Development of user-friendly digital library resource discovery tool to mitigate learners' technical hitches

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Abstract. This article aims to improve the library Resource Discovery Tool (RDT) as a library catalog extension of the third generation that allows one search box to seem through various databases and repositories. Although RDT's interaction is considered positive for library users, issues of usability and accessibility related to user desires, needs, and preferences continue to be a problem. This article describes the technological methods, standards, and protocols required, and then establish RDT concerning the obstacles encountered. The problems were classified into three categories; operation issues, visual interface, and level of navigation. An alternative approach, supported by these categories to strengthen the usability and functionality of RDTs was an adaptation. For every specific category of problem, the description was handled with the objective of this paper to alleviate RDT usability and accessibility by indexing a variety of digital information resources beyond the library collections. The developed RDT holds an index that represents the full text content which may be searched, and also offers a linking facility to open the full text content.

Keywords: library resources usability, information retrieval accessibility, open-source discovery interface

1 Introduction

1.1 Background

The advancement of open source software has led to the need for library resource discovery tools (RDTs) to be developed. As a consequence, libraries move from library automation to resource exploration by discovering various commercial and free information resource software applications [1]. The discovery toolset is based on the central index of the material, object, metadata, full text, or other items on which the search result is based in the library database [2]. The invention layer offers an interface that allows users, supporting keywords entered for this purpose, to seem for and retrieve the results and pick the required content. Therefore, the results generated concentrate on relevance, faceted navigation, and other web-based compatible fea-

tures [3]. EBSCO Discovery Service, Summon, World Cat Discovery, and Primo Central are a series of index-based commercial discovery tools, while Blacklight, VuFind, eXtensible catalog, and Franklin are incorporated in the open-source discovery interface [4]. These open-source search tools are capable of harvesting content from multiple sources and openly providing access to the content. In essence, for librarians who want to own a Google-like search box, open source discovery tools have become a de facto option. The goal of this paper is to develop a user-friendly platform by exploring digital library instruments to alleviate the technical hitches of online learners. The researchers suggested that the adaptability approach should be taken into account, based on the guideline approach but concentrating on resource harmonization with the user's requirements and preferences [5]. Therefore, to investigate how the adaptability strategy could improve the usability and accessibility of RDTs, this paper reviewed in its literature various articles representing the usability issues discovered in various RDTs developed concerning their operations, visual interfaces, and level of navigation from the user viewpoint.

1.2 Adaptations

RDTs Operation concerns: Ex Libris®Primo RDT as evaluated by researchers [5], for users with diverse objectives; the tool has proven to be successful and helps users complete numerous tasks with a limited number of steps. Primo discovery tool allows search findings to be filtered without reentering keywords in different ways. They also noted that Primo allows comparisons to search results through the information tabs found in the title, and provides where appropriate a seamless transfer to external websites but does not take into account users ' interests, preferences, and disabilities. An EBSCO Discovery Service (EDS) usability test has defined user friendliness and therefore, the capacity to limit the search results [6]. RDTS operations are rich in functionality that includes methods of alternative search and filtering. For a few users, this may be a source of trouble; the EDS study showed that the different interface features “overwhelming” or “confusing.” Additional EDS issues include an excessive number of clicks to access electronic resources, irrelevant search results, hard to understand jargon (for instance, “reviews " for peer-reviewed journals), and restrictions on recognition of language by librarians. Thus, further study endorsed that, aside from the search box, users pay little attention to end-user functionality. Users also are going to be mixed up about the filter/facet functionality in selecting the correct one to minimize the search for the type of resource they need (e.g., when finding out “research documents,” under e-books, or audiobook) [1]. The study that has shown the complexity of using Summon library search tool indicated that complex interfaces are the foremost problem [7]. The document suggested that the selection and layout of end-user functions could affect the usability behind tool interfaces. Other researchers [8] found that, to have tabs for search alternatives leads to the better discovery of resources rather than drop-down lists therefore, the results examined, recommending that during the development of RTD, the needs, and interests should be taken into account.

