do conhecimento, o mapa conceitual pode tornar-se um instrumento importante para ajudá-lo a entender e a lidar com estruturas informacionais (Lima, 2004, p. 137) [Concept maps, graphic in nature, are a powerful instrument to facilitate understanding relations between concepts and knowledge overall. For information scientists, who deal with subject analysis in order to structure a certain area of knowledge, concept maps can become an important instrument to help them understand and deal with informational structures].

As described by EBSCO (The Evolution of the EBSCO Discovery Service, 2020), the Knowledge Graph by EBSCO increases the capacity to search based on synonyms and semantic relations:

> The Knowledge Graph does more than recognize multiple meanings, however. It also shows the user connections between subjects via a visualization tool called the Concept Map. For example, a search for “Italy” provides an image of Italy with multiple spokes extending from it, each representing an Italy-related concept, such as “Rome,” “Alps,” or “Papal States.” These spokes suggest additional subjects to the user, and they can relaunch their search with an improved query. This connect-the-dots approach facilitates better information literacy, as it helps users hone their searches (The Evolution of the EBSCO Discovery Service, 2020).

Researcher Ashleigh Faith (2021) reinforces how the use of concept maps associated to the knowledge graph by EBSCO increases search capacity while also making it equitable:

> A discovery service with a sophisticated Knowledge Graph (a digital database network that tags connections between concepts, subjects, and topics) can

> understand ideas independently of the words used to express them. This means that the patron doesn't have to know the "right" word for their search. Instead, the discovery service figures that out for them (Faith, 2021).

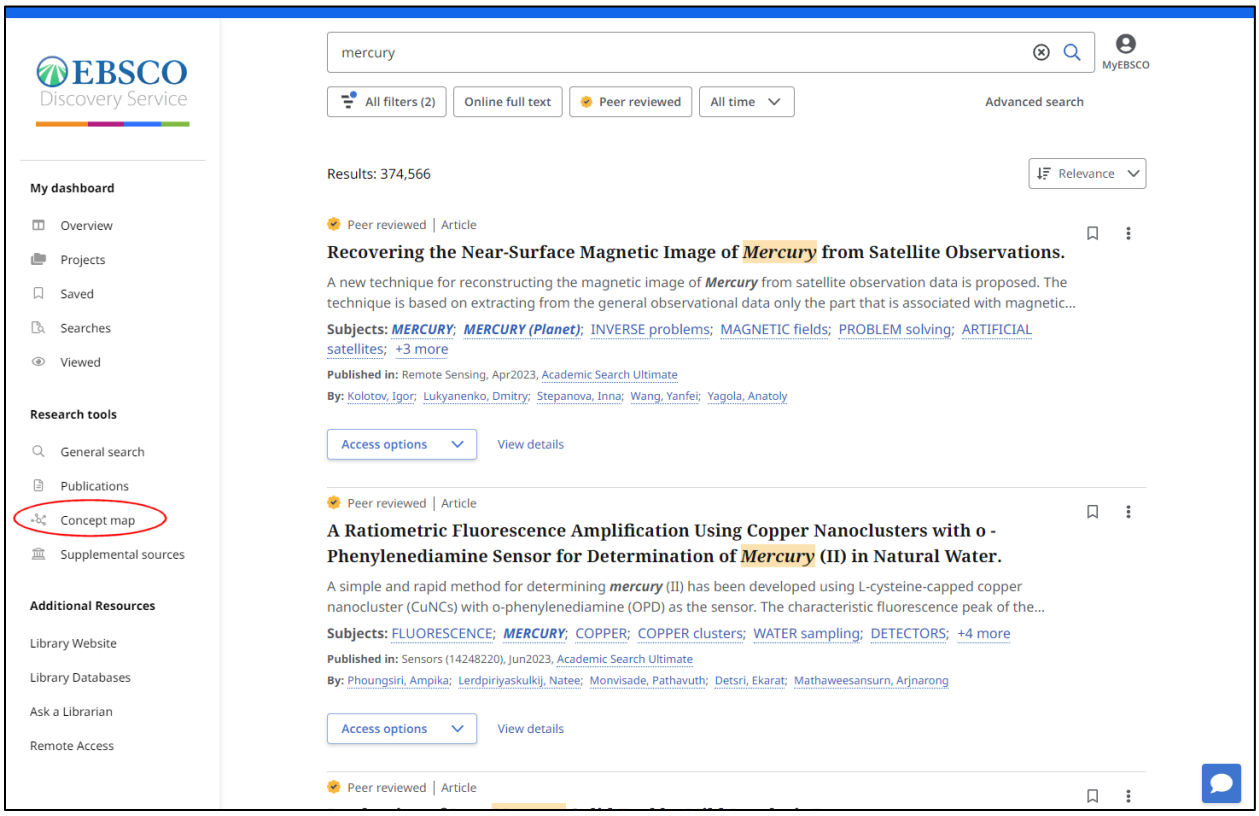
Library users learn in different ways. By seeing and exploring concepts in innovative and alternative forms, the idea is to allow for more possibilities to make new discoveries and enable a greater understanding of areas with which they are not yet familiar as researchers (new concepts) or that are outside of the traditional sphere of specialization (concepts from other domains). The purpose of using knowledge graphs and subject mapping is to enable a more equitable search. As researcher Faith (2021) claims:

