From Discovery to Delivery

—An Evaluation of Discovery Service WorldCat Discovery at Skövde University Library

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Abstract: This paper is to evaluate the discovery service WorldCat Discovery (WCD) at Skövde University Library (SUL) through the usability study of the discovery tool WorldCat Discovery (WCD). By reference to the concepts of “Information Portal” and “Next-generation catalogue”, as well as Dillon’s (2001) evaluation model, the overall impression of the discovery service WCD perceived by users at SUL is investigated; the benefits and the problems of the discovery tool WorldCat Discovery are examined and discussed. Data are collected by a two-stage survey among the users of Skövde University Library, which targets on students and researchers at the University of Skövde. The results show that the discovery service WCD is evaluated positively in general and is confirmed to be used in the future by most of the target group members at Skövde University Library. The features of single search interface and basic filter functions are the major benefits, but the access to full-text articles in minor-used languages and metadata quality are the main problems perceived by target group members during performing common search tasks through the WCD interface. By identifying the benefits and problems in relation to the aspects of discover and delivery, this study addresses a cooperative effort between academic libraries, discovery service vendors and content providers to a “seamless” integration of discovery services with academic libraries.

Keywords: Evaluation, Usability, Discovery, Delivery, Service, Interface, Digital library, WorldCat, University of Skövde
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1 Introduction

The relation between digital libraries and web has been under heat discussions since the beginning of the 21st century. Already in 2006, statistics provided in a study conducted by Ohio College Library Centre (OCLC) suggested that “89% of college students use search engines to begin the information searches whereas only 2% of them begin their search on the library web site” (Lees, 2006, p. 1). Ten years later, Perruso (2016) reported similar findings in a 4-year longitudinal study that 70% of first-year undergraduates start with a general web search (p. 615). Although it seems a bit radical to conclude that the web search engine is always first choice for most users just based on the above study results, it raises a traditional yet immediate concern of the role of libraries in a digital environment. Obviously, libraries are not willing to lose the “war” with other information sources in order to attract users. Discovery tools are developed and discovery services have been integrated with academic libraries over the past 6 years, which can be regarded as an effort to bring back users to libraries (Narayanan & Byers, 2018). A trend can be identified today that digital libraries are embracing web technologies and striving to serve users with enhanced search experience while maintaining high quality standard as a response to the complexity of information behaviour.

At the macro level, as discussed by Maceviciute (2014), changes in external political and economic pressures drive technologically innovative ways of producing and sharing knowledge; changes on organizational level related to research libraries raises the concern of the balance between the interest of academic values and business approaches; and changes in digital scholarship as a domain embeds the modification of “old ideas”, for instance, of the traditional ways of librarians’ work (p. 284-285). Therefore in a modern environment, the actual success of a final application is not merely an installation of advanced infrastructure; it has to be accepted by users, trusted by librarians and evaluated to be a source of “health of relations” within and outside the organizations (Maceviciute, 2014, p. 289).

At the micro level, the urgency of modernization of digital libraries has been addressed by Breeding in 2010. In order to keep competitiveness among various information providers, digital libraries have to choose either modernize their own online catalogue or incorporate other ready-made web services (Breeding, 2010, p. 32). The concept of “Web-scale” discovery service in digital libraries was characterized by Breeding (2010) as a discovery platform that can “manage access through a single index to all library content to the same extent that search engines address content on the web” (p. 34). Discovery tools were defined as “web software that searches journal-article and library-catalogue metadata in a unified index and presents search results in a single interface” (Fagan, Mandernach, Nelson, Paulo & Saunders, 2012, p. 83). With this “Web-scale” vision, those all-access discovery tools referred as “Academic Google” provided by various vendors are integrated with academic libraries as a counterpart to Google Scholar and other search engines (Narayanan & Byers, 2018, p. 276).

Nowadays, few digital libraries depend on their own traditional online catalogue. Discovery tools such as Summon from Serials Solutions, Primo Central from Exlibris, the EBSCO Discovery Service, and WorldCat Local / WorldCat Discovery from OCLC have been integrated with many libraries (at least academic libraries), and evaluated from various aspects (Akeroyd, 2017; Allison, 2010; Djenno et al., 2014; Elaiess, 2016; Enis, 2014; Fagan...
et al., 2012; Guay, 2017; Narayanan & Byers, 2018; Newton, 2017; Pant, 2015; Yang & Dawson, 2017).

In the context of modernization of digital libraries, this paper takes the setting of Skövde University Library (SUL) in Sweden to investigate the integration of such a discovery tool with academic library through the evaluation of discovery service WorldCat Discovery at Skövde University Library.

1.1 Background

The setting for the evaluation of the discovery service WorldCat Discovery (WCD) in this study is chosen as Skövde University Library (SUL). The rationale behind is firstly out of personal convenience as SUL is located in the same city where the author lives. Secondly, as a research library, SUL is more relevant to the topic of discovery service based on their academic needs. Moreover, such an evaluation is in line with the vision of SUL to keep up the modernization. It is also feasible and effective to collect empirical data among users of SUL with the help from the personnel of SUL.

Some background information of the discovery service WCD, the library SUL, and the implementation of WCD are provided below for a better understanding of this study from a contextual perspective.

1.1.1 WorldCat Discovery

WorldCat Discovery helps people easily find and get resources available at your library and in libraries worldwide through a single search of WorldCat and familiar, authoritative e-content collections. It also connects users to your collections via popular websites where people typically start their research (OCLC.org, 2018).

WorldCat Discovery is a set of discovery service provided by the OCLC (an abbreviation referring to Ohio College Library Centre when founded in 1967 and currently referring to OCLC Online Computer Library Centre) (OCLC, n.d.). As an American non-profit organization, OCLC and its member libraries maintain and provide access to the database WorldCat, which is claimed as the largest online public access catalogue (OPAC) in the world.

In order to make library holdings more visible to the online searchers, OCLC in 2004 started to “open” WorldCat database by integrating library records into familiar internet search sites such as Google so that when users search through Google for instance, they can be directed to relevant library holdings as well (WorldCat.org, n.d.). In 2006, OCLC launched its own portal WorldCat.org so that libraries can add the search box of WorldCat Local (WCL) directly on libraries’ websites (Lees, 2006; WorldCat.org, n.d.). By this way, users are able to use the search interface of WCL directly on libraries’ interface and get their search experiences enhanced by the discovery service WCL enabled by its inbuilt features. In 2014, based on the “cloud” technology, WCL was advanced to WorldCat Discovery (WCD). So far, this set of services enables searchers to discover “1.3 billion electronic, digital, and physical resources in libraries worldwide by using a single search” (Enis, 2014, p. 1).

There are six main features built in the discovery service WorldCat Discovery, described by the organisation itself as enabling its users (both library patrons and library staff) to:
The discovery service WCD is provided by OCLC based on the subscription from its member libraries. It should be noted that although the direct client of OCLC are libraries, the implement of this service will eventually impact the search experience of end users. In the context of this study, three of the above features are closely related to library patrons as the performances of common search tasks based on the academic interests of students and researchers at Skövde University Library are supported by those features, which will be explained in the following texts. Whereas the other three features are more relevant directly to library staff as they aim to increase visibility of libraries, expand e-book collections and support library staff, and therefore will not be discussed in this study.

The three features relevant to this study are:

- **Reach across your collections with a single search**
  
  This feature enables “searching for resources simultaneously across formats and collections instead of consulting multiple services and interfaces” according to OCLC. In a modern digital information environment, a quick and simple operation of search process more likely contributes to the positive search experience for users. This “Google-like” all-access through single search interface is probably one of the biggest attractions to both libraries and their end users.

- **Control your search experience without complexity**
  
  This feature claims to “deliver a flexible user experience” by matching available tools with users’ specific information needs. Moreover, this feature enables ease of use by saving search time for users through limiting search results by format, data, location and other qualifiers, which is enabled by the pre-set filters. Although filter functions are not unique to the discovery tool WCD, the reduced complexity by their “effective” feature design might be an advantage to simplify users’ search experience.

- **Reveal open-access collections in search results**
  
  This feature claims the open-access of extensive collections by including more resources from providers. The broadened resource coverage will benefit users with much more collections beyond local library holdings as claimed by OCLC. However, given the complexity of the issue in terms of open-access, it is not only the scale of collections that users are able to get access, but also the quality of access, such as the availability of a full-text view of a journal article for users, that will eventually affect real user experience, either positively or negatively.

### 1.1.2 Skövde University Library
Skövde University Library belongs to the University of Skövde which is a state university granted in 1983 in Skövde, Sweden. The University of Skövde consists of 5 thematic institutions and 8 departments, with research focusing on informatics, systems biology, virtual engineering, health and education, and enterprises for the future. In 2017, the university had 7361 students and 458 employees (University of Skövde, 2018). As part of the academic institution, SUL provides academic information and scientific publications through both traditional printed materials in physical library and through electronic resources.

1.1.3 Implementation of WCD at SUL

In preparation of this study, relevant background information as to the implementation of WorldCat Discovery (WCD) was obtained from one of the librarians at Skövde University Library (SUL) through the exchange of emails in the form of question—and—answer in January, 2018.

Skövde University Library (SUL) was the first among Swedish research libraries to implement the discovery tool WorldCat Discovery (WCD) which was referred as WorldCat Local (WCL) prior to 2014. The discovery tool WCL was first selected in June 2012 as there was a need for relevant discovery service in their library system. Mainly attracted by the convenience enabled by the single search box interface and its price advantage, SUL subscribed to OCLC for the discovery service WorldCat Local and developed their usage as the WCL was developed into WCD in 2014, and up until today. The general impression of WCD from library personnel has not been so positive. Except the price advantage, it is commented that even some basic functions are not working well; and considerable work still remains to be done to include their own printed collections after all these years. Prior to the study presented here, there has no evaluation of the WCD other than a more general evaluation of all the library’s technical platforms. This platform evaluation started in 2017 and was still ongoing at the time of this study in the spring of 2018. Therefore the specific evaluation of WCD fits in the overall evaluation agenda.

1.2 Problem formulation

With the “web-scale” discovery vision, the integration of discovery tools has been said to show their prominence by enhancing users’ search experience, in the form of a service that can deliver to users all library content in good quality without users having to search multiple databases (Fagan et al., 2012, p. 83). However, the effectiveness of such discovery services has also been questioned. Shortcomings regarding aspects such as resource coverage, indexing, metadata quality, and linking mechanisms are pointed out in reviews of current state of web-scale discovery services (Akeroyd, 2016; Michael, 2012; Narayanan & Byers, 2018). Further investigations into benefits and challenges connected to the integration of discovery tools at academic libraries should therefore be performed. In this study, this takes the form of a specific focus on the two aspects of discovery and delivery as presented below.

1.2.1 Discovery

Inspired by the success of Google’s broad resource coverage and easy access, discovery tools are developed as “academic google” aiming to provide users with a wide range of online sources in a Google-like search experience (Narayanan & Byers, 2018, p. 276). It is claimed by OCLC in its feature specification that the search tool will enable users search the world’s
most comprehensive library database with more than 412 million records, which is an ambition that “traditional” digital libraries are not yet able to achieve on their own.

With the integration of discovery tools, the services of digital libraries are enhanced not only by their extent, but also by the ease of use as in Google search experience. The feature of single search interface advocated by Breeding (2010) aimed at a unified user experience, praised by Newton (2017) as “amazing, magic” search experience in WorldCat Discovery. For the library staff as well, it is seen as an advantage that saves the trouble of explaining to users where books and journals are listed. Instead, users just begin with any term which can be author, title or whatever, and see the results direct (Breeding, 2010, p. 34). This is of course appealing and many academic libraries make efforts to integrate discovery tools.

However, accompanying the excitement brought by the “web-scale” vision and its possibilities enabled by advanced web technology, the complexity of users’ information behaviour in the modern digital environment is also increasing. Breeding predicted in 2010 that this search environment would significantly raise users’ expectations, for instance, “a better visual design, relevancy-ranked results, facets for drill-down through search results, presentation of cover art, enhancement of records with summaries and reviews, and the ability for users to rate items or submit review” (p. 32). While discovery service providers today strive to realize similar “fancy” features, many evaluation results reveal that in some occasions, even some basic requirements concerning the provision of accurate and relevant search results cannot be guaranteed by the integration of discovery tools. It addresses the need for a better result control based on the real performance of results delivery rather than simply focusing on the enrichment of discovery features.

### 1.2.2 Delivery

The discovery of information does not represent a whole search process by itself, but is rather part of a series of user and library system interactions, which also involve the delivery of results as part of the search process. As described that in the early stage of the development of a discovery service, it was actually enabled by a chain of services that “once resources are discovered, the users have been expected to use a different service, such as a document supply service” in order to get the results delivered (Guy and Palmer, 2010, p. 158). It means that when users click on the button “full-text” in the discovery tool interface, the actual view of this requested document is offered by its own content provider, e.g. a publisher, which can be out of the control of the discovery service vendor, e.g. OCLC.

The involvement of various services creates inconsistency in terms of the delivery of search results, in the case that relevant services are not integrated well. A risk of content delivery delay in discovery service was pointed out by Narayanan & Byers (2018, p. 276). For instance, if the publisher is late in providing data or late in indexing, this in turn causes the delay of the provision of content or metadata description from discovery service providers (in the case of WCD, this provider is OCLC), and possibly causes delay in the whole service chain. By contrast, in the case of Google Scholar, such reasons for delay present less of a problem since they harvest their contents through web crawlers (Narayanan & Byers, 2018, p. 276).

Another risk is the content delivery failure, as exemplified by the failed access to full-text content for users, which is due to the lack of an automated mechanism for discovery services to check the actual existence of the full text as crawling does in Google Scholar (Narayanan
& Byers, 2018). The failure of linking to full texts will potentially cause frustration among users or reduce the confidence from users towards academic libraries which are expected to provide a platform with enhanced full-text access capabilities by the integration of a discovery service (Akeroyd, 2017; Narayanan & Byers, 2018, p. 276).

The inconsistency in results delivery also reflects the issues of metadata quality, which has been the “selling point” of academic libraries compared with other web information sources. Problems in discovery services concerning repetition of article titles, confusing source types, lack of bibliographic records highlight the need for deeper indexing either from publishers or discovery service vendors to ensure the content can be delivered in a high standard and stable manner, since there is a gap between the ambition and the real practice (Akeroyd, 2017; Breeding, 2010; Narayanan & Byers, 2018).

To conclude this problem description, SUL integrated the discovery tool WorldCat Local (WCL), which was later on advanced to WorldCat Discovery (WCD), which was expected to benefit library users at SUL from the claimed features such as simple search interface and broader collections; at the same time, the above indicated problems concern both the users and the library at the University of Skövde. It is therefore desired and meaningful to conduct a user evaluation of the discovery service WCD at SUL. The evaluation results will potentially provide insights for other libraries in similar situations in terms of integration of discovery tools, modification of search services, and relevant decision-making.