RDTs Visual Interface: Studies show that the progressive approach to the disclosure of simple search interfaces can be a solution for RDTs requirements, where the interface illustrates some key start-up functions and then provides more advanced features as requested by the user [9][10]. Thus, to identify fewer and more meaningful interface features, it will need to consider the following variables. First, it is important to consider the user's information requirements, behavioral descriptions, roles, task models, priorities, and their understanding of search systems [11]. Second, libraries need RDTs to point out instruments to the right people and to help promote the use of library collections to justify their preservation [12]. Thus, the design of RDTs requires that libraries match the preferences, needs, requests, and customs of users. In addition, it is necessary to bear in mind that libraries quickly deploy resources that do not allow for customization. Therefore, as the interface is suited to high contrast, blurring or disappearing text and icons would certainly be a concern for users with low vision disorders [13]. According to the search results presentation, RDTs usually display outcomes amid metaphors and visual indicators, these are considered important for the comparison of search results by usability, which raises the inconsistency of metadata as a problem. The value of technical metadata, also called accessibility metadata that could provide useful information to disable users (e.g., whether a resource was accessible via a text-to-speech application or behind a paywalls) should be underlined [1]. Therefore the accessibility issues addressed in the above-mentioned literature may generally be narrowly defined as a common interface design phenomenon that causes problems with usability. As a major usability characteristic of library RDTs, an interface with smooth navigation is more likely to be employed to mitigate the above problems [14], [15].

RDTs Level of Navigation: The subsequent section of this literature compares the above-mentioned usability problems with navigation concerns addressed in handling user sources of impediments in a library RDT interaction, either personal or through design features. Most studies were linked to library websites about the accessibility of digital library resources [9], [16]. Several of the articles used automated testing software to review Web Content Accessibility Guidelines (WCAG) for compliance with library websites [17], [18]. Although there are few research projects relating to RDTs in the library areas, as well as studies that take into account the needs of people with disabilities when working with library search tools. Research indicated that people with dyslexia may make spelling errors during typing, therefore, guided search tools should be considered to allow the tolerance of errors and autocomplete wording to mitigate the impact of dyslexia. This is often referred to as an accessibility problem that can impact people who may need various assistive devices with dyslexia and visual impairments. In turn, the appropriateness of background and foreground colors, font style, scale, intensity, and link design were among accessibilities issues reported in the aforementioned article. However, using the fragile or incorrect marking of links relevant to site navigation by creating a list of links for access, this could prevent users with an inability to use an RDT library, thus for screen-reader technology, such as Job Access With Speech (JAWS), this might pose a difficult to users [3]. Even

among users with similar conditions, the case mentioned so far can demonstrate the variation in needs and preferences in the use of RDTs; therefore, adaptation approach seems to be a feasible option for improving accessibility and usefulness.

2 Methods

2.1 RTD Development Approach, technological methods, standards and protocols

With different open-source software, a digital library Resource Discovery Tool (RDT) was developed, this case focused on the library resource discovery procedure, which evaluates the methods in several configurations. This development it is essentially a method of finding of resource exploration that can be incorporated with any online information retrieval (IR) framework. The work incorporated Blacklight software, an integrated library system (ILS), and a DSpace repository system framework as well as other independent commercial and open-access external databases. Data (in Marc format) for the sample test was exported to the bibliographical database (IndCat into Koha Version 19.11.00) and then to Blacklight. Similarly, resources were extracted from selected institutional repository systems (IR) developed by DSpace software (version 6.3), which were then imported into Blacklight. At different layers and stages of implementation, a number of open-source software protocols and open standard technologies were used within the assembly; see figure 1 below illustrates the scheme of obtaining bibliographic data from various external sources of discovery.