> EBSCO has been investigating the impact that a patron's search language has on how they do their research — what methods they use, what words they employ — and has evolved EBSCO Discovery Service™ (EDS) into a search tool that can meet the needs of all its users. Whether a patron is trained in "libraryspeak," or whether they are searching in different languages, they can perform a search that is just as good as any done by an expert researcher. This is called "equitable search" and it has opened discovery to a more diverse array of information access points, meaning EDS understands more words in other languages as well as "everyday" English. EDS achieved this in several stages through its Knowledge Graph: * Synonyms and controlled subjects were mapped together; * Users' natural language was mapped to each subject grouping, including more than 200-plus languages and dialects; * Subjects were then mapped to each other with explicate relationships, such as "type of" and "symptom of" (Faith, 2021).

The knowledge graph relates concepts and enables data linking, a structured documentary language tool. To "view" concepts and their relationships, created based on this knowledge graph, EBSCO provides, through its discovery tool, the "EBSCO Concept Map", which will be addressed in the next section.

The EBSCO Concept Map, which is available on the search results screen, is activated by users on demand, based on the search term or expression that users enter into the search box, after clicking on "Concept Map", as indicated in Figure 5:

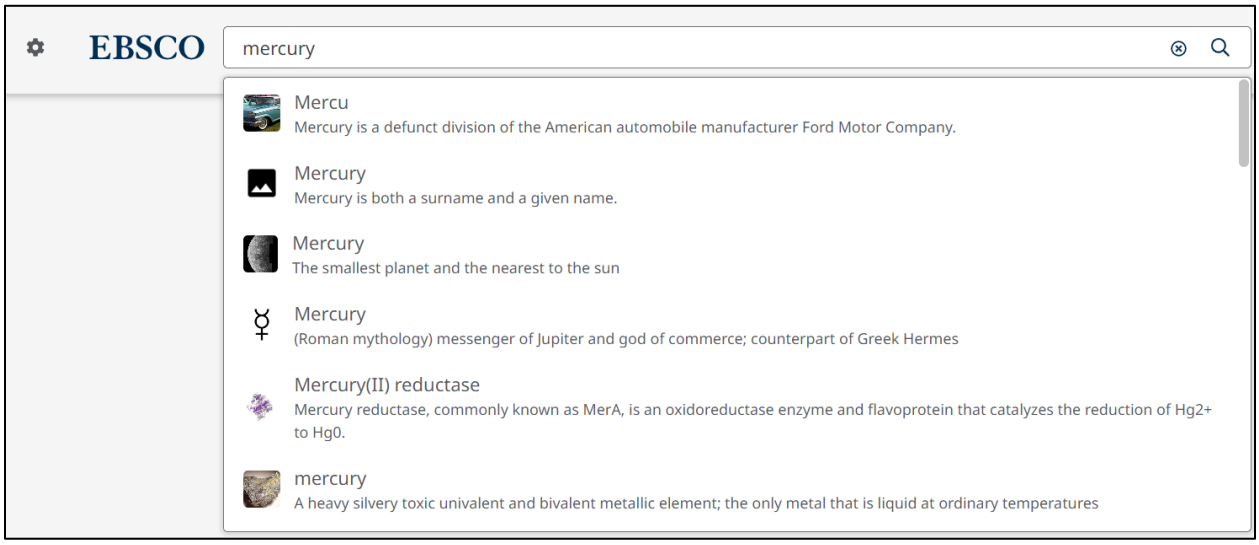
Figure 5 – EBSCO Discovery Service Interface with search results for the term “mercury” with the option “Concept Map” option highlighted on the left-hand menu



Source: EBSCO Discovery Service user interface (2024).