1.3 Purpose and research questions

Based on the problem formulation above, the purpose of this study is set to evaluate the discovery service WorldCat Discovery (WCD) through a usability study at the Skövde University Library (SUL).

To achieve this purpose, the following research questions have been formulated:

Question 1: What is the overall impression of the discovery service WorldCat Discovery perceived by students and researchers at Skövde University Library?

Question 2: What benefits and problems are experienced by students and researchers when performing search tasks in WCD at SUL?

1.4 Delimitations

To answer the two research questions, several issues need to be clarified.

First of all, the target groups for this evaluation are students and researchers at Skövde University Library. In the context of this study, users of the discovery service WCD can be identified as three major groups which include students, researchers and personnel. However, as the search experience of students and researchers for academic interest is the focus of the research question, which is assumed different from the information needs of personnel with administrative or service interest, the study targets on the user groups of students and researchers. Besides, partly due to the limited resources and time, it is not feasible to include all three groups of users for the study.
Secondly, three features are set as the parameters for usability test of the discovery tool WCD, which are single search interface, basic filter functions and full-text access as they are most relevant to the user groups of students and researchers at SUL for accomplishing common search tasks. The design of the concrete questions will be described in the section of methods. Further on, the task experiments aim to simulate the real search experience of the target groups of students and researchers as close as possible in order to most possibly reflect their search practice. The concrete scenario and tasks will be described in the section of methods as well.

Moreover, as to the study instruments, the questionnaire will be constructed through Sunet survey which allows a switch between computer interface and mobile view for respondents in order to maximize the response rate. However, the task experiments are conducted through stationary computers as it is more convenient for participant to operate the search process and switch screens between the survey and WCD search interfaces.
2 Literature Review

Following the purpose of this study to evaluate the usability of WorldCat Discovery at the Skövde University Library, it is relevant to study previous usability studies of WCD. Through the search of key words “discovery service”, “search tools”, “usability”, “evaluation” and “WorldCat Discovery” in the library at the University of Borås, Google Scholar as well other internet resources such as OCLC.org, WorldCat.org and Wikipedia.org etc., twelve articles and reports which are relevant to the topic of discovery service and specifically dealing with usability studies of WCD are presented.

As mentioned in the background section, WorldCat Local (WCL) was the first product developed by OCLC, later evolving into WorldCat Discovery (WCD) in 2014. Both names of WCL and WCD are used to refer to the same discovery service in the presentation below if the discussion refers to general features existing in both versions.

2.1 Perceived benefits of discovery tools

2.1.1 Simple search interface

Under the “web scale” discovery vision, the single search box model was perceived as the biggest advantage of WCL/WCD. This single search box means that users would be able to search across local library catalogue and various subscribed databases and get full-text access within the same search interface of WCL/WCD.

The design of this single search box model was evaluated by OCLC own staff at University of Washington (UW) in May 2007 shortly after WCL went live. The result in the first round test showed that most UW students were generally successful in finding the materials they need in this single search box interface (Ward, Shadle & Mofjeld, 2008, p. 17). The second round test showed that WCL was effective in “topical discovery” and in displays of all manifestations of a work for a single edition (Ward et al., 2008, p. 21).

In 2009, Boock, Chadwell and Reese conducted a usability test among 40 undergraduate students, 16 graduate students, 24 library employees, 4 instructors and 18 faculties at Oregon State University Libraries (OSU). They reported that through this single box search, various work versions, formats and editions could be brought together (Boock et al., 2009, p. 3).

Similar to OSU, Western Washington University Libraries were also appealed by the feature of a single search box in WCL and considered adopting OCLC’s WCL as their primary discovery interface as a replacement of their current Innovative Interfaces WEbPAC Pro (WebPAC) (Thomas & Buck, 2010, p. 648). As part of a large decision-making process, a usability test was performed by 24 participants with 20 common catalogue tasks in either the library’s current interface WebPAC or WCL. The goal was set to evaluate whether the OCLC’s WCL interface was better than the in-use interface WebPAC to justify the decision to change search tools. Two benefits were brought by the single search environment as the results. One was that WCL could support “discovery of materials regardless of source” and the other was that all the services such as “local holds, requests for Summit resources from consortial libraries, or interlibrary loan requests from non-consortial libraries” were offered in a single interface rather than in a separate interface (Thomas & Buck, 2010, p. 652).
Besides the built-in single search box model, the entire interface of WCL was continuously improved by OCLC, for instance to adjust the order of search results, to clarify various editions, and to increase visibility of search terms etc. (Fagan et al., 2012, p. 88). A better control of interface during the implementation of WCL could be illustrated by the possibility to include a button such as Get It! customized at the University of Delaware Library (UDL) (Gaffney, 2012). When users at UDL click on the button Get it!, a new window will be open to check local holdings and provide an option for placing an Interlibrary Loan (ILL) request. The study results indicated that WCL was effective in reducing ILL requests by integrating the local library holdings and worldwide holdings into one interface, which was seen as a great advantage to help users discover materials in local holdings and reduce the work load of ILL staff (Gaffney, 2012, p. 74).

The overall design of the search interface received “overwhelmingly” positive response from the participants of the usability study of WCD by Bertot, Berube, Devereaux, Dhakal, Powers and Ray (2012). The data was collected through a multipart survey with pre-tasks, WCL tasks and post-task questionnaires, followed up with a focus group interview with 14 students on graduate level in the information studies college at the University of Maryland (UM). The comments were “clean”, “clear”, “well-balanced” and “aesthetically appealing” (Bertot et al., 2012, p. 216).

2.1.2 Broad resource coverage

Besides the simple search interface featuring the single search box model, the broad resource coverage has been considered another major benefit with the integration of WCL/WCD.

Boock et al. (2009) in their report concluded that by using the WorldCat database, users were able to “easily find nearby libraries’ holdings in addition to their own” (2009, p. 2). An inclusion of over 57 million article citations also added strength to WCL according to their report (Boock et al., 2009, p. 3).

The detailed records contained in WorldCat database given by Gaffney (2012, p. 69) was over “164 million books, 14.5 million dissertations and theses, 200, 000 million articles, and more”. When users click on a record for an item in WCL, they could see information concerning call number, location, availability in the local library (if it is held by the local library, in this case, the University of Delaware Library), the WorldCat bibliographic data, and a list of other libraries that own the material.

The broad resource coverage of WCL was affirmed in Majors’s (2012) usability test, which involved all the vendor-provided discovery tools, namely Encore Synergy, Summon, WorldCat Local, Primo Central, and EBSCO Discovery Service in a study involving undergraduates across all academic disciplines (p. 188). It was commented by participants that they appreciated the ability of WCL to find different kinds of resources with much more electronic and digital resources comprehensively included (Major, 2012, p. 192).

In 2014, WCL advanced to WCD based on cloud technology, it was expected to provide an ideal combination of applications that could both “do the complicated librarians’ work” and serve as “a tool simple enough for the users” (Enis, 2014, p. 3). One improved capability of WCD was that a library’s own resources would be assured to be listed first in search results (Enis, 2014, p. 3). Another important implication would be full-text access to content in other databases by subscribers through OCLC WorldCat Discovery Services (Jacksonville, 2014), which implied greater capability from resource sharing perspective.
2.2 Perceived shortcomings of discovery tools

While the simple search interface and broad resource coverage were perceived as the major benefits for users and motivations for libraries to integrate discovery services WCL/WCD; various flaws and shortcomings have also been revealed by previous usability study results.

2.2.1 Low interoperability

In the early stage of discovery tools, many libraries considered either integrating WCL with their library interface or replacing their own interface. However, the usability test by Boock et al. (2009) showed flaws of integration of WCL with Oregon State University (OSU) libraries’ local service LibraryFind™. One problem was that the WorldCat database could not represent the full information of the local records as in their local service LibraryFind™. The switch from LibraryFind™ to WCL would mean the missing of substantial bibliographic data—the local call number (Boock et al., 2009, p. 5). The loss of call number search was seen as a minus point for OSU libraries.

Even though OCLC was continually working on the issues related to interoperability, it was still fairly limited in scope and still much in development. It was criticized as “one-size-fits-all” approach by Boock et al. (2009) since individual academic libraries’ needs for specific features that were not implemented by OCLC. Compared to their local service LibraryFind™ which was a service developed with considerable investment by OSU for facilitating research activities; it was a step “backwards” to switch LibraryFind™ to WCL (Boock et al., 2009, p. 6). Therefore, in comparison to other search tools including Encore, Summon and LibraryFind™, WCL was judged still in its infancy and a decision was made to postpone the implementation of WCL.

Western Washington University Libraries was in similar situation where OCLC’s WCL was compared with their WebPAC. While the strength of single search interface was recognized by their usability study, it was found that the extensive search environment with single search interface exposed challenges for users, for instance, the merge of format types within a single set of results caused confusion for participants to distinguish between books and articles (Thomas & Buck, 2010, p. 652). Another issue during this merge was the inconsistent ways of displaying authors’ names, exemplified by the disorder of first name and surname (Thomas & Buck, 2010, p. 669). The low interoperability implied challenges for academic libraries to integrate WCL or replace their own search tools. A decision was then made by the management team to delay the switch from WebPAC to WCL while monitoring the development of the product WCL.

2.2.2 Insufficient metadata

Low interoperability was not only caused by the merge of data or formats, but also affected by low metadata quality, involving inconsistent indexing methods, lack of clear instruction and repeated returned results etc. For instance, it was noticed that the “lack of indexing of full uniform titles created a tremendous barrier to users seeking music resources”, which would imply a loss of functionality with the transition from WebPAC to WCL (Thomas & Buck, 2010, p. 669).

Gaffney (2012) pointed out the inconsistence in terms of catalogues which resulted in the items selected by users being presented in different bibliographic records (Gaffney, 2012, p.
The work to assist users with the interpretation of catalogue holding therefore remained apparent according Gaffney (2012). Another problem in terms of the Interlibrary Loan request, due to lack of clear indication of prepublication records in WCL, users were frustrated because they thought that they could get access to material that later proved to not have been published yet, therefore being unavailable (Gaffney, 2012, p. 77). Lack of clear instructions also brought a noticeable phenomenon that students treated the single search box as a “Goole” like search and used a trial and error methodology to figure out the possible ways for searching results (Majors, 2012, p. 190).

Another weak area was found in relation to WCL’s journal searching experience as there were redundant or contradictory messages returned with the retrieval results, which was probably due to poor coordination between WCL and the university’s online public access catalogue (Bertot et al., 2012, p. 217). For instance, participants could not understand why some titles were repeated several times or what could be the ranking principles (Bertot et al., 2012, p. 218). Another noticeably weak area was related to the issue of access, when off-campus students were required to log in repeatedly in order to continue to search; and when users were suggested with materials physically close to their location but no access privilege (Bertot et al., 2012, p. 217; 219). It was felt an urgency to make the concept of “local” clear to users.

After the advancement from WCL to WCD, there still existed specific problems in terms of metadata such as misleading icon for citation, unclear meaning as to the function “Place hold” (Winterling, 2016, p. 5). Besides, there was unclear definition as to whether “Journal source phrase” means a title or keyword search, together with a slowness of the search process, which was noticed by the test team as well (Goldfinger, 2017, p. 14). It could be noted that metadata quality was still an issue in need of improvement in spite of considerable functional improvements of WCD compared with WCL.

2.2.3 Limits in advanced search

By “advanced search” in this context, it means that in contrast to simple search box in the starting page of WorldCat Discovery, which only enables key words search, the “advanced search” offers a series of options such as filter functions to either expand or narrow down the search results based on search interests of users. The usability test by Boock et al. (2009) suggested that the advanced searching in general is extremely limited. It was commented as difficult to “identify and request specific editions and formats” for instance (Boock et al., 2009, p. 5). The inability of limiting searches to holdings in a particular branch and/or location was also seen as a weakness of WCL (Boock et al., 2009, p. 6). The issues concerning advanced search created a feeling of loss of interface control, which presented hinders to the research activities for Oregon State University (OSU) (Boock et al., 2009, p. 13).

The limit in advanced search in WCL was also reflected in the comparison with other web information sources. For instance, in the study conducted by Majors’s (2012), students suggested desired features that were not built in WCL yet. One of the interesting examples was to add “Amazon’s online shopping” experience such as rating, reviews, lists of similar items etc. to the WCL’s existing features (Majors, 2012, p. 196). Although the real effects of those features on academic tasks are still in need of discussion, it reveals that in certain aspects, the development of discovery tools is not “advanced” enough to attract all potential users.
The shortcomings of WCL in terms of advanced search definitely affected users’ preferences among various search services. Djenno, Insua, Gregory and Brantley (2014) conducted usability tests with the purpose to choose between the discovery systems Summon and WorldCat Local for the University Library at the University of Illinois at Chicago. The results showed students’ split preferences over different search tools on various aspects such as content, functionality and interface (Djenno et al., 2014). One observation from the study was that although participants would use discovery tools such as Summon in the future, they would use “a Google product for certain searches” rather than either of the two tools, and would go to Amazon to obtain a book rather than the suggested options by the discovery tools (Djenno et al., 2014, p. 278). A conclusion from this is that the weakness in advanced search of discovery services might position libraries and discovery tools inferior to other internet utilities.

During the transition from WorldCat Local to WorldCat Discovery in 2015, Rebecca K. Goldfinger (2017) led a research team conducting two rounds of usability testing at the University of Maryland Libraries (UMD). A few major differences between WCL and WCD were first noted by the commission team such as the reposition of display of result items and option links, and the reorganization of hierarchical categories, the disappearance of option to print the record, together with the periodical appearance of error messages (Goldfinger, 2017). The results of the two rounds of testing revealed that some problems still existed even though the filter function, the library holdings visibility and the interlibrary loan ability was found to be improved. Frustrations from participants in accomplishing specific tasks could be identified with multiple attempts to use limiters to locate video/DVD format, and with the difficulty to “determine the available format of the article based on the summary holdings statement” in the WCD (Goldfinger, 2017, p. 13). Another inconvenience occurred when users conducted advanced search while initial search criteria was automatically cleared so that users had to enter the search terms again (Goldfinger, 2017, p. 13).

Similar to the problems mentioned in above study, the loss of search results when participants clicked the browser back button and the removal of search terms when participants proceeded with advanced search also appeared in the usability study by (Winterling, 2016, p 5). With the purpose to ease the transition from WCL to WCD and to address potential issues before the launch of WCD, Winterling (2016) conducted the study prior to the implementation of WCD at the J. Murrey Atkins Library. Three groups of participants which included faculty, graduate students, and undergraduate students were recruited to test functionalities of WCD with 12 predefined tasks. However, it was pointed out possible to avoid such problems by clicking the button “Close Item Detail” in the upper right corner or “View Filters” in the upper left corner, which highlighted the necessity of training/tutoring in order to inform users and thereby to reduce users’ frustration (Winterling, 2016, p. 5). Generally, issues related to advanced search were commented as problems which occurred in the aspects of both layout and functions.