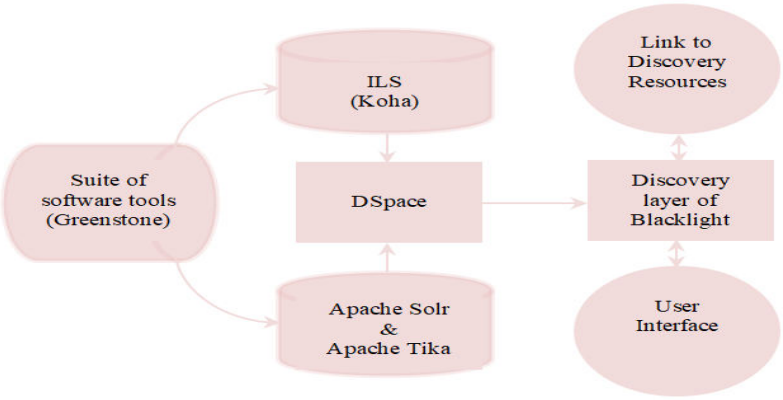

Fig. 1. Functions of the discovery system model

It includes three layers: the greenstone LAMP architecture (Linux-Apache-MySQL-Ruby on Rails) is provided by Layer-I (core layer), MySQL is included like an electronic database (release 5.7), an Apache web server (version 2.4), a Ruby on Rails programming/scripting language (Ruby version 2.5.8 and Rails version 6.0.0) and utilizes Linux Ubuntu-18.04 LTS as an operating system. Layer-II (full-text layer)

uses Apache Tika as a full-text extractor (version 1.18) and Apache Solr (version 6.1.0) to index the harvested metadata from various subscribed or external sources. Layer-III (front layer) is just an interface adapted to give users value-added services with Blacklight. As demonstrated in this paper, the discovery system model focuses on the collection of Koha formatted records from machine-readable cataloging (MARC 21) by setting up the ILS's open archives initiative (OAI) compliant function. The seamless integration of a discovery system with the online IR Z39.50 as well as its interoperability is important for its success and protocols when required to be established. Koha OAI-PMH (i.e., PMH stands for the Metadata Harvesting Protocol) is the prime logical method of integrating blacklight with any ILS whereby the files Koha.ini and config.ini must be configured to sync the Koha driver with Blacklight. The following logical step should be engaged in making changes to Koha, a MARC_local.properties file imported to MARC documents from Koha to Blacklight, by creating a separate section named that source, oai.ini files had to be configured from any OAI-PMH source to collect and index blacklight data. The harvest is followed by the batch import of the collected records into the invention sheet's indexing process. In Koha, Tag 856u should be loaded in for full-text indexing by uploading full-text documents in any form and scale. Apache Tika must be installed and configured properly for this purpose and the link must be generated within the fulltext.ini file. On top of Koha, the Blacklight layers serve as a major index, an interface, or as an optional portal. The following configuration requires more steps to import DSpace metadata into Blacklight, and to render OAI-PMH compatible with every other repository's framework, for which two files must be synchronized, such as dspace.config file, and the oai.cfg file. To line up an OAI-PMH harvester, a separate DSpace file is recognized in the oai.ini registry. When the machine is linked, it is possible to collect documents from the Blacklight index from an OAI-PMH repository. To better manage, represent, and usable data retrieval, the incorporation of the Knowledge Organization System (KOS) into an online IR system is necessary (Clayton & Widener, 2017). The addition of the KOS framework would be important to improve the integration of Dewey Decimal Classification (DDC) into the Blacklight Interface config.ini (in the user interface to invoke alpha browsing), facet.ini (in the user interface to invoke DDC dependent browsing), and MARC_local.properties (in support of Dewey class number-based indexing). This configuration is able to create modules, thus collecting data from a broad range of relative external sources beyond the boundaries of the library concerned, including access and licensed access, which is not part of the Blacklight area. Users can enable resource search by setting the search API value in the config.ini section of the search tab, and in the searchbox.ini file. A separate section must be generated in the search.ini format after choosing the source. It also supports full-text indexing, and Apache Tika is used as a method for full-text extraction. The setup is a Java-based approach that allows metadata and text from various file types to be extracted by default at a time full-text indexing of Blacklight is disabled. Then the trail is set in the fulltext.ini file by configuring Apache Tika and commenting on the line requested in the MARC_local.properties file. This evolves also by replacing old technologies such as federated browsing, allowing the emerging worldwide adoption of discovery tools for web-scale discovery services. In relation to