After clicking on the “Concept map” option in the left menu, the user is directed to a new screen (Figure 6), in which they can first choose the knowledge domain desired for the term, based on a suggested list. The goal of this first step is to provide to user the disambiguation between homographs. A brief meaning of the term in each domain is presented together with each option.

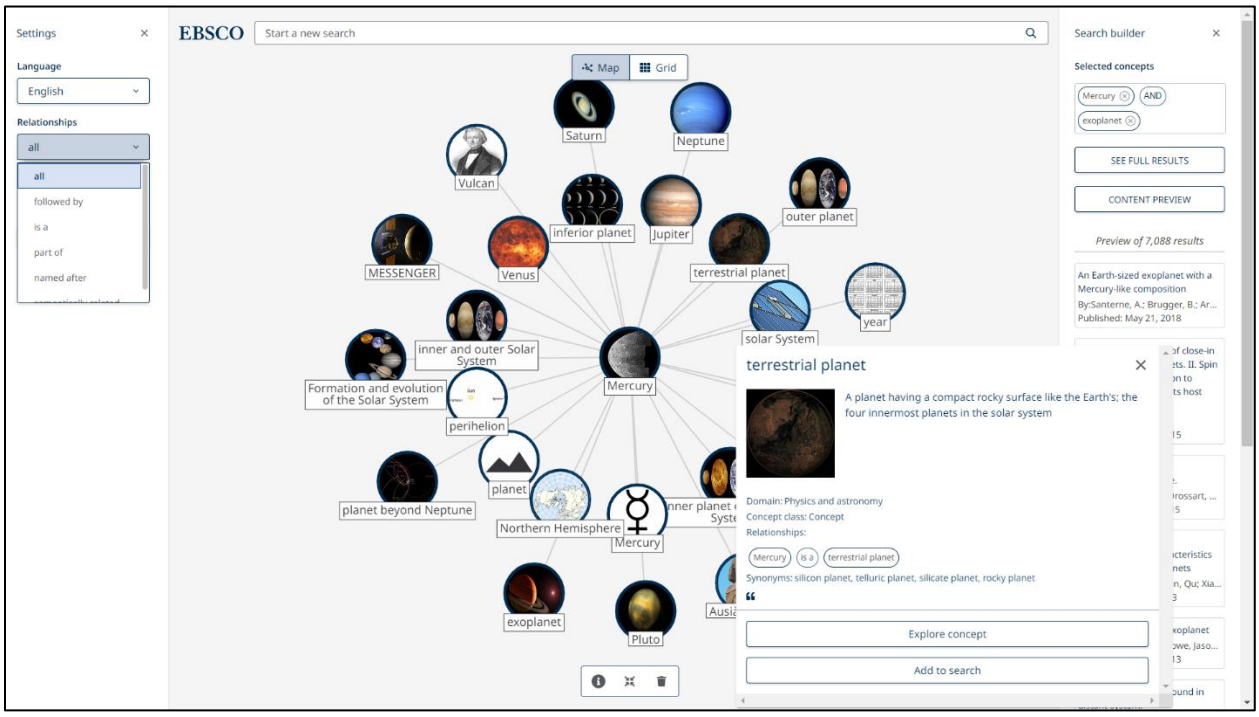
Figure 6 – Selection of knowledge domain for the term “mercury” in the EBSCO Concept Map



Source: EBSCO Discovery Service user interface (2024).

After the user chooses the desired domain (by clicking on it or touching it), a second screen is shown with the concept map and the concepts. The concept related to the search term is at the center and semantically related concepts are around it, within the knowledge domain selected, as in the example illustrated in Figure 7. The concept map presented of the EBSCO Discovery Service is a visual representation of the EBSCO Knowledge Graph for the chosen term.

Figure 7 – Screen with the EBSCO Concept Map for the concept “Mercury”, as the planet, in the knowledge domain “Physics and Astronomy”



Source: EBSCO Discovery Service user interface (2024).

This concept map tool also enables users to see the definition of each concept and add it to the “Search builder” (see Figure 7), to compose a new search strategy in the discovery tool. As such, the concept descriptions (see Figure 7) on their own already provide users with the ability to learn about topics that can open new perspectives, so that they can either focus their research on some specific aspect or redirect their research or study. Consequently, this documentary language tool has turned into a source of information in and of itself.

By applying documentary languages in a combined way in the discovery service, the EBSCO Discovery Service aims to provide greater precision and a more assertive retrieval of the content desired, as well as the discovery of new related concepts, displayed by the concept map and created based on the knowledge graph, which would not be visible in traditional lists of search results.

