An Analysis of Web-scale Discovery Services From the Perspective of User's Relevance Judgment

Boram Lee, EunKyung Chung *

Department of Library and Information Science, Ewha Womans University, Seoul, Republic of Korea

A B S T R A C T

Although web-scale discovery services have been implemented increasingly worldwide, there is a need for the exploration of search effectiveness from users' perspectives. In this sense, this study examined web-scale discovery services in the view of users' relevance judgment comparing to individual databases in the fields of Education and Library and Information Science. Using four search topics for the EBSCO Discovery Service (EDS), ERIC, ERC, LISA, and LISTA, their search effectiveness were measured in terms of modified precision, recall, and reciprocal rank based on the relevance judgments of four participants. Comparison of the measurements showed that the web-scale discovery service was less effective than individual databases. In particular, EDS's effectiveness was lower than that of ERIC and ERC in terms of modified precision and recall. The modified reciprocal rank of EDS was lower than those of most individual databases in the fields of Education and LIS. Moreover, the relationship between the rankings from EDS and those from four participants was weak, as indicated by Spearman rank-order correlation coefficients (0.141 in Education and 0.170 in LIS). In fact, the effectiveness in the fields of LIS and Education of EDS was lower than those individual databases to a degree dependent on the field.

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1. INTRODUCTION

Web-scale discovery services are considered a primary trend in the academic libraries, and are rapidly increasing worldwide. As of December 2014, there are 7881 academic libraries with discovery tools in the United States (Breeding, 2014). A total of 77% of academic libraries in the United Kingdom had adopted discovery services (Spezi, Creaser, O'Brien, & Conyers, 2013). In Korea, as of February 2016, a total of 86 libraries[1] (approximately 40.2%) among 214 academic libraries had adopted discovery tools. As web-scale discovery services have been introduced and used in various fields, the volume of related research has also increased (Richardson, 2013; Thomsett-Scott & Reese, 2012). In characterizing the features of web-scale discovery services, studies have focused on the growth, scale of index, ranking based on relevancy, and next generation of libraries. In addition, to select certain services among the available options for web-scale discovery services, studies have compared several discovery services in terms of usability, features, ease of use, advantages versus disadvantages and so on. In this sense,

web-scale discovery services have been introduced and implemented in a variety of academic libraries, but is an evolving technology (Brennan, 2012; Caplan, 2012; Richardson, 2013).

However, as Spezi et al. (2013) pointed out, more user-oriented research is warranted to improve web-scale discovery services. A key aspect of web-scale discovery services is use of a centralized index to increase the effectiveness of search results with a relevance ranking (Breeding, 2014). As the heart of Google's success is the ranking of relevant information resources with a simple one-box search interface, the ordering of search results according to a relevancy ranking has a marked impact on the service. In this sense, this study aims to explore the effectiveness of web-scale discovery services in terms of user-oriented relevance judgment compared to individual databases. For the purpose of this study, four participants judged the effectiveness of search results from a web-scale discovery service and four individual databases. We selected the EBSCO Discovery Service as a web-scale-discovery service as it is a primary web-scale discovery service in the fields of interest and was given the highest satisfaction rate by users (Breeding, 2014). To compare the EBSCO Discovery Service, two disciplinary fields were selected: Education and Library and Information Science. For the Education field, two databases, ProQuest's ERIC and EBSCO's Education Research Complete (ERC), were used for comparison. For the Library and Information Science field, we selected ProQuest's Library and Information Science Abstracts (LISA) and EBSCO's Information Science & Technology Abstracts with Full Text (LISTA).

* Corresponding author at: Department of Library and Information Science, Ewha Womans University, 52 Ewhayeodae-gil, Seodaemun-gu, Seoul 03760, Republic of Korea.
  E-mail addresses: rajeunir@gmail.com (B. Lee), echung@ewha.ac.kr (E. Chung).
  [1] A total of 45 EBSCO Discovery Services, 18 ProQuest Summon, and 23 ExLibris Primo have been implemented in academic libraries in Korea as of February 2016. These numbers came from the correspondence with their product services' Korean branches

Table 1
Search topics and queries.

Field	Search topic	Search type	Search query
Education	Academic adjustments of elementary students	Basic	elementary student academic adjustment
		Advanced	elementary AND (student* OR child* OR school*) AND ("learning adaptation*" OR "learning adjustment*" OR "academic adaptation*" OR "academic adjustment*")
	Education of classic literature	Basic	classical literature education
		Advanced	("classical literature" OR classics) AND education
Library & Information Science	Information seeking behavior models	Basic	information-seeking behavior
		Advanced	("information-seeking behavior*" OR ISB) AND model*
	Next-generation library catalog	Basic	next-generation catalog
		Advanced	next-generation AND (catalog* OR OPAC OR integrated library system*)

2. RELATED STUDIES

To understand the discovery services in the academic libraries, we examined three categories of research: overview and reviews, implementations and usability issues, and evaluations of web-scale discovery services.