2.3 Conclusion

The previous studies reported in literature from 2008 until 2017 reviewed both benefits and problems of WCL/WCD in the setting of academic libraries. Benefits of WCD from simple search interface and broad resource coverage possibly provide users at SUL with a positive search experience; however, shortcomings perceived in previous studies such as insufficient data and limit in advanced studies will potentially have a negative effect on the search experience of current users at SUL. Therefore they will become issues of focus in this study.
As the issue of interoperability does not directly concern the target groups in this study, it is thus not evaluated in this paper. However, the problems in relation to low interoperability during the integration of WCD with academic libraries, such as confusion of formats and sources caused by this single interface environment and extensive resource coverage will be discussed in relation to the aspect of metadata quality as those problems have an effect on users’ search experience.

Whether the usability of this discovery tool WCD is perceived similarly by the users at SUL? What are the main advantages and disadvantages reflected by the benefits and problems of this discovery tool WCD experienced by the current users in the new setting, where SUL is the first adopter of WCD in Sweden? The current study therefore attempts to provide an up-to-date evaluation of the discovery tool WCD.
3 Theoretical Framework

The theoretical framework for this study is built up around the concepts of “Information Portal” and “Next-generation catalogue”. To this is also added a Dillon’s (2001) evaluation model based on “Process, Outcome and Affection (POA) approach”. Together, these theoretical perspectives help to ground the integration of discovery service at academic libraries and indicate the potential benefits and challenges with the integration of discovery tools.

3.1 Information portal and Next-generation catalogue

The concept of “Information Portal” is a metaphor borrowed from the field of astronomy to describe the organization and access of data in the field of information science (Allison, 2010). Similar to the universe which is constituted by known and unknown areas, there are visible and invisible parts of the web. Compared to visible web where information that can be retrieved as data is collected and indexed, the invisible web or deep web corresponding to “black holes” in the universe of information, contains data that is not included by search engines for various reasons, for instance, some websites might be skipped intentionally due to lack of authorization for political reasons, or they are simply not HTML coded (Allison, 2010, p. 379). This implies a risk for library users to miss the latest and possibly relevant information in the massive information environment without the provision of comprehensive search services.

Even though the information universe may be limitless, as pointed by Allison (2010), it has observable horizons from the viewpoint of an information seeker. A model of “Next-generation catalogue” based on the concept of “Information portal” was proposed by Allison (2010, p. 379). The integration of discovery services with academic libraries could therefore potentially bring together the best available resources. Inspired by Allison’s illustration (2010, p. 38), the figure of “Knowledge sphere: an information portal” can be modified in relation to the context of this study—the catalogue of SUL (University of Skövde, 2018) (see figure 1. below).

![Figure 1. Knowledge sphere: an information portal exemplified by the catalogue of SUL](Source: modified by the author of the study based on Allison’s figure)
As stated by Allison (2010), such a catalogue should “reflect the strengths and subject interest of the community and place the searcher at the centre of information” (Allison, 2010, p. 38). However, in her original illustration, the image of searcher was placed at the side of the portal, which seems not compatible with the central position of information seekers. This modified figure therefore chose to place the image of searcher in the centre of the figure to best illustrate the central position of information seekers in this knowledge sphere.

In the context of academic libraries, the interest of the institution community was emphasized by a customized search interface that can provide users access to all available resources including “library holdings, full-text materials, multimedia databases and other specialized collections” (Allison, 2010, p. 380). What is more, the collections should be dynamically growing given that they are indexed “in as close to real time as possible” and “incorporate web 2.0 features and online services” (Allison, 2010, p. 380). The concept of “Information Portal” provides principles for concrete requirements on the features of “Next-generation catalogue” as exemplified in the following list (Allison, 2010, p. 380-381):

1. A clean, well-designed Website that will encourage quick retrieval of information and minimizes the need for searchers to physically go to the library.
2. Search engines that index the latest information.
3. A broad scope of content, including multimedia, text, and print sources.
4. Aggregate searching that pulls together relevant information.
5. Online and on-demand services that are relevant to the searcher’s immediate needs.
6. Seamless chaining or connection of searches between databases so searchers do not have to figure out where to go for full text or supplemental resources.
7. Search interfaces that allow serendipitous discovery.
8. Functionality for user tags, reviews, and ratings that help searchers select from results lists.
9. Capability for a researcher to change his search’s focus from a narrow strategy to a broader strategy.
11. Spell checking and other features that guide users to improved results.

The above described features are not new today. While for academic libraries, some of the features are still in developing developmental phases, such as adding video format and integrating discovery services, others are under discussion such as functionality for use tags, reviews and ratings in connection to the library catalogue, which will be possibly realized by the integration of discovery tools at academic libraries. That also means that it has become important to look further than to technological features alone as done in most usability studies, and start investigating in more detail whether and if so, how, those features meet the needs of searchers and institutions, as is the focus of this study.

3.2 Usability

As the concrete standards for the feature of “Web-scale” discovery are suggested above, it becomes natural to evaluate the usability of the customized interface based on the study of the “learnability, efficiency, memorability, errors and satisfaction” of the interface in reference to design guidelines (Nielsen, 2003; 2006). However, the current evaluation is not limited on the interface level, which constitutes only part of the discovery service. The definition of usability provided by ISO 9241 is useful in the context of digital libraries and discovery tools as studied here, because the major criteria of usability: effectiveness, efficiency and satisfaction provide testable parameters for the features of WCD (Chowdhury & Foo, 2013, p. 168).
Further on, Chowdhury and Foo (2013) provide concrete instructions as to how to evaluate digital library discovery services that are associated with it (Chowdhury & Foo, 2013, p. 169):

- conduct usability studies involving digital library users, and therefore identify a subset of the target users of the digital library and involve them in the study
- study the selected users’ context and the goals for which they are going to use the concerned digital library
- assess how the chosen users use the digital library to accomplish their tasks
- find out how efficiently the study participants can use the various features and functions of the digital library concerned
- find out what their overall perception and level of satisfaction with the digital library service is

Although the above guidelines are suggested for the evaluation of overall services in digital libraries, they should be equally applicable for the evaluation of specific discovery service such as WCD as part of the entire library system.

To test the major criteria of usability which are effectiveness, efficiency and satisfaction, a commonly adopted method was to design suitable tasks conducted by representative users, then to record the process evaluators, and to analyse the produced data such as time per task, errors, and user attitude.

This method, however, was argued by Dillon (2001) as insufficient for capturing all aspects because some tasks supported by technology might be difficult to measure; time as an indicator of efficiency might not be equally weighted by users; and there are more factors than satisfaction that affect users’ performance such as personal experience and mood. Instead, Dillon (2001) associated the three criteria effectiveness, efficiency and satisfaction with the context and users, by which he extended the commonly adopted approach to three levels: Process, Outcome and Affect (abbreviated as the “POA” approach to evaluation).

In the POA approach, three key issues are emphasized: what the user does, what the user attains, and how the user feels. Correspondingly, “Process” aims to understand users’ moves and attention through the information space, “Outcome” focuses on the results of the interaction, while “Affect” aims to identify the meaning of the interaction for users in their world. By this approach, Dillon concluded: User experience =actions + result + emotion (2001, p. 4).

In order to capture the interactive experience between a user and a tool that is in focus for this type of usability study, Dillon (2001) later on suggested “new” measures of user experience in the form of “aesthetics, perceived usability, leaning over time, cognitive effort, perception of information shapes, intention to use and self-efficacy” (Dillon, 2001, p. 6).

While it might be effective to conduct the usability study of WCD with effectiveness, efficiency and satisfaction as the major criteria and it is also feasible to evaluate WCD by the design of suitable tasks in the context of this study; the measure of effectiveness and efficiency by numbers might not be able to reflect the future use of the discovery service in this context.
This usability study therefore takes Dillon’s (2001) position that the ease of use is insufficient to predict intention to use; and adopts Dillon’s POA approach with the considerations of aspects of process, outcome and affect. Thereby the evaluation focuses on the experiences and comments on the performance of tasks pertaining to search processes by representative users, rather than the traditional measurement of time per task or errors. A modified table illustrates the application of POA approach in the evaluation of discovery service WCD in the current study (see *Table 1.* below).

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>• Navigation paths taken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Use of back button or links</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Use of menus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• What constitutes the end of the interaction?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Details submitted?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Information located?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Satisfied?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• frustrated?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Enriched?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Wiling to come back?</td>
<td></td>
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</table>

*Table 1. Application of POA approach in the evaluation of WCD*

(Source: modified by the author of the study based on Dillion’s illustration)

It should be noted that due to the constraint of time and scope of this study, it was not feasible to adopt all Dillon’s (2001) “new” measure of user experience in the forms of aesthetics, leaning over time, cognitive effort, perception of information shapes, and self-efficacy, which would have been ideally used to investigate long-term dynamic user experience. Instead, the measures in the forms of perceived usability and intention to use will be adopted in the current evaluation.
4 Methodology

To fulfil the purpose of this study to evaluate the discovery service WCD, and to answer the two research questions, this section devotes to clarify the choice of methods and study design, followed by data collection with the detailed descriptions of a two-stage survey, namely questionnaire and task experiments. First, questionnaire and task experiments were constructed in Sunet survey simultaneously as the instruments to collect data. Thereafter, questionnaire was published and responses were collected, followed by the answers processing. Based on the results of recruitment through questionnaire, participants for task experiments were contacted. Then experiments were conducted and answers were processed. After that, post-task comments for specific questions were collected and processed. Two methods of data analysis as to qualitative and quantitative data will also be explained in the end.

4.1 Choice of methods and study design

The choice of mixed methods is based on the examination of the strengths and weakness of each option. If we follow the research convention to discuss methodology under the two big “umbrellas” as qualitative and quantitative strategy, the most obvious distinction between them is the deep insights provided by qualitative data against the objective quantification from quantitative methods (Bryman, 2012, p. 35). However, qualitative methods might appear to be too subjective, difficult to replicate and lack of transparency (Bryman, 2017, p. 405-406), quantitative methods might be associated with the artificial impression presented by the measurement and a static view due to the disconnection between research and real life (Bryman, 2017, p. 178-179). As both qualitative questions and quantitative measurement are necessary in this study, a two-stage survey including pre-task questionnaire and task experiments is chosen to collect data.

It should be noted though; the methods chosen in this study are not always clear-cut, and may not fit in the strict distinctions of either method. The ultimate use of each method depends on for instance, the instruments for data collection and the methods for data analysis. The intended survey method in this study may carry more weight of quantitative characteristics due to the use of measurement; however, the texts of questions and comments in the survey are qualitative in nature, but can be analyzed from a quantitative perspective as well.

Before the design of the survey, relevant literature with the same interest of discovery tools was consulted first. The task based multipart survey has been found productive for evaluation of discovery services and usability studies of discovery tools. Bertot et al. (2012) used the methods of pre-task questionnaire, WCL tasks, post-task questionnaire, and complemented with a follow-up focus group interview to access the usability of WorldCat Local. The pre-task questionnaire of the survey was used to provide background information such as participant demographics; current resource location tool usage and technology used by study participant whereas the following eight tasks were designed to test WCL (Bertot et al., 2012, p. 211). Reflections about participants’ experience were obtained from post-task questionnaire, in addition a focus group interview was held in order to get qualitative feedback about WCL (Bertot et al., 2012, p. 212). Task-based testing was also used by Majors (2012) to compare several Web-scale discovery tools including WorldCat Local, where “think out loud” technique was combined to provide qualitative insights. With similar study purpose to compare two discovery systems at one academic library, Djenno et al.
(2014) employed similar task-based technique complemented by post-test questionnaires and recorded interviews to get both quantitative statistics and qualitative insights. In the WorldCat UMD usability report in 2017, Goldfinger used “speak aloud” technique, video recorded by Camtasia software while the participants performed their search tasks in WorldCat. Deodato (2015) even provided a step-by-step guide for evaluating Web-Scale discovery, which involved an extensive scope from the formation of an evaluation team to the education of library stakeholders, to the final recommendations, where a detailed evaluation plan was executed by task-based tests to cover the aspects of content, functionality, usability and administration of WorldCat Discovery.

Although the forms of survey in the above studies slightly deviate from each other depending on their research questions, the task-based technique and the combination of qualitative and quantitative strategies is found applicable for this study. Besides, the design of specific tasks can be inspired by the formation of existing questions in similar studies since they have been piloted before.

4.2 Data collection

Based on the design of the survey study, empirical data are collected through questionnaire followed by task-experiments, which will be described in the following sections.

4.2.1 Questionnaire

One of the most efficient instruments for gathering empirical data in survey design is questionnaire (Bryman, 2012, p. 232). Questionnaire designed with open or closed questions can be completed by participants themselves. Compared with other social research methods such as structured interview, “self-completion” questionnaires have the advantage that are cost-effective, time-efficient, less affected by interviewers, and also convenient for respondents (Bryman, 2012, p. 234). Questionnaire can be in printed forms sent out by mail/postal, or conducted in certain location. In this study, a web-based questionnaire is adopted due to the large target groups and the limited time frame as it is relatively easier to collect and has lower cost compared to printed copies sent out by mail/postal (Wildemuth, 2017, p. 175).

The design of the questionnaire aims to answer the first research question:

Question1: What is the overall impression of the discovery service WorldCat Discovery perceived by students and researchers at Skövde University Library?

Based on Dillon (2001) evaluation model, the purpose of the questionnaire focuses on contextual information for the study such as the demographic features of participants, their overall impression of WorldCat Discovery, and users’ expectations of relevant features of discovery tools in general.

Development of questionnaire

The formulation of questions can be qualitative while the expected answers are statements mixed with rating values based on Likert-scale which is commonly used to measure intensity of feelings (Bryman, 2012, p. 166). As closed-ended questions require less time and effort from the respondent and prove easier for analysis (Wildemuth, 2017, p. 174), most questions
applied in the questionnaire are closed-ended, with a few open-ended options for answers allowing some room for exploration (see appendix A). After the introduction part to clarify the study purpose and time frame, the background information of participants is asked as question 1. The main part of the questionnaire contains 9 questions. Question 2 and 3 are designed to find out some contextual information such as respondents’ search habit. Question 3 leads to two sets of following questions with the answers of “Yes” or “No” as division. Questions 4A to 7A are designed for users of WCD with the aim to get feedback on the overall impression of the claimed features of discovery service WCD. Questions 4B to 7B are used for respondents that never used this discovery tool, but that still may have relevant expectations on such discovery tools in general. Question 8 is an open-ended question in order to further explore respondents’ information needs. Question 9 is used to investigate respondents’ attitudes towards WCD in terms of future use. The final question 10 is of another character, inquiring about the respondents’ willingness to participate in the following task experiments.