The integration of specialized documentary languages allows the discovery of new and interconnected concepts beyond the immediate scope of the research query, beyond the descriptors

indicated solely by the producer of the information. Through the concept map, for example, generated from the underlying knowledge graph, users can discover related ideas and topics that may not have been apparent in traditional keyword-based searches alone. This holistic approach broadens the user's understanding and promotes interdisciplinary exploration and discovery of relevant information, including in an interdisciplinary way, in other domains of knowledge.

In addition to these advantages, the use of documentary languages increases the overall accuracy of research results in discovery systems, taking into account variations in terminology and language use. This linguistic flexibility ensures that users receive comprehensive results, even when expressing their search phrases through different terms.

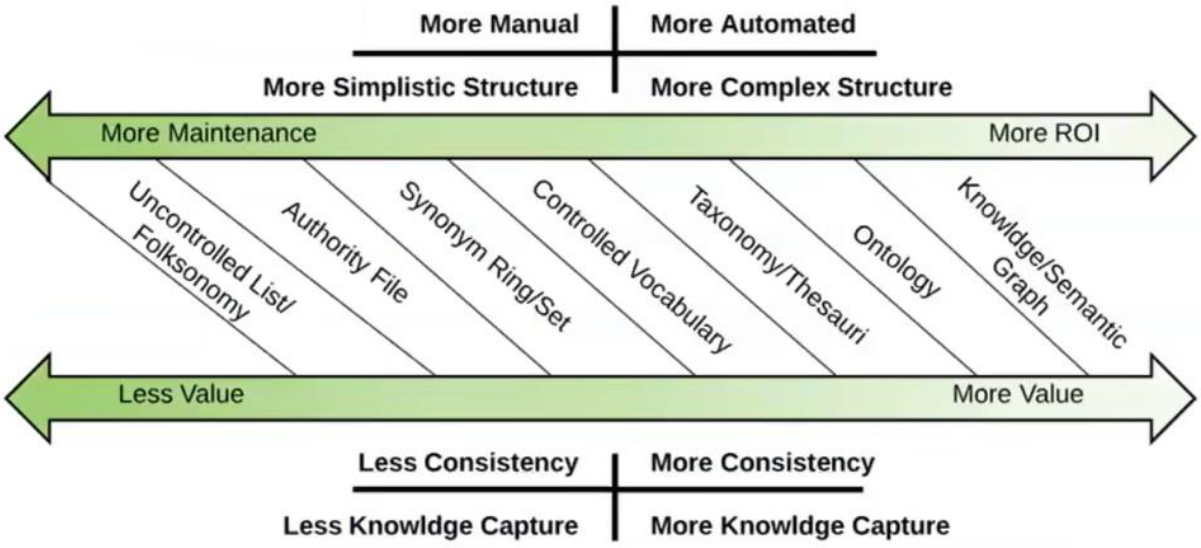
In general, the incorporation of documentary languages in discovery services enriches the search experience, providing greater accuracy in retrieval, as well as allowing the discovery of new concepts and the improvement in the accuracy of results.

Conclusion

Based on the above discussion, one can see how the EBSCO Discovery Service uses different documentary languages with the goal of improving the experience of information search and retrieval for end users, through unified retrieval and the use of different documentary languages.

One can conclude, based on this discussion, that using documentary languages in discovery systems provides greater return on investment (ROI) with respect to the application of documentary languages: the more structured the documentary languages used are, the greater the consistency in terminology and, consequently, the greater the value for end users, as illustrated in Figure 8, by Ashleigh Faith (2020):

Figure 8 – Documentary languages applicable to information retrieval tools



Source: Faith (2020).

With respect to information retrieval systems used by libraries, documentary languages, based on Information and Communication Technologies (ICTs), play a significant role in organizing and indexing information resources, since they allow us to take advantage of the full potential of the normalized, structured terminology for a broader and more precise retrieval, especially useful in libraries that have large material collections and heterogeneous sources.

The technology itself, whether software or hardware, is not capable of providing an effective information search and retrieval experience on its own, regardless of the tool or software used: whether an online catalog, metasearch or discovery service. It is the structured work of professionals on descriptive and thematic representation, based on standards and documentary languages, which enable greater success so that the library service can achieve its ultimate goal: to provide users access to information, regardless of the format, nature or source in which the resource is located.

Automation in libraries and information units certainly makes work more efficient for those who describe information – professional librarians undertaking technical processing – and for those who search and retrieve information - end users who need and wish to access it. The work

of information professionals is necessary to demonstrate and provide this information, using effective tools, systems, methods and languages.