Discovery services have been introduced in editorials or commentaries in academic journals in terms of a variety of their definitions, characteristics, advantages, and disadvantages (Hoy, 2012; Ellero, 2013; Richardson, 2013; Thomsett-Scott & Reese, 2012). Hoy (2012) defines a discovery service as a large search system with a central index and a simple interface for library users. For discovery services, "ease of use", "scale of index", and "the increased use of library resources" were the primary advantages. In contrast, the following disadvantages of discovery services were identified: "mixed types of information", "cost of discovery services", and "unrealistic users' expectation". Ellero (2013) reviewed 45 articles published from 2008 to 2013 on discovery services to indicate the directions of discovery services from the perspective of metadata. The findings demonstrated that the discovery systems are disintegrated and contain mixed and varying levels or granularity of metadata. Richardson (2013) reviewed the growth of discovery services in academic libraries within the past 5 years. As of 2013, more than 5500 libraries provided discovery services to users and 53 articles had been published on this topic. More importantly, the use of discovery tools affects the practice of academic libraries. Thomsett-Scott and Reese (2012) reviewed the literature on discovery tools in terms of implementation, maintenance, evaluation, and effects. The review suggested that discovery services have both valuable characteristics and problems. Usability studies showed that traditional library terms, such as call numbers and holding statement, were considered obstacles to users understanding of the service. Spezi et al. (2013) reported the impact of library discovery technologies in the UK. In the landscape of rapidly growing use of discovery services in the libraries, the current status and recommendations for stakeholders were pointed out. Vaughan (2012) investigated web-scale discovery services in terms of library's needs and vendor's implementation issues. By combining the perspectives of the library and the vendor, recommendations to improve discovery services were suggested. Hofmann and Yang (2012) examined the current status of next-generation online public access and discovery tools in academic libraries by analyzing 260 college and universities' libraries in the US and Canada. The use of discovery tools has increased from 16 to 29%. Among the libraries using discovery tools, 96% maintained the traditional online public access. However, the use of faceted interfaces has also increased.

In terms of implementation issues and usability, Bull, Craft, and Dodds (2014), Denton and Coysh (2011), and Gross and Sheridan (2011). Bull et al. (2014) reported the users' perspectives of a discovery service, FindIt@Bham, of the University of Birmingham in the UK. A large-scale online survey received a total of 737 responses from a population of 28,697 students, and the level of satisfaction with the FindIt@Bham discovery service was rated "very good" or "good" by 71.13% overall. However, there is a discrepancy between undergraduate students and graduate students in terms of satisfaction levels. Focus groups

with a total of 14 participants were conducted to obtain further information regarding the perceptions of discovery services. Denton and Coysh (2011) investigated the implementation issues of a discovery tool, VuFinder, by means of a usability test and a survey instrument. In a total of 10 students, usability tests were conducted using a set of 14 task-oriented questions, and an online survey was administrated to a total of 75 participants. The findings showed that all participants preferred the discovery services over the classic catalog interface. However, new functionality of discovery tools, such as journal title search and certain terms in the interface, were found to be barriers to users' perspectives. Gross and Sheridan (2011) explored users' behaviors using a discovery tool, Summon, by means of a series of usability tests in 5 students. The findings showed that a new homepage design with a single search box was effective. Users found the single search-box interface to be easy to use, but had a limited understanding of the search results, such as where the results came and the results they obtained.

Because several discovery tools are available, evaluative analyses have been conducted. Chickering and Yang (2014) conducted comprehensive analyses of 14 major discovery tools, including commercial packages and open-source software, by comparing 16 criteria. The findings of this study identified eight ranks of discovery tools according to 16 criteria for comparison. In the first rank, Primo and WorldCat Local were found with fourteen out of 16 criteria. Axiell and EBSCO Discovery Service were in the second and third rank, by fulfilling 13 and 12 of the 16 criteria, respectively. In contrast, AquaBrowser, Encore, and Endeca were in the fourth rank with 11 of 16 criteria. BiblioCommons, Summon, and VuFinder were in the fifth rank with 10 of 16 criteria. In particular, VuFinder showed the highest rank among the open-source software packages for discovery tools. Of the six, another open-source software package, eXtensible Catalog, had 9 of 16 criteria. The seventh rank, Enterprise and Visualizer, had 7 of the 16 criteria. Blacklight, an open-source package, was ranked eighth, with 6 of 16 criteria. Hessel and Fransen (2012) compared two library systems, a traditional online catalog system and discovery service, in the University of Minnesota Libraries-Twin Cities. This study included 153 and 476 participants, respectively, for each system, and the findings suggested differences in the use and perceptions of the two systems. Yang and Wagner (2010) evaluated 17 discovery tools (7 open-source and 10 commercial packages) using a check-list of 12 features of next-generation catalogs. Overall, open source discovery tools were more innovative than commercial packages in terms of adoption of advanced features of next-generation catalogs. Aharony and Prebor (2015) analyzed the current status and perspectives of librarians' and information professionals towards discovery tools in Israel using a technology acceptance model (TAM), cognitive appraisals of threat and challenge, and the Big Five model of personality dimensions. For the TAM, the participants demonstrated that as they perceived the discovery services easy to use and effective,

Table 2
Number of search results from discovery services and subject DBs.

	Discovery	DBs	Total
No. of results	7,004,284	19,653	7,023,937