**Participants**

As the study context is the University of Skövde, the user groups of the discovery service WCD at SUL are naturally potential participants of the study. Three user groups are students, researchers and other personnel with administrative tasks. However, the search experience in focus for this study has to do with academic interests, which are assumed different from the information needs of personnel with administrative or service interest. Moreover, partly due to the limited resources and time, it is not feasible to include all three groups of users for the study, although it is desired. As a result, the groups of students and researchers are decided as target participants for this study, which can be defined as special population based on their unique characteristics in terms of information needs (Wildemuth, 2017, p. 145), in contrast to general population.

The sampling frame for questionnaire can be presented in the following table (University of Skövde, 2018):

<table>
<thead>
<tr>
<th>Academic status</th>
<th>Number of target respondents (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate (Bachelor)</td>
<td>6520 (87.00 %)</td>
</tr>
<tr>
<td>Graduate (Master)</td>
<td>841 (11.22 %)</td>
</tr>
<tr>
<td>Faculty (Researcher)</td>
<td>133 (1.77 %)</td>
</tr>
<tr>
<td>Total</td>
<td>7494 (99.9 %)</td>
</tr>
</tbody>
</table>

*Table 2. Sampling frame for questionnaire*

The sampling strategy is self-selection sampling as all members of the target groups are invited to participate but those who actually respond become the sample for the study. This self-selection sampling could affect the representativeness of the study in terms of the coverage and selection bias, in the case that some of the target group members might miss the exposure of the questionnaire due to various reasons; or in the case that the will of respondents to participate in the study is out of their personal concerns, rather than academic interests (Khazaal, Van Singer, Chatton, Achab, Zullino, Rothen & Thorens, 2014).

Despite of the limitation of self-selection sampling, this strategy is still considered as an effective sampling method based on the advantages that the access online could reach more people than traditional “paper-and-pencil” method; and that the following data analysis process could also be simplified through the online surveys (Khazaal et al., 2014).
Performing the questionnaire

Before the launch of the survey, as suggested by Wildemuth (2017, p. 174), it is desirable to go through two stages in the forms of pre-testing and pilot testing. The pre-testing of the entire survey took the form of expert reviews. Such pre-testing can be performed by both scientists and practitioners that are experts in the field, and for this study performed, by the supervisor of this paper and the personnel at SUL.

The questionnaire was launched 16\textsuperscript{th} of March through Sunet Survey on the intranet of the University of Skövde, student portal, and the website of the Skövde University Library. After one week, 25 answers had been returned, which was judged insufficient for the study. More answers were collected either online or through printed copies by talking to students inside the library and around the campus of the University of Skövde on 23\textsuperscript{rd} and 24\textsuperscript{th} of March. With the help of some teachers at the University of Skövde, some more questionnaires were also distributed. By the 3\textsuperscript{rd} of April, a total of 59 answers had been submitted, and 11 respondents had signed up for the follow-up task experiments.

Ethical consideration

Ethical issues are important as they directly relate to the integrity of a piece of research (Bryman, 2012, p. 130). Following the guiding principles that “no-harm” should be done to participants; anonymity was guaranteed by publishing the questionnaire on the intranet of the University of Skövde, student portal, and library website rather than distributing via personal email.

The respondents were not required to provide any personal information as to name and age, rather general information on study subject as that is assumed relevant to this study. Besides, respondents were well informed of study purpose and data usage by the detailed introduction texts before the start of the questionnaire. Their participation was completely voluntary and anonymous.

4.2.2 Task experiments

Bryman (2012, p. 50) describe experiments as data collection methods in which some variables can be manipulated as an input to get some output for the understanding of their effects. In the case of this study, the tasks provide the variables that are designed with certain degree of control. The perceived benefits and problems of the tool of the discovery tool WCD are reflected through the performance of the tasks by participants in this study.

The design of the tasks is intended to provide insights that contribute to answering the second research question:

Question 2: What benefits and problems are experienced by students and researchers when performing search tasks in WCD at SUL?

The research question means the users’ searching experiences through the search tool, and the comments of the features are the relevant data to be collected. The research question also implies that the degree of satisfaction on performing the tasks, the good or bad aspects of each feature from the users’ comments, and the preferences of users are seen as the indicators of benefits and problems of this discovery tool WCD.
**Development of task-experiments**

Before the task experiments, a consent form was provided and signed by the participants according to common research practice (see appendix B). The experiments begin with questions aimed at collecting background information concerning the participants’ academic status. Thereafter, some instructions are provided for the conduction of the tasks. The design of tasks aims at testing the features of WCD through the search process in WCD’s interface (see appendix C).

Task 1 is designed to test the single search interface feature by asking participants to search out publications in various formats for a given topic in the form of “air quality”. As discussed in previous studies, one of the major benefits from single search interface is the ability to present the relevant results in a unified interface (Fagan et al., 2012, p. 83). The ability to return the search results in various formats within the WCD’s single interface was then one example task for testing this feature. The task involves the participant’s performance of search process, the participant’s degree of satisfaction with the search process, and his/hers views on good and bad aspects of the WCD’s search interface.

Task 2 is intended to evaluate the advanced search by testing the usage of filter functions as indicated by previous study results that the performance of filter functions was perceived as limited in advanced search (Boock et al., 2009; Majors, 2012; Djenno et al., 2014). Three conditions for searching journal articles were manicured in the forms of “peer reviewed” “between 1990 and 2018” and “three languages English, German and Spanish” in the task. The purpose was to find out whether the relevant filter functions can be selected flexibly, without complicity as claimed by WCD. The study participants’ experiences of good and bad aspects and suggestions for improvement in terms of advanced search with the focus on filter functions are collected through this task design.

Finally, task 3 is focused on the issue of accessibility by asking the participants to request full-text content of the articles for the topic of “air quality” that they have been asked to find. The issue of access involves first of all resource coverage as discussed in previous studies (Majors, 2012; Enis, 2014), which therefore serve a reflection of the extent of resource coverage. The issue of access to full-text content also involves results delivery as described in problem formulation (Guy & Palmer, 2010; Narayanan& Byers, 2018) and therefore could reveal relevant advantages and disadvantages of WCD in terms of accessibility. The participants’ degree of satisfaction with the performance of the tasks, along with their views of good and bad aspects concerning possibilities for full-text access, together with suggestions for improvement were collected through the design of this final task.

In conclusion, the experiment ends with an opportunity for general feedback concerning the participants’ preferences after the testing of the above features. Some additional questions are also prepared allowing for possible interesting explorations.

As part of the task experiments, the provision of qualitative data such as comments can provide a rich explanation for the quantitative relationship and overcome the limit on richness of the data that are collected through controlled experiments (Wildemuth, 2017, p. 80). Therefore post-task comments are chosen to collect in-depth insights on the search experience from users. The concrete questions were formulated based on the answers in task experiments, which were not clear or difficult to understand. The comments from relevant participants were collected and processed.
Participants

As reasoned previously for the selection of participants of questionnaire, the search experience of students and researchers is the most relevant to the purpose of this study. Therefore the task experiments are also carried out by students and researchers at the University of Skövde.

After the email contact with the 11 participants that have signed up for task experiments by answering the final question in questionnaire, 7 of them replied that they were able to participate. Therefore in total 7 participants were recruited for task experiments.

For the post-task comments, two participants were contacted as some of their answers were unclear and difficult to understand.

After recruitment, the participants that took part in task experiments were distributed along demographics and coded by table 3 below:

<table>
<thead>
<tr>
<th>Code</th>
<th>Student (S) or Faculty (F)</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>F</td>
<td>Male</td>
</tr>
<tr>
<td>P2</td>
<td>F</td>
<td>Male</td>
</tr>
<tr>
<td>P3</td>
<td>S</td>
<td>Male</td>
</tr>
<tr>
<td>P4</td>
<td>S</td>
<td>Female</td>
</tr>
<tr>
<td>P5</td>
<td>S</td>
<td>Male</td>
</tr>
<tr>
<td>P6</td>
<td>F</td>
<td>Male</td>
</tr>
<tr>
<td>P7</td>
<td>F</td>
<td>Male</td>
</tr>
</tbody>
</table>

*Table 3. Demographics and coding schema of participants for task experiments.*

- Performing the task experiments

For the task experiments, a printed version of consent form was prepared as it was easier for participants to sign the consent form before the tasks. The tasks of the experiments were also constructed and results were collected in Sunet Survey as it is efficient in terms of both data collection and data analysis.

As suggested by Wildermuth (2017) that the pilot testing should be carried out by the member of target groups but not participating in the same study (Wildemuth, 2017, p. 174). Due to the limited number of candidates that were available for the task experiments, which would mean a loss of one participant if the pilot testing would have been carried out. Therefore the pilot testing for task experiments was not realized, instead, a thorough discussion of each task in the experiments was carried out at a meeting on 4th April, 2018 with a group of experts in the form of library personnel from SUL based on their working experiences.

The task experiments were conducted on 6th of April and 9th of April with two groups of participants (4 in total), who chose the time convenient for them. Participants conducted the task experiments in a room equipped with computers at Skövde University Library. After participants logged in to the computer with their personal account, the link to the task experiments were sent to each participant by email and tasks were performed individually by participants. The first session (6th of April) took approximately 45 minutes including signing consent form, and the study leader’s explaining instructions for performing tasks. The second
session (9\textsuperscript{th} of April) took approximately 1 hour to clarify the relevant matters and to conduct tasks. After the above two sessions in controlled environment, the link of the task experiment was sent to 3 other participants who could not come at the above indicated occasions and instead completed the tasks by themselves. By 20\textsuperscript{th} of April, altogether 7 answers were received as the results of task experiments. Three comments from task experiments were in need of clarification by two relevant participants (P2 & P4). An email with the relevant question was sent to participant (P4) on 19\textsuperscript{th} April and the answer was returned on the same day later on. Face to face communication with relevant questions was conducted with participant (P2) at the participant’s office on 22\textsuperscript{nd} April.

In the phase of data collection, as it was not feasible to organize all the participants at the same time. Some of the distribution of task experiments has to be sent out via email, which slightly deviates from the initial plan as traditional task experiments are normally carried out in laboratory settings. However, both ways of distribution see pros and cons. In the controlled environment, it was noticed that in spite of possible stress under observation, participants could focus on the tasks and contributed more insights. The self-complete task experiments, in comparison, received fewer comments, but provided flexibility of time for some participants. There was considerably less willingness to participate in experiments than to respond in questionnaire probably due to the constraints of participants’ time schedule.

- Ethical consideration

For the task experiments, it is not possible to keep the participants anonymous as they were recruited by signing up the contact information in the questionnaire. However, their privacy is protected by keeping their personal information confidential. First of all, a consent form was provided and signed by the participants to clearly explain the study purpose and data usage. Secondly, confidentiality is ensured with each participant coded by P1 to P7 to protect their privacy. Another ethical consideration specially given to the work load of experiment, in which the tasks are designed to avoid unreasonable burdens for participants such as excessive long sessions (Wildemuth, 2017, p. 74).

4.3 Methods of data analysis

The choice of methods for this study is a mix of qualitative and quantitative methods as clarified previously. The methods of quantitative analysis are described first, followed with the presentation of the methods of qualitative analysis in detail below.

4.3.1 Quantitative analysis

The methods of quantitative analysis employed in this study are descriptive statistics presented with frequency table, bar chart and measurements of central tendency.

As the data focuses on the description of each single issue such as single search interface, filter functions, full-text access rather than the relations between different issues, it is more appropriate to present the results by analysing one question/answer at a time. Typical techniques of quantitative analysis such as frequency table and diagrams are used in this study because they not only provide a clear result based on the categories, but also display a vivid view based on the percentage (Bryman, 2012, p. 337). In these ways, the results presented after the reduction and synthesis of data are relatively easier to interpret and
understand. A frequency table is used in this study to provide the number of respondents and the percentage belonging to each category for each question, such as how many participants have the experience of using WCD in the past. Bar chart is used to display for instance; the preference of WCD among participants.

The statistical numbers produced by Likert-scale responses are measured by central tendency through the observation of Median. Three forms of average can be recognized as Mean, Median and Mode (Bryman, 2012, p. 338). Mean is produced by summing up all the values in a distribution and then divide by the number of values, which however, has the disadvantages of possible distortion by the “outliers” (Bryman, 2012, p. 338). The mode is the number that is repeated most often (Bryman, 2012, p. 339), however, if the numbers in the scale appear only once as in a small sample, there is no mode to calculate, which excludes the use of Mode as measurement in this study. To avoid the effects of “outliers” with the answer of “extreme values”, Median is most suitable in this case to find out the mid-point in a distribution of value (Bryman, 2012, p. 339).

The choice of Median to measure central tendency in this study is also due to the nature of Likert-scale. As the Likert-scale is set from 1 to 5 from strongly disagree / strongly dissatisfied to strongly agree/ strongly satisfied to represent the intensity of feeling in this study, which is commonly interpreted as an ordinal level rather than an interval scale (Jamieson, 2004). It therefore rules out the use of Mean which is based on symmetric distribution.

4.3.2 Qualitative analysis

For the qualitative data dealing with words or texts such as comments and opinions in this case, the technique of thematic analysis is employed.

This method of thematic analysis to cluster texts under each theme/sub-theme under a framework is especially suitable for unstructured texts as produced in this study by the comments from participants (Bryman, 2012, p. 565). As the evaluation of WCD involves both positive and negative user experiences in this study, some categories such as good or bad aspects of a feature can be pre-determined. Some aspects in turn can be clustered under certain theme, such as discovery and delivery discussed in this study. By identifying comments in relation to aspects of discovery and delivery, comments that reflect either positive sides of each feature, the problems that hinder the performance of tasks, or motivation for preferences can be flexibly coded for data analysis purpose. This thematic analysis also provides a basis for theoretical understanding of certain concepts (Bryman, 2012, p. 163; 579-580). In this case, the benefits and problems can be discussed in relation to aspects of discovery and delivery during search process.
5 Results

This chapter is devoted to a presentation and interpretation of study results produced from pre-task questionnaire and task experiments.

5.1 Questionnaire

As discussed in the chapter of methods, results of questionnaire are presented either by table or bar chart under each question in order to present a clear summary and vivid view of the relevant results.

1. What is your current academic status at the University of Skövde?

The demographic characteristics shows that most respondents are undergraduate students 39 (67.2 %) and the least are from the group of graduate students 5 (8.6 %), which are in line with the percentage of the population as a whole at the University of Skövde as the number of master students is the smallest among all the students and researchers in total at the university. There are 14 researchers (24.1 %) answered the questionnaire. It seems that one participant did not provide the background information indicated by the total number of answers 58 instead of 59 (see figure 2. below).