References

"EBSCO Discovery Service (EDS) - Information Sheet." EBSCO, last modified January 13, 2020. https://connect.ebsco.com/s/article/EBSCO-Discovery-Service-EDS-Information-Sheet. Accessed 3 Jan 2024.

"EBSCO Discovery Service (EDS) Custom Catalog Questionnaire." EBSCO, last modified May 6, 2022. https://connect.ebsco.com/s/article/EBSCO-Discovery-Service-EDS-Custom-Catalog-Questionnaire. Accessed 3 Jan 2024.

"How is relevance ranking determined in EBSCO Discovery Service (EDS)?" EBSCO, last modified January 13, 2020. https://connect.ebsco.com/s/article/How-is-relevance-ranking-determined-in-EBSCO-Discovery-Service-EDS. Accessed 3 Jan 2024.

"Learning to Search/Searching to Learn: The Evolution of EBSCO Discovery Service™." EBSCO, last modified July 8, 2020. https://www.ebsco.com/blogs/ebscopost/learning-searchsearching-learn-evolution-ebsco-discovery-servicetm. Accessed 3 Jan 2024.

"Quality Data & Precision Search." EBSCO, last modified July 27, 2023. https://www.ebsco.com/academic-libraries/products/ebsco-discovery-service/quality-data-precision-search. Accessed 3 Jan 2024.

"The Evolution of the EBSCO Discovery Service™ User Interface." EBSCO, last modified July 8, 2020. https://www.ebsco.com/blogs/ebscopost/learning-searchsearching-learn-evolution-ebsco-discovery-servicetm. Accessed 3 Jan 2024.

"Using OAI-PMH to Create and Maintain Records in your EBSCO Discovery Service (EDS) Custom Catalog Database." EBSCO, last modified May 1, 2020. https://connect.ebsco.com/s/article/Using-OAI-PMH-to-Create-and-Maintain-Records-in-your-EBSCO-Discovery-Service-EDS-Custom-Catalog-Database. Accessed 3 Jan 2024.

"What is EBSCO's Controlled Vocabulary?" EBSCO, last modified October 25, 2018. https://connect.ebsco.com/s/article/What-is-EBSCOs-Controlled-Vocabulary. Accessed 3 Jan 2024.

"Which EBSCOhost database authorities have limited support via the EBSCOhost API AuthoritySearch Method?" EBSCO, last modified January 22, 2020. https://connect.ebsco.com/s/article/Which-

EBSCOhost-database-authorities-have-limited-support-via-the-EBSCOhost-API-AuthoritySearch-Method. Accessed 3 Jan 2024.

"EBSCO Discovery Service user interface". EBSCO, last modified January 3, 2024. https://research.ebsco.com/c/377kib/search. Accessed 3 Jan 2024.

Breeding, Marshall. "Plotting a new course for metasearch: it might be time to seriously reconsider how we set up the search environment for our electronic resources." *Computers in Libraries*, vol. 25, no. 2, 2005, pp. 27-29. https://search.ebscohost.com/login.aspx?direct=true&db=edsinc&AN=edsinc.A128793159&site=eds-live. Accessed 3 Jan 2024.

Breeding, Marshall. "The State of the Art in Library Discovery 2010." *Computers in Libraries*, vol. 30, no. 1, 2010, pp. 31–34. https://librarytechnology.org/document/14574. Accessed 3 Jan 2024.

Buckland, Michael Keeble. "Information retrieval of more than text." *Journal of the American Society for Information Scien*ce, vol. 42, no. 8, 1991, pp. 586-588. https://asistdl.onlinelibrary.wiley.com/doi/10.1002/(SICI)1097-4571(199109)42:8%3C586::AID-ASI8%3E3.0.CO;2-W. Accessed 3 Jan 2024.

Cabré, María Teresa. "La terminología hoy: concepciones, tendencias y aplicaciones". *Ciência da Informação*, vol. 24, no. 3, 1995, pp. 1-15. https://revista.ibict.br/ciinf/article/view/567. Accessed 3 Jan 2024.

Faith, Ashleigh. "A Library 'Translation App' for Patrons: EBSCO Discovery Service™ and Equitable Search." *EBSCOpost*, November 29, 2021. https://www.ebsco.com/blogs/ebscopost/library-translation-app-patrons-ebsco-discovery-servicetm-and-equitable-search. Accessed 3 Jan 2024.