its full-text level with advanced recoverability functions, the solution is able to index and search through local content and hosted systems on the level of metadata. However, before selecting the blacklight applications, the other two open-source platforms, namely, VuFind and Extensible Catalog, were shortlisted for comparison with blacklight having their differences in technical and architectural functionality variations. Comparisons of detailed criteria/parameters were given, not to demonstrate which instrument performs better than the other, instead to describe the tool's possible characteristics. As no broad variations are found in the operations or access to metadata or index information, since these tools are contrary to predefined data, therefore, Blacklight was essentially our choice for this model's front layering discovery application. In different configurations, all features were tested and validated with separate search syntax to experience the applicability and utility of the specific software tool. The selection of any tools for exploration depends on their features/parameters because all tools do not support such parameter values at an advanced level. Blacklight advantages over other tools were the use of Ruby with Rails platform as a programming/scripting language in place of PHP with that of VuFind, as Ruby is newer than PHP. The tool is providing strong search functionality to the convention-driven rail environment and has made a great development platform for organizations requiring extensive customization. Blacklight has allowed many pleasantly objectives to coexist and demonstrate different custom behaviors. Blacklight has been used for MARC-built Solr indexes, Encoded Archival Definition (EAD), Text Encoding Initiative (TEI), Public Broadcasting Core (PBCore), Dublin Core, digital content management (content DM) record exports, and a variety of locally defined metadata standards. This versatility makes Blacklight desirable not only as a front-end library catalog but also as an institutional repository search solution.

3 Results and Discussion

3.1 The criteria for a successful system and user benefits

Libraries are currently involved in digital content presentation, the organization of virtual academic libraries and open access, educational film production and management, providing online access to resources, and mass digitizing of print resources [19]. The presentation of books in e-books, audiobooks, and text creation in PDF, HTML, and EPUB alternatives is one of the leading activities in the digital library environment [20]. In addition, the focus of user engagement with libraries is on library search tools as libraries continue to embrace technology. User interactions have been expanded from basic card catalogs to web-based catalogs, then tools for metasearching, and finally to web-scale resource discovery tools (so-called RDTs) [21]. RDTs are considered as modern library catalogs that provide users with a Google-like search interface, give libraries statistics of their collections, and provide content providers with an alternative platform to encourage the use of resources [22][23]. Due to its ability to use a single search box to search in-house and remote databases in a manner that is suitable for even experienced users, the RDT has become the prefer-

ence of library users [24]. RDT, as an open-source product, has advanced search options, filters for search results; ranking results, cloud resource information, search, image cover titles or thumbnails, push technology, i.e. Really Simple Syndication (RSS), and other architectural features. See Figure 2 below, which shows a number of significant features in the digital library resource discovery tool that has been developed.