![Figure 2. Demographical characteristics of respondent (n = 58)](image)

2. Where do you usually start when you search scientific publications through the services offered via Skövde University Library's website? (More than one answer is possible)

The frequency table below illustrates that the databases are the starting points for 27 respondents while WCD is in the second place with 23 respondents which indicates a frequent usage of the discovery tool WCD by the users of Skövde University Library compared to other services that are provided via the library interface (see table 4. below).
There is a sub-question in terms of the starting search points:

If the library interface is not your starting point, please describe in your own words where you usually start your search.

The answers reveal that Google scholar is the most frequent starting point which was mentioned in the comments by 12 respondents among 15 respondents, compared to other sources such as newspaper and course books, which are mentioned just once by respondents.

3. Have you ever used the discovery service WorldCat Discovery (previously called “WorldCat Local”) through the Skövde University Library interface?

The results show that WCL/WCD has been used by 34 participants with a slightly higher percentage (57.6 %) answering “Yes” in comparison to the 25 non-users (42.4 %) with the answer “No” (see table 5. below).

<table>
<thead>
<tr>
<th>Answers</th>
<th>Number of Responses (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>34 (57.6 %)</td>
</tr>
<tr>
<td>No</td>
<td>25 (42.4 %)</td>
</tr>
<tr>
<td>Total</td>
<td>59 (100.0 %)</td>
</tr>
</tbody>
</table>

The following Questions 4A to 7A are follow-up questions to Question 3:

If yes, please indicate to what degree that you are satisfied with the following features in WCL/WCD.
The following Questions 4B to 7B are follow-up questions to Question 3:

If no, please indicate to what extent that you desire the following features in search tools in general.

4A. It is easy to find various formats such as books, articles and video for a search topic in WCL/WCD (see figure 3. below).
4B. It is easy to find various formats such as books, articles and video for a search topic (see figure 4. below).
Overall satisfaction in terms of finding various formats in WCL/WCD shows positive with the value of median 4.0 measured from 1 to 5 scores in Likert Scale. It was surprisingly identical as to the expectation degree on this feature with median 4.0 as well. The value of median also indicated that the ability of finding various formats in search tools in general is considered very important for most of the participants (see table 6. below).

<table>
<thead>
<tr>
<th>Overall impression</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of satisfaction in WCL/WCD</td>
<td>4.0</td>
</tr>
<tr>
<td>Degree of expectation on search tool in general</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Table 6. Overall impression of functions in terms of finding various formats

5A. It is easy to use the filter functions such as selecting date and language to limit the search results so that they are more relevant to a search topic in WCL/WCD (see figure 5. below).

5B. It is easy to use the filter functions such as selecting date and language to limit the search results so that they are more relevant to a search topic (see figure 6. below).
Overall satisfaction in terms of filter functions in WCL/WCD measured from 1 to 5 scores in Likert Scale appears natural with the value of median 3.0. Whereas the value of median 4.0 for the degree of expectations indicates that users value filter functions in search tools in general with higher expectation (see table 7. below).

<table>
<thead>
<tr>
<th>Overall impression</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of satisfaction in WCL/ WCD</td>
<td>3.0</td>
</tr>
<tr>
<td>Degree of expectation on search tool in general</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Table 7. Overall impression of filter functions*

6A. It is easy to identify and view full-text versions of interesting search results such as journal articles or e-books from different databases in WCL/WCD (see figure 7. below).

6B. It is easy to identify and view full-text versions of interesting search results such as journal articles or e-books from different databases (see figure 8. below).

![Figure 5](image1.png)  
*Figure 5. Degree of satisfaction in terms of finding various formats in WCL/WCD (n = 31)*

![Figure 6](image2.png)  
*Figure 6. Degree of expectation in terms of filter functions in general discovery tools (n = 22)*

![Figure 7](image3.png)  
*Figure 7. Degree of satisfaction in in terms of full-text access in WCL/WCD (n = 32)*

![Figure 8](image4.png)  
*Figure 8. Degree of expectation in terms of full-text access in general discovery tools (n = 23)*
Overall satisfaction in terms of full text access and database identification in WCL/WCD measured from 1 to 5 scores in Likert Scale is also neutral with the value of median 3.0. It also implies a gap between the degree of satisfaction and expectation on this aspect for general search tools with the value of median 4.0, which indicates high expectation on full-text access (see table 8. below).

<table>
<thead>
<tr>
<th>Overall impression</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of satisfaction in WCL/WCD</td>
<td>3.0</td>
</tr>
<tr>
<td>Degree of expectation on search tool in general</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Table 8. Overall impression of full-text access and database identification*

7A. It is easy to request the printed copy of a scientific publication if it is not possible to access the full-text online in WCL/WCD (see figure 9. below).

7B. It is easy to request the printed copy of a scientific publication if it is not possible to access the full-text online (see figure 10. below).

8. Besides the above selected features which are evaluated by the participants, several other features are also mentioned by 6 participants (n = 6, although one response has been omitted due to it being of a non-serious/joking character) as desired features of a discovery tool such as WCD.
It is very helpful to reflect the comments under the main theme of this study, focusing on the aspects of discovery and deliver, so that the issues can be disseminated into details. As discussed previously, discovery services involve a chain of services, from the support for searching actions to the return of results. Some issues more related to search actions can be clustered under the aspect of discovery, while other issues more relevant to the searching results, are better organized under the theme of delivery. It should be noted though that the clustering is not strict as some issues can be relevant for both aspects. It is however more convenient if they are examined with certain focuses. The comments are synthesized by the table below (see table 10 below).

<table>
<thead>
<tr>
<th>Themes</th>
<th>Discovery</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other desired features</td>
<td>Use regular expressions</td>
<td>Sort out repeated results</td>
</tr>
<tr>
<td></td>
<td>Options to select or delete journals from the results</td>
<td>Fix misleading titles</td>
</tr>
<tr>
<td></td>
<td>Citation count, recent view count, recommend articles (e.g. by topic, journal, author etc.)</td>
<td></td>
</tr>
</tbody>
</table>

*Table 10. Other desired features of discovery tools (n = 6)*

The using of “regular expressions” which is a computer language is more about searching through patterns (“Regular expression,” n. d.). The options to select or delete journals are also more relevant to the search options such as filter functions. The desired features of sorting out repeated results and fixing the issue of misleading titles indicate the quality problems in terms of the aspects of information delivery. Whereas features such as citation count, recent view count and recommended relevant articles, are actually often seen in Google Scholar. As those features are not common in discovery tools such as WCD, it will certainly be regarded as an improvement if a discovery tool can delivery those features.

9. Would you like to use WorldCat Discovery for your search of scientific publications in the future?
   Based on the previous evaluation of the features of WCL/WCD with a slightly positive impression, the feedback on the preference of future usage of this discovery tool is not surprising that 32 users (58.2 %) would use this tool while only 2 users (3.6 %) show negative attitude towards this tool, and 21 users (38.2 %) with some degree of uncertainty probably need more knowledge and experience to learn about this tool (see figure 11. below).

*Figure 11. Preference of future use of WCD (n = 55)*
10. There are altogether 11 respondents who signed up for the follow-up task experiments in the questionnaire.

It is noted that the discovery tool WCD was used by most of the respondents and it is listed in the second position to the answer “databases” among the most frequently used search services at SUL. In general, the overall impression of WCD from students and researchers at SUL appear positive or neutral. Participants showed slightly higher expectation on search tools in general in terms of filter functions and full-text access while less expectation regarding access to printed copies. The positive impression is also reflected in the confirmation of future use of WCD in comparison to rejection of WCD. However, it is noticed that 47 participants made no comments, whereas only 6 participants provided comments as to other desired features of discovery tool in general, among which some are either difficult to understand or not serious. That reflects that it is perhaps not an effective way to invite comments through questionnaire.

5.2 Task experiments

The results of task experiments are summarized and presented in tables and bar charts. For the text answers, the method of thematic analysis is used to analyse the results. There are altogether 4 researchers and 3 students that took part in task experiments. Comments from 2 participants (1 student and 1 researcher) were collected after task experiments.

The experiments were designed as three tasks conducted by participants based on a scenario as the following:

You are searching for previous research in preparation of conducting a study of your own on the topic of “air quality”…

5.2.1 Task 1

Please find three relevant sources on the topic “air quality”, one book, one journal article, and one video. Please save the results so that you can check later.

1. Which formats were found by participants?

In reference to the topic of “air quality”, the results show that only one participant found all three formats. All of the participants found the formats of both book and article, while 6 of 7 could not find the format of video (see figure 12. below).
2. How did the participants conduct the search?

The search process was conducted through typing keywords in the simple search box on the start page by 6 participants, 2 participants used advanced search, 1 out of 6 participants tried both keywords searching and advanced search, none of them used auto complete function after starting to type keywords in the search box (see table 11. below).

<table>
<thead>
<tr>
<th>Search process</th>
<th>Number of Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typed own keywords in the simple search box on the start page</td>
<td>6</td>
</tr>
<tr>
<td>used auto complete function after starting to type keywords in the search box</td>
<td>0</td>
</tr>
<tr>
<td>used “Advanced search” and filled in a number of qualifiers and keywords in specific fields</td>
<td>2</td>
</tr>
</tbody>
</table>

*Table 11. Process of searching for various formats in WCD (n = 7)*

3. The degree of satisfaction with WCD interface for finding various formats was indicated by participants by the following figure.

The results show that 3 out of 7 participants were satisfied with the WCD interface in terms of finding various formats, 3 out of 7 participants were neutral while only 1 participant out of 7 was dissatisfied with the WCD interface in terms of finding various formats.

The central tendency for degree of satisfaction with WCD interface for finding various formats appears neutral with value of Median 3.0 measured by 1-5 score in Likert Scale (see table 12. below).

<table>
<thead>
<tr>
<th>Degree of satisfaction</th>
<th>Very dissatisfied</th>
<th>Dissatisfied</th>
<th>Neither satisfied nor dissatisfied</th>
<th>Satisfied</th>
<th>Very satisfied</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of answers</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

*Table 12. Degree of satisfaction in terms of finding various formats (n = 7)*
Comments of good aspects and bad aspects as well as suggestions for improvement in terms of finding various formats in WCD can be synthesized under the themes relevant to this study (see table 13. below).

<table>
<thead>
<tr>
<th>Comments</th>
<th>Good</th>
<th>Bad</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Themes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discovery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some options to filter the search results (P 1)</td>
<td>The option in the search tools is limited and not complete. (P 1)</td>
<td>Should contain more sorts (P 4)</td>
<td></td>
</tr>
<tr>
<td>Information is easy to obtain (P 2)</td>
<td>It does not provide me to search within a specific subject, such as strictly psychological articles. (P 3)</td>
<td>Easier to pre select when you type your search string (P 5)</td>
<td></td>
</tr>
<tr>
<td>Easy to use the search tools on the right side (P 5)</td>
<td>Not able to select formats before search or don’t know how to do it (P 5)</td>
<td>Diminishing the alternatives (P 6)</td>
<td></td>
</tr>
<tr>
<td>Easy to select peer-reviewed articles and those that can be downloaded (P 7)</td>
<td>Unclear about videos (P 6)</td>
<td>Adding articles categories (P 7)</td>
<td></td>
</tr>
<tr>
<td>Good order under the category (P 4)</td>
<td>There is no video form man can choose (P 4)</td>
<td>Information about whether a certain format is available to download/see in the interface after the search. (P 2)</td>
<td></td>
</tr>
</tbody>
</table>

*Table 13. Issues reflected by the task of finding various formats*

It can be seen that some issues related to aspect of discovery are commented as positive, such as the availability of options to filter the search results and the easiness of using the tools for finding various formats that are designed on the interface; while negative comments still see the limits and incompleteness of relevant search options and inability to use advanced search such as narrowing down to specific subject. The improvements in terms of finding various formats through the single interface are suggested to add more options for sorting out the format and make it easier to conduct preselect as in advanced search or diminish alternatives to make it clearer.

In terms of aspect of delivery, good comments are such as clear and simple presentation of information, and good order of categories. The delivery of the format of video is commented as bad as 6 out of 7 could not accomplish this task. The improvement is suggested to add more options of formats such as audio. Besides, there is a demand of sufficient metadata to indicate the availability of formats and to instruct relevant operations.
5. How did the participants save the search results?

The task for saving search results demonstrates that participants used various ways of operations to make sure that the searching results are saved. The link function seems used more often with 4 times than the options of save (3), Email (2), and cite (2) (see figure 13. below).

![Figure 13. Frequency of using different options for saving search results (n = 7)](image)

6. The degree of satisfaction with WCD interface for saving search results was rated by the participants as the following illustrations.

The results illustrate that 3 out of 7 participants were satisfied with WCD interface for saving search results, 2 out 7 participants were neutral, while one participant was very satisfied and one dissatisfied. None of the participants was very dissatisfied with the options for saving search results.

The central tendency for degree of satisfaction with WCD interface for saving search results appears quite positive with the value of Median 4.0 measured by 1-5 score in Likert Scale (see table 14. below).

<table>
<thead>
<tr>
<th>Degree of satisfaction</th>
<th>Very dissatisfied</th>
<th>Dissatisfied</th>
<th>Neither satisfied nor dissatisfied</th>
<th>Satisfied</th>
<th>Very satisfied</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of answers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Table 14. Degree of satisfaction in terms of saving search results (n = 7)*

7. 8. 9.

Comments of good aspects and bad aspects as well as suggestions for improvement in terms of saving search results in WCD are also synthesized under the themes relevant to this study (see table 15. below).
<table>
<thead>
<tr>
<th>Themes</th>
<th>Good</th>
<th>Bad</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Saving with citation (P 1)</td>
<td>Save as &quot;Export to EndNote&quot; does not work on my PC (P 4)</td>
<td>Less options. (P 2)</td>
</tr>
<tr>
<td></td>
<td>Simple (P 2)</td>
<td>No easy way to download a list of articles at the same time (P 7)</td>
<td>Possibly standardized searches, search pattern. (P 1)</td>
</tr>
<tr>
<td></td>
<td>Easy to save (P 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simple and easy (P 4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Easy to save individual articles in list and export citations (P 7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The links work (P 6)</td>
<td>Difficult to find saved results later (P 1)</td>
<td>The citation should be directly to show the citation text, not download some files (P 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Page is quite long and crowded (P 2)</td>
<td>Have some program which is more often to use (P 4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The saving is a bit different to check back (P 1)</td>
<td></td>
</tr>
</tbody>
</table>

Table 15. Issues reflected by the task of saving search results

The options for saving search results are commented generally as easy and simple to use in terms of the aspect of discovery. While the option of saving with citation is commented positively, the function of “Export to EndNote” does not work properly, which indicates there are still certain problems on the aspects of discovery in terms of function of saving results. Some suggestions for improvement are such as standardized search and drop-down menu. While some participants prefer fewer options to make the display clear, others favour more options to download more relevant data.