Faith, Ashleigh. "The First Step Into Equitable Search: a comparison on how to make a linked ontology data model." Filmed May 7, 2020 at EBSCO Global Webinar Series, Ipswich, MA, video, 19:26. https://vimeopro.com/ebsco1/supporting-your-institutions-as-they-move-online/video/417229407. Accessed 3 Jan 2024.

Gruber, Thomas R. "A Translation Approach to Portable Ontology Specifications." *Knowledge Acquisition*, vol. 5, no. 2, 1993, pp. 199-22. https://www.sciencedirect.com/science/article/pii/S1042814383710083. Accessed 3 Jan 2024.

Krieger, Maria da Graça, and Maria José Bocorny Finatto. *Introdução à Terminologia: teoria e prática*. São Paulo: Contexto, 2004, p. 223.

Laufer, Carlos. *Guia de Web Semântica*. São Paulo: Centro de Estudos sobre Tecnologia Web – CeWeb.br, 2015. https://ceweb.br/guias/web-semantica/capitulo-4. Accessed 3 Jan 2024.

Lima, Gercina Ângela Borém de Oliveira. "Mapa conceitual como ferramenta para organização do conhecimento em sistema de hipertextos e seus aspectos cognitivos." *Perspectiva em Ciência da Informação*, vol. 27, no. 2, Jul./Dez. 2004, pp. 134-145. https://brapci.inf.br/index.php/res/v/38690. Accessed 3 Jan 2024.

Lima, Vânia Mara Alves. "A função comunicativa da terminologia nas linguagens documentárias e a transferência do conhecimento." Paper presented at Simpósio Iberoamericano de Terminologia Riterm, Buenos Aires, 2010. https://www.researchgate.net/publication/320552627_A_funcao_comunicativa_da_terminologia_nas_linguagens_documentarias_e_a_transferencia_do_conhecimento. Accessed 3 Jan 2024.

Morgan, Eric Lease. "Catalogs of the Future." *Computers in Libraries*, vol. 19, no. 9, 1999, pp. 38-42. https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=2381430&lang=es&site=eds-live. Accessed 3 Jan 2024.

Novaes, Denise. "Reflexões linguísticas para a organização hierárquica de conceitos em tesauros." *Ciência da informação estudos e práticas*, edited by Cláudio Gottschalg Duque, Brasília: Centro Editorial, 2011, pp. 97-152.

Novak, Joseph D., and Alberto J. Cañas. *The theory underling concept maps and how to construct them*. Pensacola: Florida Institute for Human and Machine Cognition, 1984. http://cmap.ihmc.us/publications/researchpapers/theorycmaps/TheoryUnderlyingConceptMaps.bck-11-01-06.htm. Accessed 3 Jan 2024.

Santana, Anderson de. "Serviços de Descoberta." Paper presented at Seminário Nacional de Bibliotecas Universitárias, 18, Belo Horizonte, 2014. http://dx.doi.org/10.13140/RG.2.2.11811.25124. Accessed 3 Jan 2024.

Spang-Hanssen, Henning. "How to teach about information as related to documentation." *Human IT*, vol. 5, no. 1, 1970, pp. 125-143. https://humanit.hb.se/article/view/168. Accessed 3 Jan 2024.

Stokman, Franciscus Nicolaas, and Pieter Hendrik de Vries. "Structuring knowledge in a graph." In *Human-Computer Interaction*, edited by Gerrit Van Der Veer and Gijsbertus Mulder, Springer: Berlin/Heidelberg, Germany, 1988, pp. 186-206.

Vaughan, Jason. "Web Scale Discovery What and Why?" *Library Technology Reports*, vol. 47, no. 1, 2011, pp. 5-11. https://journals.ala.org/index.php/ltr/article/view/4380. Accessed 3 Jan 2024.

Wersig, Gernot, and Ulrich Neveling. Terminology of Documentation: a selection of 1,200 basic terms published in English, French, German, Russian and Spanish. Paris: The UNESCO press, 1976.

Wersig, Gernot. "Information science: the study of postmodern knowledge usage." *Information processing & management*, vol. 29, no. 2, 1993, pp. 229-239. https://www.sciencedirect.com/science/article/pii/030645739390006Y. Accessed 3 Jan 2024.

Zamini, Mohamad, Hassan Reza, and Minou Rabiei. "A Review of Knowledge Graph Completion." *Information (2078-2489)*, vol. 13, no. 8, 2022, p. 396. https://www.mdpi.com/2078-2489/13/8/396. Accessed 3 Jan 2024.

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