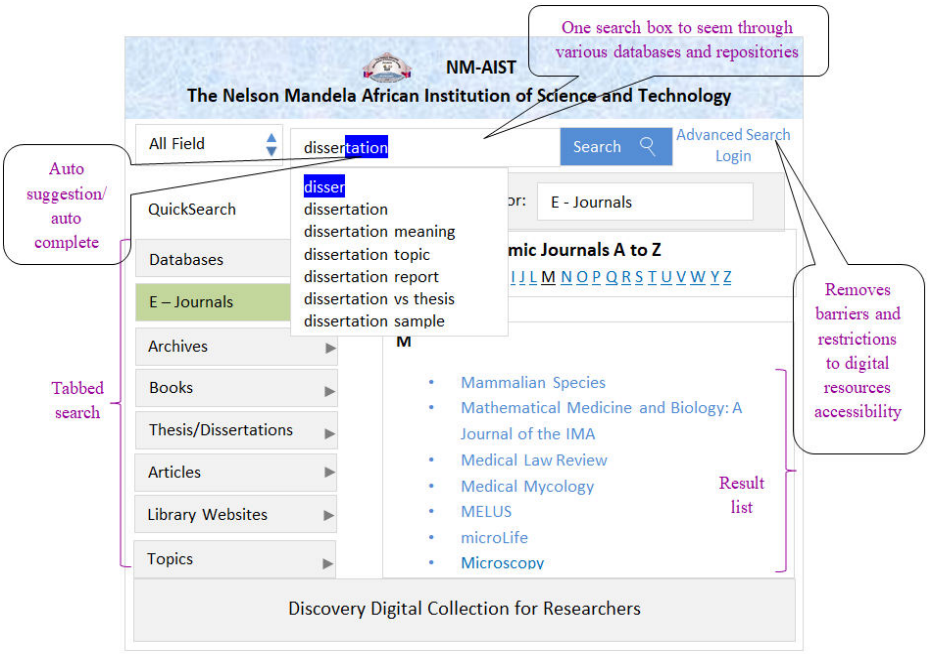

Fig. 2. The library resource discovery tool developed.

The above developed discovery tool takes into account adaption issues addressing the usability and accessibility of RTDs. Adaptation has been described regarding enabling simple communication, rapid data discovery, web-based application adjustment to accommodate many users, and solution individualization. In literary works, there are two forms of adaptation techniques, namely, adaptable and adaptive [25]. The adaptive approach is an automated mechanism in which the tool learns the actions of the user from his or her history of interaction and automatically adjusts the interface [26]. As stated by Zimmermann [27], adaptable systems give the user total freedom from his/her point of view to vary the look of the interfaces, but it is a demanding method for users to spend time implementing the modifications. The adaptive process, on the other hand, allows the computer to make improvements on behalf of the user; however, such automatic adjustments can confuse certain users [28]. The benefits and drawbacks of both approaches should be presented from at least two different perspectives in library environments. First, library practice that guarantees sacrosanct privacy will

prohibit any information from being obtained from the user. That goes to the point of erasing the log files and personal history automatically [29]. Secondly, profiling people with disabilities would not be realistic because individuals with similar disabilities might have different needs related to accessibility. This meant helping users to decide on the interaction style that best suits their needs. The invention method, constructed from the above perspectives, conveyed an adaptable technique to be our choice for the developed RTD that automatically increases website accessibility by elevating the link contents and navigation of online resources.

4 Conclusion

An online search tool for digital library resources discovery has been developed to allow one-point access to different repositories and databases. The application of RDTs should be responsive to the user needs, as stated in related articles, and as shown in this paper. Study results show that simple RDTs must be further developed to provide simplification and adaptability to meet the needs of various user groups. This RTD developed addresses issues related to search outcomes, resource description, the use of icons, and fonts that reflect the need to enhance the effectiveness of user's requirements. As a result, the problems of usability and accessibility explored in this work led to the creation of an easier method for knowledge and access discovery for multiple users. RTDs are rich in search interfaces with distinctive features to discover and access online library resource; comparison with other RTD's, the developed RTD removes some actions of verifying the identity of a user or process. On the other hand, the overall effort of this study was focused on adaptation strategies where the adaptable approach is being taken to meet the usability and utility needs of different people with disabilities regarding presentation, information, and interface navigation. The created innovation tool allows users to make their choices about the library's search utilities. Within the longer-term steps, researchers could conduct research to match various designs, which could result in an additional suite of information resource retrieval for anticipated RDT disabled users

5 Recommendation

Libraries may prefer a discovery service based on its functionality and content coverage as well as resource management system from vendors based on sets of distinct requirements. Users require a discovery system excelled at providing precise methods for interacting with the library's local collections in a variety of ways. The genre of discovery services will continue to be enhanced to add new functionality and capabilities in response to requests from libraries and users to improve their competitive position. Some useful improvements and enhancements should be in the areas of application programming interfaces, expanding API ecosystem, enhancing social features, rich media materials and collections, research data sets, discovery, and access related to special collections, materials, analytics and altimetrics.

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