However, there are some negative experiences related to the aspect of delivery, such as long and crowded pages, the difficulty to find saved results, and the inconsistent presentation of the saved results. Some suggestions to improve the saving function are the availability of direct citation texts instead of files. Other seems suggesting to use other programs than WCD.

5.2.2 Task 2

Please find three peer reviewed journal articles between 1990 and 2018 on the topic “air quality” in each of the three languages English, German and Spanish and save the results.

1. How did the participant conduct the search?
The results show that 6 out of 7 participants conducted task 2 through typing their own words into the simple search box on the start page, followed by a use of filtering options in the left hand menu for narrowing the search result list. 1 out 7 participants used the advanced search option and filled in a number of qualifiers and keywords in specific fields, followed by a use of filtering options in the left hand menu for narrowing the search result list. None of them typed their own key words into the simple search box on the start page and search/browse the result list manually (see table 16. below).

<table>
<thead>
<tr>
<th>Options</th>
<th>Number of Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typed own key words into the simple search box on the start page, followed by a manual search/browse of the result list.</td>
<td>0</td>
</tr>
<tr>
<td>Typed own key words into the simple search box on the start page, followed by a use of filtering options in the left hand menu for narrowing the search result list.</td>
<td>6</td>
</tr>
<tr>
<td>I used the advanced search option and filled in a number of qualifiers and keywords in specific fields, followed by a manual search/browsing of the result list.</td>
<td>0</td>
</tr>
<tr>
<td>I used the advanced search option and filled in a number of qualifiers and keywords in specific fields, followed by a use of filtering options in the left hand menu for narrowing the search result list.</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 16. Search process of task 2 (n = 7)

2. The degree of satisfaction with WCD interface for limiting search results was indicated by participants as the following table.

The results illustrate that 3 out 7 participants were satisfied with WCD interface for limiting search results. 2 out 7 participants were dissatisfied while 1 was neutral and 1 was very satisfied. None of them was very dissatisfied.

The central tendency for degree of satisfaction with WCD interface for limiting search results shows quite positive with Median value 4.0 measured by 1-5 score in Likert Scale (see table 17. below).

<table>
<thead>
<tr>
<th>Degree of satisfaction</th>
<th>Very dissatisfied</th>
<th>Dissatisfied</th>
<th>Neither satisfied nor dissatisfied</th>
<th>Satisfied</th>
<th>Very satisfied</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of answers</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Table 17. Degree of satisfaction in terms of filter functions (n = 7)

3. 4. 5.

Comments of good aspects and bad aspects as well as suggestions for improvement in terms of filter functions in WCD can be clustered under the themes of discovery and delivery as in previous analysis in task 1 (see table 18. below).
### Table 18. Issues reflected by the use of filter functions

<table>
<thead>
<tr>
<th>Themes</th>
<th>Good</th>
<th>Bad</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discovery</td>
<td>The filter functions are good on the left menu. (P 1)</td>
<td>You cannot choose all three languages at the same time. (P 2)</td>
<td>Pull-down menu might be better (P 1)</td>
</tr>
<tr>
<td></td>
<td>That there are several option to choose from (P 2)</td>
<td>Once you clicked on English language, the other languages disappeared. (P 3)</td>
<td>To be able to select several languages at the same time. (P 2)</td>
</tr>
<tr>
<td></td>
<td>Easy to understand (P 3; P6)</td>
<td>I cannot choose all the 3 language the same time. Only can choose English and Spanish, or English and German (P 4)</td>
<td>It would have been easier to have the options remain but not only one is available to you (P 3)</td>
</tr>
<tr>
<td></td>
<td>Easy to find all the options (P 4)</td>
<td>When searching Spanish articles, I miss direction for articles in English (P 7)</td>
<td>The Spanish home sites need English translation (P 6)</td>
</tr>
<tr>
<td></td>
<td>Easy to set the desired language, years and specific author (P 7)</td>
<td></td>
<td>This is not really a filter function, but it would be useful to have a link to related articles, e.g. those published/cited by the same authors or with similar abstract (P 7)</td>
</tr>
<tr>
<td>Delivery</td>
<td>It seems most of the languages listed in the menu. (P 1)</td>
<td>But the search results for Spanish are not really to a full text reference, even it is indicated a &quot;view full text&quot;. (P 1)</td>
<td>How about the minor used languages? (P 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Even when searching for Spanish and German there are results in English, i.e. articles published in an e.g. Spanish journal. (P 2)</td>
<td>To exclude e.g. English results from search in Spanish (P 2)</td>
</tr>
</tbody>
</table>

Related to the aspect of discovery, it is commented as generally good in terms of the design of layout, the availability of options, and the easiness in terms of understanding as well as operation. Bad comments in this aspect are mostly related to the operation of choosing three languages at the same time although it was not mandatory to choose three simultaneously. It was however commented as a suggestion for improvement because it would be more efficient that if users can choose as many languages as desired simultaneously rather than going back and forth to choose the articles in each language. There is a demand of translation in English in order to understand Spanish. The pull-down menu is also mentioned as an improvement in terms of the design of interface.
In terms of the aspect of delivery, the problems involved are the confusion caused by the mix of language; in other words, the precision is low, which may be due to inconsistence in metadata description or specific purpose from the publisher side. Whatever reasons for the delivery problems, it is seen not efficient in terms of filter functions. As to the delivery of full text, which will actually be evaluated in task 3 though, the issue of misleading information is already reflected during the test of filter functions.

Suggestions to improve the filter functions are therefore to better deliver precis results through excluding irrelevant search results. And delivery of articles in minor used language is also brought to attention although it is not tested in this task. Other feature is suggested to link to similar articles although it maybe not relevant to filter function.

5.2.3 Task 3

Please try to obtain full text versions of the articles in each of the three languages that you saved in the previous task.

1. Were the participants able to obtain the article in English as full text version?

For the articles in English, 6 out of 7 participants were able to obtain full-text version. One article that was indicated by the participant (P2) seems however, not valid response based on the reference information in the answer which directs to database in Spanish. The 6 databases for the articles in English available in full-text version were clearly identified by the participants.

2. Were the participants able to obtain the article in German as full text version?

For the articles in German, the access rate was also 4 out of 6 that were able to obtain the full-text version in German. The 4 databases for articles in German were also identified by the 4 respective participants.

3. Were the participants able to obtain the article in Spanish as full text version?

The results for the full-text access for the articles in Spanish seem a bit chaotic. 4 participants were able to get access to full-text version; however, only 2 of them were able to identify the database clearly while the other two were only able to provide general information (URL) of the article. 2 participants (P1 & P 2) were not able to access the full-text version in Spanish. One (P1) of the participants provided reference information for three articles in Spanish that could not be accessed in full-text. Another participant (P2) showed difficulty to identify the source information.

4. How did the participants try to obtain the full text version(s) of the article(s)?

The process of full-text access demonstrates that participants used various ways in order to obtain the full-text version of the articles. All of the 7 participants clicked on the button “view full text” while two of them tried to use the filter functions on the left menu as well. One participant tried with typing own keywords in the simple search box on the start page. None of them used “Advanced search” by filling a number of qualifiers and keywords in specific fields (see table 19. below).
5. The degree of satisfaction with WCD interface in terms of full-text access was evaluated by the participants by the following table.

The results reflect that 3 out of 7 participants were very satisfied with full-text access in WCD interface. 2 out of 7 were satisfied while 1 was dissatisfied and 1 was very dissatisfied. None of them showed neutral with WCD interface in terms of full-text access.

The central tendency for degree of satisfaction with WCD interface in terms of full-text access is also quite positive with Median value 4.0 measured by 1-5 score in Likert (see table 2.0, below).

<table>
<thead>
<tr>
<th>Degree of satisfaction</th>
<th>Very dissatisfied</th>
<th>Dissatisfied</th>
<th>Neither satisfied nor dissatisfied</th>
<th>Satisfied</th>
<th>Very satisfied</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of answers</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Table 20. Degree of satisfaction in terms of full-text access (n = 7)*

6. 7. 8.

Comments of good aspects and bad aspects as well as suggestions for improvement in terms of full-text access in WCD can be categorized under the themes of discovery and delivery as the following (see table 21. below).

<table>
<thead>
<tr>
<th>Comments</th>
<th>Good</th>
<th>Bad</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Themes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discovery</td>
<td>Works well in English and German (P 1)</td>
<td>When you cannot get the access (P 2)</td>
<td>I don't know if the problem exists in other languages. (P 1)</td>
</tr>
<tr>
<td></td>
<td>It was easy to use and understand (P 3)</td>
<td>At times it takes long time to get. First click saved results, then press item, then view full text, and then it may still need to press another button on the showing page (P 3)</td>
<td>English instructions in the sub databases (P 6)</td>
</tr>
</tbody>
</table>
The results of the comments reveal that although most participants evaluate the access of full-text as positive, there are some issues mentioned as problems. The operation of the interface is commented as quite easy, efficient and works in English, but not so well for languages of German and Spanish, which is probably relevant to the volume of collections in non-English is considerably lower than collection in English. Negative comments also show that some operation is still complicated as the repeated pressing of buttons. The problems also lead to the thoughts about the full-text access in other minor-used languages in discovery tools.

Other problems which are more relevant to the aspect of delivery are reflected by the chaotic searching results during the access of articles in Spanish, which involve misleading information about the availability of full-text access and the failure of delivery of articles in full-text content. Suggestions are the direct link to PDF and the direct view of full text, which sets the demand for better quality and efficiency in terms of the delivery of search results.

### 5.2.4 Concluding remarks/feedback

The concluding remarks and the feedback are targeted on the opinions from participants regarding discovery tool WCD in specific and search tools in general. Be it relevant to the topic of this study, it also aims to generate more insights in the field of library and information science.

1. Do you think you will use WorldCat Discovery in the future?

The preferences of participants on the use of WCD in the future appear slightly positive with 4 answered “Yes” and 3 answered “No” (see table 22. below).
purposes. where I need full access. (P2)

WCD seems to find many more articles than e.g. Medline even when searching for biology-related topics. It is also very easy to find full texts if they are available. This makes it promising as a complement to other search engines. (P7)

Google is much better. (P1)

I use more narrow databases for my particular scientific field. (P5)

I use Google scholar. (P6)

Table 22. Preference and motivation for the use of WCD in the future (n = 7)

2. What services or tools do you normally use when searching for the type of material described here in these tasks?

It is interesting to know what other services and tools that are normally used when participants search for the type of materials described in the tasks. Services include Google, Google scholar; reference databases such as IEEE, ACM, Springer, Elsevier etc. or SocIndex and PsycInfo, Pubmed, Web of Science are indicated by participants (see table 23. below).

<table>
<thead>
<tr>
<th>Participants</th>
<th>Other services or tools other than WCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Google, or the reference databases directly, such as IEEE, ACM, Springer, Elsevier etc.</td>
</tr>
<tr>
<td>P2</td>
<td>Google scholar.</td>
</tr>
<tr>
<td>P3</td>
<td>SocIndex and PsycInfo</td>
</tr>
<tr>
<td>P4</td>
<td>Filter on the left side</td>
</tr>
<tr>
<td>P5</td>
<td>Google and google scholar that is connected to WCD</td>
</tr>
<tr>
<td>P6</td>
<td>Filters for authors, years, peer reviewed, article</td>
</tr>
<tr>
<td>P7</td>
<td>Pubmed, Web of Science, Google Scholar</td>
</tr>
</tbody>
</table>

Table 23. Other services or tools other than WCD

3. If you compare WCD with the search services that you normally use, what advantages can you see with WCD?

4. If you compare WCD with the search services that you normally use, what disadvantages can you see with WCD?

The advantages and disadvantages of WCD compared with other services and tools are synthesized under the theme of discovery and delivery as well (see table 24. below).

<table>
<thead>
<tr>
<th>Themes</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discovery</td>
<td>Easier to use and understand. (P 1)</td>
<td>In Google scholar I get quick results and have also access to the full-text via the library. (P 2)</td>
</tr>
<tr>
<td></td>
<td>You can specify the searches better. Fine grained. (P 2)</td>
<td>WCD is too complex and the handling is more difficult. (P 3)</td>
</tr>
<tr>
<td></td>
<td>This is a good approach to</td>
<td>First time little bit confusing (P 6)</td>
</tr>
</tbody>
</table>
The advantages of WCD on the aspects of discovery are commented as easy to use and understand, together with many choices, although complex, difficulties and confusions are also mentioned by participants. WCD is commented as a good approach as a starting point for search. Google is considered more efficient in terms of retuning of results and equally effective with the access of full-text since some links in Google can also redirect the access through certain libraries.

The delivery of information is commented as lack of flexibility and precision with certain confusion caused by misleading information. Lack of relevance is also commented as a disadvantage of WCD. Besides, the number of articles delivered by WCD is seen as fewer compared with other services, however, it is commented as easier to find peer-reviewed articles in WCD and to get rid of irrelevant information compared with other services or tools.

### 5.2.5 Post-task comments

The post–task comments were used for the clarification of relevant questions that were not so clear. Comments from 2 participants (P 2 & P 4) involved in three questions were collected after task experiments.

1. For the question in task experiment 1 “What are your suggestions to improve WCD for saving search results?” two comments from two participants are not so clearly indicated.

One comment was “Less options. Possibly standardized searches, search pattern. Pre-selection of format type, e.g. drop-down menu” from participant A, who explained that (P 2):

“I mean less option on the screen so that it would not look so crowded and I don’t have to scroll down the whole page to find the filter functions that I need. Possibly standardized searches and search pattern mean that I hope the search tool knows what I am looking for, so that I don’t have to go through all the functions every time I look for an article, just like Google Scholar where can always remember what I checked or maybe somehow the information is connected with my profile. That is why when I log in; there are already pre-selected filters that are especially for me. When I mentioned the drop-down menu, I am thinking for one way, there is reduced display of items on the same page; for the other way, the system runs quicker, not when I tick one box, it runs once. I have to wait afterwards to
proceed to the other filters. What I wanted is that the system runs after I have selected all the filters. That would be much more efficient” (P 2).

The clarification from participant (P 2) reveals three issues relevant to the search service WCD.

- There is still problem on the aspect of interface design, which is commented as long and crowded display of the entire filter functions, for which drop-down menu could be a better solution.
- Another problem is related to the efficiency of the system as the searching process runs after every selection, which could be better if the search engine starts to check after all the desired filters selected.
- The third aspect implies a personized service in WCD as it does in Google Scholar, which can automatically recommend articles according to users’ search interest.

Another comment “As save "as citera", can we not have some program which is more often to use?” needs clarification from participant (P 4). who provides the explanation that:

“I think this tool is not so often used by most of students. I don’t know if I need to install this tool before I use it or if it can only be used at the library? Why not use some popular ones that we are more familiar with?” (P 4)

The explanation from participant indicates that there are certain degree of unfamiliarity in the search tool WorldCat Discovery and perhaps a demand of relevant knowledge of WCD.

2. For the question that in task experiment 3 “Were you able to obtain the article in English as full text version?”, the answer by participant (P 2) was confirmed as an error in the comments due to the misunderstanding of this instruction, which requires the reference information of article in English, rather than the article that could not be accessed in any language.

3. For the question in task experiment 3 “Were you able to obtain the article in Spanish as full text version?” participant (P 2) provided the following link which was however the same reference given by another participant as the available full-text for article in Spanish.

http://www.msssi.gob.es/biblioPublic/publicaciones/recursos_propios/resp/home.htm (P 2)

For this comment, participant explained that:

“I don’t think the other one finds it accessible, rather just a link for some editorial information than the real full-access of the whole content” (P 2).

After the check of the link, the confusion in terms of full-text access is reflected by the availability of several PDF versions containing only 1 or 9 pages, which indicates the need of regular check by the discovery service providers in terms of the existence of full-text content to avoid problems such as broken links.

The task experiments were quite successful in finding out the perceptions from participants in terms of the good and bad aspects with WCD in supporting the performance of the tasks. However, it was not able to identify whether there was a difference between researchers and students as the tasks were initially designed. Similar confusions were involved in certain tasks regardless of their levels of academic status.
6 Discussion

In this chapter, the results of the analysis presented in the preceding chapter are discussed in relation to previous research. The research questions are answered, the main themes of this study are elaborated, and the limitation concerning methods for this study is reviewed.

6.1 Evaluation results

The evaluation results are synthesized in relation to the two research questions, which focus on the overall impression of the discovery service WCD perceived by users at SUL and the identification of benefits and problems during performing common search tasks by participants through WCD at SUL.

6.1.1 Overall impression of WorldCat Discovery

The overall impression of the discovery service WCD is in general positive from the results of both questionnaire and task experiments.

The results show first of all, that the discovery service WCD integrated with Skövde University Library can support the accomplishment of common tasks for users at SUL. Directed by the theoretical framework where the concepts of “Information Portal” and “Next-generation catalogue” emphasize the interests of the community and place the searcher in the centre of the knowledge sphere (Allison, 2010, p. 381), the evaluation is based on the academic interests of students and researchers at the University of Skövde. Under the scenario concerning the users’ searching experiences of scientific publications, several common tasks such as searching various formats, saving search results, narrowing down to e.g. peer reviewed, date and language-defined articles, and obtaining full-text content, are designed with the consideration of tasks, tools, users, as well as contexts as indicated by Dillon’s (2001) model for usability studies. The degree of satisfaction evaluated by users is one of the important indicators for the impression of this discovery tool, which generally appears positive illustrated by central tendency by Likert-scale. However, there are still rooms for improvements reflected by the slightly higher expiations on search tools in general.

As argued by Dillon (2001), the degree of satisfaction alone cannot predict the future use of WCD; the preferences from users are also investigated. 58.2 % respondents confirmed in the questionnaire that they would use the discovery tool WCD in the future. Task experiments produce similar results in terms of users’ preferences, where 14.3 % participants said that they would use the discovery tool WCD for all purposes and other 42.9 % of the participants said that they would use the discovery tool for some purpose, which constitutes 57.2 % of the participants in total.

It is interesting to compare the evaluation results with the study conducted by Djenno et al. (2014), which showed that even though the basic criteria of effectiveness and efficiency could be achieved by discovery tools in their study, satisfaction as a critical measure of usability was not met in many instances (p. 278). It also illustrates that there are more factors than basic criteria involved in usability studies. Personal experience and mood for instance could also be decisive for users’ performance, which supports Dillon’s (2001) view that user experience =actions + result + emotion.
6.1.2 Benefits and problems of WCD

As discussed in the previous studies, simple search interface and broad resource coverage are the two major benefits perceived by users of discovery service WCD, and also the motivations for libraries to integrate such discovery services. Whereas low interoperability, insufficient metadata and limit in advanced search are the main shortcomings perceived by users based on the earlier study results.

The comments in this study however reveal that both benefits and problems exist in terms of aspects of interface, resource coverage, advanced search, and metadata.

- Interface

First of all, similar to the benefit perceived in previous studies (Bertot et al., 2012; Boock et al., 2009; Enis, 2014; Majors, 2012; Thomas & Buck, 2010), the single search box model is seen as an advantage in this study, which is exemplified by the results that most of the participants can perform the tasks either through the simple search box or advanced search options designed in WCD’s search interface. The general design and layout are commented positively such as easy to use and understand. The display of options is clear, simple and in good order.

However, the search experience cannot be controlled “without complexity” as claimed by OCLC in the feature specification. Long and crowded display of pages was commented by participants of this study. Majors (2012) once discussed similar problem that it was not possible for participants to see all the information because of the page layout (p. 196). As a result, considerable efforts have to be spent on frequent scrolling up and down in order to see all the available information. Therefore drop-down menu suggested by some participants could be potential solution to such design problems.

- Resource coverage

There are also benefits and problems in terms of the resource coverage. It was commented as easy to find peer-reviewed articles. Finding the formats of articles and books was not a problem and there appeared no problems in identifying different formats, which suggests an improvement compared to the previous study by Thomas and Buck (2010), where tasks concerning distinguishing between books and articles presented challenge for participants (p. 652).

However the search for video format appeared problematic, which revealed the resource coverage was not as broad as claimed by OCLC. It should be noted though that whether it is a problem for users if they fail to find video format should be viewed objectively as not all participants might consider it as important based on their different interests. Finding articles in different languages also present certain challenges for participants in this study, which however appeared rather complicated than the aspect of resource coverage as causes of access failure to articles in German and Spanish need to be further identified, which will be discussed later in relation to the aspect of results delivery.

- Advanced search
The filter functions were tested to evaluate the advanced search. As most of the participants confirmed the usage of the filter functions to narrow their search results and were able to accomplish most of the tasks, the search experience in terms of filter functions was seen positive. The good aspects were the available options to choose and the easy operation of search process, which also indicated the improvement in terms of advanced search in comparison to the limit revealed by the previous study (Boock et al., 2009; Majors, 2012; Djenno et al., 2014; Goldfinger, 2017).

One of the typical problems revealed concerning advanced search in this study was the inability of pre-select different filter functions simultaneously, which was the same as mentioned by Goldfinger (2017, p. 13) that it was not possible for users to keep initial search criteria and have to enter the new search term repeatedly. The advanced search was once mentioned as extremely limited by Boock et al. (p. 5) in 2009, still found evidence in these task experiments, which was reflected by the constraints for searching within a specific subject, such as psychological articles.

It is interesting that similar to the study by Majors (2012, p. 196) where “Amazon’s online shopping” experience was suggested, those “Google” features such as citation count, recent view count, recommend articles etc. were desired by participants in this study as well.

- Metadata

Most of the problems encountered by the participants in this study can be identified with the issue of metadata quality. The access to full-text version was still limited and complicated. Misleading information caused confusion among participants, such as the description as to whether an article was available in full-text or not, which was similar problem that was mentioned by Gaffney (2012) as lack of indication of prepublication records in WCL (p. 77). Repeated journal titles for instance revealed the inconsistency of indexing, which was mentioned by Bertot et al. (2012) in relation to the ambiguity of ranking principles (p. 218). Failed access to certain formats and languages indicated the similar issue discussed by Thomas and Buck (2010) which was caused by the lack of indexing (p. 669). Precision and relevance were questioned in this study by some participants as well.

It can be concluded that the major benefits reflected by this study are the single search box model, more collections, and the basic filter functions although minor problems in terms of the layout and simultaneous selection existed. The main challenges are the access to resources and metadata quality, even though the problems might not be caused by the discovery service alone, which has to be discussed in relation to the aspects of discovery and delivery.

6.2 Discovery and delivery

Dillon’s (2001) evaluation model takes elements of user actions, results and emotion into user experience. Based on Dillon’s (2001) POA approach discussed in the section of theoretical framework, three issues regarding usability of WCD can be discussed in relation to aspects process, outcome and affection.

Process as to what users do:
Although most participants could perform the designed tasks without much problem, the process was not always smooth. There were moments of broken search process, which set the demands as to better interface design, clear instructions, and sufficient information to improve the performance of discovery service. That raises the significance of understanding users’ information needs and search habit through for instance, constant evaluations.

Outcome as to what users attain:

The study results showed that most common tasks could be supported by WCD interface; however, some search results could not be delivered according to participants’ requests or not be delivered to a satisfactory extent for participants. That means the result control of service delivery is equally important to search actions through “fancy” features of discovery tools during the development of discovery services.

Affect as what users feel:

Even though the overall impression of discovery service WCD from participants at SUL was not negative, other search tools or services such as Google Scholar were still preferred by some of the participants to a large extent. That reflects that the interaction with discovery service does not always mean an “enriched” search experience for users, sometimes appear a “limited” one.

A typical search process through discovery interface such as WCD can be abstracted as the following: users/searchers start the search action in order to discover information based on their interests, and a list of results will be returned with their presentation on the screen. When the process goes smooth, which means no problems occurring on the aspects of both discovery and delivery, a discovery service provides advantage, such as simple search interface and broad resource coverage as discussed by previous studies. In relation to the results in this study, the major benefits searchers get from the discovery tool WCD are for instance, a simple search interface, flexible filter functions, and easy access to full-text articles in English etc. (see figure 14. below).

![Diagram of search process through discovery interface](image)

*Figure 14. Major benefits of WCD in relation to aspects of discovery and delivery*

However, if the search process does not go well due to various deficiencies in the aspect of either discovery or delivery, users will experience such problems as low interoperability, limit in advanced search, insufficient metadata as mentioned by previous studies. The bad aspects of WCD commented by participants indicate the disadvantages of WCD, which are
exemplified by repeated titles, misleading information, lack of instruction and description, failed access to video format or full-text article in Spanish etc. (see figure 15. below).

![Diagram](image)

*Figure 15. Main problems of WCD in relation to aspects of discovery and delivery*

The search process involving the aspect of discovery and delivery is enabled by a chain of services, rather than the discovery service alone. Whether a search process goes smoothly or broken depends on many factors, among which indexing problems are one of the typical issues. For instance, Narayanan and Byers (2018) mentioned that there was a lack of indication for a particular subscribed journal to be included in the central index of the discovery service or not by the publishers (p. 277). Besides, the existing inconsistency might be caused by false expectation of immediate access to all indexed materials, which is created by discovery tools (Howard & Wiebrands, 2011). The delivery of accurate and relevant results depends largely on the depth and breadth of indexing, which demands considerable cooperative works from each service in the whole process (Guajardo, Brett, & Young, 2017; Kelley, 2012; Narayanan & Byers, 2018).

6.3 Indications and possible solutions

*Indications*

The evaluation results of discovery service WCD at SUL have several indications for academic libraries.

First of all, advantages of discovery tool may support the motivation of academic libraries to adopt such discovery tools, which would mean “enriched” user experiences by searching within single interface for instance. However, shortcomings of discovery tool often become hinders for a smooth search process for users and result in dissatisfaction and even frustration for users of academic libraries, which implies that it may not be a “all-in-one” solution to users’ complex information needs in a modern digital environment (Narayanan & Byers, 2018, p. 276).

Moreover, simulation of “Google-like” search experience by discovery services may help academic libraries achieve “web-scale” vision, but also expose users with problems of information quality. Academic libraries having been distinguishing themselves from other sources of information with high information quality (Arms, 2000) may find their image weakened by integration of discovery services if the quality cannot be guaranteed to the same or higher level than before. Therefore, instead radical adopting of such discovery service, a critical judgement of potentials and problems of such integration will be beneficial for both
academic libraries and their users. Evaluation of WCL carried out at Oregon State University (OSU) (Boock et al., 2009) and usability test of WCL conducted by Western Washington University Libraries (Thomas & Buck, 2010) before their decision of adoption of discovery service were such critical examples.

**Possible solutions**

Given the complex of above described issues, the possible causes for certain problems are no less multifaceted. Take the example of failed full-text access to articles in Spanish, which occurred for most of the participants during task experiments, the possible causes could be as illustrated with a list questions by one librarian (2018) at SUL: “Is it because the library has no subscription to the magazine? Is it because the link server leads to the magazine page and not to the article itself? Is it because WorldCat Discovery is unclear as to how the full text is reached? Is it because the search is too narrow?”

Those multifaceted causes also raise the awareness from academic libraries of conflicts of interests from various parties involve in the development of discovery service. To improve academic library service and ensure a smooth search process for their users, “seamless” integration of various services from all the parties involved is one of the possible solutions (Akeroyd, 2017; Breeding, 2010; Kelley, 2012; Maceviciute, 2014). As emphasized by Kelley (2012), the three parties, library, content provider and discovery service provider need to cooperate on “a common vocabulary to describe what they do”, and to maintain “transparency” between them (p. 1; 3).

- **Libraries**

From the libraries’ side, infrastructural and technological supports for the implementation and maintenance of discovery service are important as stated by Maceviciute, (2014, p. 289). Patience and resources from libraries are significant during the tough process (Nichols et al., 2017, p. 32). An effort of promotion of WCD from Skövde University Library can be exemplified by its interface design (see figure 16. below), in which the WorldCat Discovery is set as the default search entry.

*Figure 16. Skövde University Library interface*
Even with the effort of promotion from the library, there are still an amount of users at SUL not familiar with WCD as illustrated by the data from post-task comments. Therefore it will be helpful for users to get relevant knowledge of discovery services, perhaps through certain forms of training by librarians for instance.

Other efforts from libraries are such as suggested by Akeroyd (2017, p. 88) to enable the ease of access by providing seamless authentication system and the availability of interlibrary loan and printed copies within the discovery system, which was not actualized by SUL though.

- Content providers

From the side of content providers, greater transparency is demanded as to the breadth of content such as the volumes of journal that are included and the quantity of materials that are indexed in full text; as well as the depth of content as to detailed subject indexing and fine-tuned algorithms for relevance ranking (Kelley, 2012, p. 3). Another issue is that libraries may be not aware of the invisibility of the content that they subscribed, because the content is actually not being indexed in the main discovery tool. The above described information from content providers is certainly helpful for libraries as to their decision-making, providing user instructions and customizing suitable settings for their users (Kelley, 2012, p. 5).

- Discovery service vendors

The efforts from discovery service providers are invested so far mainly on the improvement of interface design and the expanding of collections. It can be reflected by the positive comments from users as well as library staff that great advancement has been made every year since the implementation of WCD. However, the quality of results becomes main problems concerned by academic libraries. There is a need of standards and best practice described by common vocabularies as pointed out by Kelley (2012) to avoid confusing and misleading information such as repeated titles commented by the participants in this study. Apart from that, it is perhaps critical for discovery service providers to find a solution to check the actual existence of full text periodically to avoid the linking failure (Narayanan & Byers, 2018, p. 278). The popularity of Google Scholar indicated by the preference of most of the participants in this study illustrates the advantage with Google crawler. The above issues are crucial factors that influence the selection of discovery service, which is according to library director at the University of Skövde, largely depending on how much support they can get from the provider.

6.4 Limitation

The limitation regarding the methods for this study can be discussed in terms of the ability of generalization, validity and reliability.

- Generality

First of all, the single setting of one library bears the weakness due to the lack of basis for generalizing the results from one case to other settings (Wildemuth, 2017, p. 40). However, another perspective of addressing the issue of generality of from one setting is from the ability to generate theory out of the findings, which is therefore referred by J. C. Mitchell (1983) as “theoretical generalization” and by Yin (2009) as “analytic generalization” (in Bryman, 2012, p. 71). The discussion of the benefits and problems in relation to the aspects
of discovery and deliver provides possible solutions which might be relevant to discovery services in general. The data was collected in two-stage survey, which increases the richness of information even though it was in a particular setting. Besides, questions in the survey are formulated based on the previous study results, which can find some commonalities in terms of the investigation of benefits and shortcomings of similar discovery tools.

- **Validity**

Validity concerns “the integrity of the conclusions of a study” (Bryman, 2012, p. 47). In the phase of designing questions and tasks for the survey, a lot of consideration is put to avoid sample related errors, especially non-response (Bryman, 2012, p. 205). To obtain data of substantial depth in this small-scale study, it is significant to design the tasks that are feasible for the participants. For instance, the task of full-text access initially is designed to test the access of articles in locally used language (in this case, Swedish) and minor-used language (in this case, Chinese). However, after the meeting with library staff at the University of Skövde in April, the languages for selection have to be adjusted to German and Spanish. The rationale behind is the fact that the Swedish peer-reviewed articles are simply not available from the content provider, and the Chinese articles are not subscribed by SUL due to its least usage.

Another limitation is related to the low response rate for questionnaire and small number of participants for task experiments, which is generally seen as the difficulty of survey research. Due to the small sample size, the study results are only valid within the scope of this paper. And other methods could have been studied and compared. More efforts should have been devoted to raise users’ engagement to be physically present at all evaluations. However, several factors such as range of people, level of cooperation and workable estimation often result in a compromise between the constraints of time and cost and the need for precision (Wildemuth, 2017, p. 197).

The qualitative sessions could have been elaborated more to get deeper insights. However, due to the constraint of time from the participants and the limited scope of this study, only comments were collected among two participants with the focuses on the clarification of their questions in order to better interpret data. More and detailed questions could have been formulated for deeper insights, which will be certainly beneficial for further studies in relevant topic.

- **Reliability**

Reliability means whether the study results are repeatable. The method of survey research is restricted in terms of reliability due to possible sampling errors such as non-response in questionnaire or non-serious answers, which is difficult to handle due to anonymity (Bryman, 2012). However, in spite of the fact that non-probability sampling is less possible to generalize the findings compared with the method of probability sampling, it is the absolute sample size with insightful comments matters in task experiments in this study, rather than the relative size of participants (Bryman, 2012, p. 197).
7 Conclusion

This paper takes the case of Skövde University Library to evaluate discovery service integrated with academic library through the usability study of discovery tool WorldCat Discovery at Skövde University Library. The concepts of “Information Portals” and “Next generation catalogue” provide the ground for the necessity of integration of discovery services with academic libraries; however, the identification of problems from previous studies made academic libraries alert to such adoption of discovery tools. The real effect of adopting discovery service has to be evaluated by users in practice. Based on the evaluation purpose, two research questions are formulated in this study as the following:

Question 1: What is the overall impression of the discovery service WorldCat Discovery perceived by students and researchers at Skövde University Library?

Question 2: What benefits and problems are experienced by students and researchers when performing search tasks in WCD at SUL?

The results answer the first research question that the overall impression of discovery service WCD from students and researchers at SUL is slightly positive, which is indicated by the slightly higher degree of satisfaction of WCD and the confirmation of future use of WCD by the respondents to questionnaire and the participants of task experiment. The discovery service WorldCat Discovery can support most common search tasks of users at SUL such as finding various formats, limiting their search according to their interests and get access to full-text content in English. It therefore indicates the integration of discovery service WCD at SUL has a positive effect on users’ search experience so far.

The results answer the second research question that the major benefits are the single box search model and filter functions although some minor problems as to the layout and design exist; whereas the main problems are the access to resources such as the failure to obtain video formats and full-text of articles in minor-used languages, and metadata quality such as misleading information, lack of instructions and inconsistent indexing.

The Dillon’s (2001) evaluation model is adopted for this study and a two-stage survey of questionnaire and survey is designed based on Dillon’s (POA) approach to collect data as to what users do, what users attain and what users feel. The results evaluated based on aspects of process, outcome and affect as in Dillon’s model reflect the impacts from integration of discovery services on users’ search experience are both positive and negative.

Similar benefits and shortcomings of discovery tool WCD can find evidences in previous studies, and be discussed in relation to aspects of discovery and delivery, which indicates that academic libraries should hold a critical view on the integration of such search tools. While academic libraries make efforts for their users to benefit from integration of discovery tools, they should also be aware of the potential conflicts of interests from different parties involved in this process, namely discovery service providers and content providers, and therefore strive to provide best service for their users by “seamlessly” integration of discovery services both in the short term and the long term of this development.

The limitations of this study derive from the weakness of generalization ability of single setting and the representative capability of sampling. While the results are valid in the scope of this study, the reliability is relatively low due to the constraints of sampling methods.
Some crucial issues such as the failure of full-text access to articles in minor-used language could be investigated further in order to find actual causes rather than the identification of problems on the surface level. It is also of significance to compare different discovery tools on the market in terms of the selection and improvement of discovery services for academic libraries. Anyway, the campaign to attract users back to academic libraries from other search tools such as popular Google Scholar demands the contributions from both practitioners and researchers.
Reference list


University of Skövde. (n.d.) Retrieved from https://en.wikipedia.org/wiki/University_of_Sk%C3%B6vde


Appendix A-Questionnaire

Questionnaire concerning the discovery service WorldCat Discovery

Dear participant,

This project is conducted by Qiuhong Boers (master student at the University of Borås) in cooperation with Skövde University Library. The purpose of this research project is to evaluate the discovery service WorldCat Discovery at Skövde University library. The results of this survey as part of this research project will be analysed and presented as part of a master thesis in library and information science, which may also be published by the University of Borås.

This study follows the guidelines for research ethics as set up by the Swedish research council. This means, among other things, that your participation is voluntary and anonymous. The data collected through this survey will not be used for any other purposes than stated above. Without your permission, your identity will not be revealed in any form.

This survey takes approximately 3 minutes to complete. We would appreciate if you can submit the questionnaire before 25th of March, 2018!

If you have any questions, you may ask the responsible person by the following email:

Qiuhong Boers
qiuhongboers@gmail.com

1. What is your current academic status at the University of Skövde?
   - Undergraduate (Bachelor)
   - Graduate (Master)
   - Faculty (Researcher)

2. Where do you usually start when you search scientific publications through the services offered via Skövde university library's website? (More than one answer is possible)
   - WorldCat Discovery
   - The Library Catalogue
   - Journals and newspapers
   - Databases
   - Student theses
   - University of Skövde research publications
   - LIBRIS
   - Encyclopaedias
   - Searching the Library's holdings

   If the library interface is not your starting point, please describe in your own words where you usually start your search.

3. Have you ever used the discovery service WorldCat Discovery (previously called "WorldCat Local") through the Skövde University Library interface?
- Yes. (In this case, please indicate your degree of satisfaction with the following features of WorldCat Discovery (WCD)/ WorldCat Local (WCL) in the following questions 4A-7A).
- No. (In this case, please indicate how you generally value the following features for you in the following questions 4B-7B).

4. A. It is easy to find various formats such as books, articles and video for a search topic in WCD/WCL.
4. B. It is easy to find various formats such as books, articles and video for a search topic.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

5. A. It is easy to use the filter functions such as selecting date and language to limit the search results so that they are more relevant to a search topic in WCD/WCL.
5. B. It is easy to use the filter functions such as selecting date and language to limit the search results so that they are more relevant to a search topic.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

6. A. It is easy to identify and view full-text versions of interesting search results such as journal articles or e-books from different databases in WCD/WCL.
6. B. It is easy to identify and view full-text versions of interesting search results such as journal articles or e-books from different databases.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

7. A. It is easy to request the printed copy of a scientific publication if it is not possible to access the full-text online in WCD/WCL.
7. B. It is easy to request the printed copy of a scientific publication if it is not possible to access the full-text online in WCD/WCL.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

8. Are there other features not mentioned above that you would like to see in a discovery tool such as WorldCat Discovery?
- No
- Yes

9. Would you like to use WorldCat Discovery for your search of scientific publications in the future?
- Yes
- No
- Don't know

10. If you are interested in participating in a follow-up task experiment where you will be asked to perform some specific information searches in WorldCat Discovery, please also provide your contact information in the fields below.

Contact information (please provide your Name, Email, Mobile phone number in the box below).
Appendix B-Consent Form

Dear participant,

Thank you for your agreement to participate in task experiments to test aspects of usability concerning the discovery tool WorldCat Discovery (WCD) at Skövde University Library (SUL). The aggregated results of the study will be analysed and presented as part of a master thesis in library and information science which may also be published by the University of Borås.

In this experiment, you will be asked to perform a series of tasks using the search tool WCD. The experiment will take approximately 30 minutes. Please make sure to complete the tasks independently.

This study follows the guidelines for research ethics as set up by the Swedish research council (Vetenskapsrådet). This means, among other things, that your participation is completely voluntary, and you may withdraw your participation at any time if you wish so; your personal information is treated confidentially and your identity will not be revealed to any person except the researcher; and the data collected through this study will not be used for any other purposes than stated in this consent form. Without your permission, your identity will not be revealed in any form.

If you have questions, you may ask the responsible person (Qiuhong Boers—student at the master program Digital Library and Information Services at the University of Borås) now or at any time during the experiment.

If you have further questions after the experiment, you may contact the responsible person by email: qiuhongboers@gmail.com

By signing this form, you are indicating that you give the researcher permission to use your answers and comments provided in the tasks in the manner and for the purposes stated above. The consent form is set up in two identical copies, one for your own archive, and one for the researcher conducting the study.

Thank you for participating, your contributions are highly interesting and valuable for this study.

Your name _____________

Date ________________
Appendix C-Task experiments

Instructions:

Please note that all the following tasks are supposed to be conducted ONLY in the database service that is in focus for this study – namely WorldCat Discovery – which means that you cannot use any other sources such as other library databases or Google for these tasks.

At the beginning of each task, you therefore need to go to WorldCat Discovery's start page, available at this URL: [https://his.on.worldcat.org/discovery?lang=en]

Once at this start page, you decide for yourself how you wish to proceed, which functions to use, and in what order, when performing each task.

There are 3 tasks in total. Some tasks may require your personal login.

Please indicate your current academic status at the University of Skövde.

- Undergraduate (Bachelor)
- Graduate (Master)
- Faculty (Researcher)

Task scenario: You are searching for previous research in preparation of conducting a study of your own on the topic of “air quality”…

Task 1:

Description:
Please find three relevant sources on the topic “air quality”, one book, one journal article, and one video. · Please save the results so that you can check later.

1. Which formats did you find?
   - Book
   - Article
   - Video
   - Unsure/Do not know

   Other formats (please specify in your own words)

2. How did you conduct the search?
   - I typed my own keywords in the simple search box on the start page
   - I used auto complete function after starting to type keywords in the search box
   - I used “Advanced search” and filled in a number of qualifiers and keywords in specific fields

   Other (please describe in your own words)

3. Please indicate your degree of satisfaction with WCD interface for finding various formats.
   - Very dissatisfied
   - Dissatisfied
   - Neither satisfied nor dissatisfied
   - Satisfied
• Very satisfied

4. What do you think is good about WCD for finding various formats?

5. What do you think is bad about WCD for finding various formats?

6. What are your suggestions to improve WCD for finding various formats?

7. How did you save your search results?
   • Cite
   • Link
   • Email
   • Save
   Others (please describe in your own words how you saved the search results).

8. Please indicate your degree of satisfaction with WCD interface for saving search results.
   • Very dissatisfied
   • Dissatisfied
   • Neither satisfied nor dissatisfied
   • Satisfied
   • Very satisfied

9. What do you think is good about WCD for saving search results?

10. What do you think is bad about WCD for saving search results?

11. What are your suggestions to improve WCD for saving search results?

Task 2:

Description:
Please find three peer reviewed journal articles between 1990 and 2018 on the topic “air quality” in each of the three languages English, German and Spanish and save the results.

1. How did you conduct the search?
   • I typed my own key words into the simple search box on the start page, followed by a manual search/browse of the result list.
   • I typed my own key words into the simple search box on the start page, followed by a use of filtering options in the left hand menu for narrowing the search result list.
   • I used the advanced search option and filled in a number of qualifiers and keywords in specific fields, followed by a manual search/browsing of the result list.
• I used the advanced search option and filled in a number of qualifiers and keywords in specific fields, followed by a use of filtering options in the left hand menu for narrowing the search result list.

Others (please describe in your own words in the commenting box below).

2. Please indicate your degree of satisfaction with WCD interface for limiting your search results.
   • Very dissatisfied
   • Dissatisfied
   • Neither satisfied nor dissatisfied
   • Satisfied
   • Very satisfied

3. If you used filter options on the left hand menu, what do you think is good about the filter functions for search results?

4. If you used filter options on the left hand menu, what do you think is bad about the filter functions for search results?

5. Do you have any suggestions to improve the filter functions?

6. If you did not use filter options on the left hand menu, please describe why you did not use them in your own words?

Task 3:

Description:
Please try to obtain full text versions of the articles in each of the three languages that you saved in the previous task.

1. Were you able to obtain the article in English as full text version?
   • If yes, please indicate which database it was from (e.g. EBSCO)
   • If no, please copy and paste the reference information for the article in the commenting box below (e.g. title, author, year etc.)

2. Were you able to obtain the article in German as full text version?
   • If yes, please indicate which database it was from (e.g. EBSCO)
   • If no, please copy and paste the reference information for the article in the commenting box below (e.g. title, author, year etc.)

3. Were you able to obtain the article in Spanish as full text version?
   • If yes, please indicate which database it was from (e.g. EBSCO)
   • If no, please copy and paste the reference information for the article in the commenting box below (e.g. title, author, year etc.)
4. How did you try to obtain the full text version(s) of the article(s)?
   - I typed own keywords in the simple search box on the start page.
   - I used “Advanced search” and fill in a number of qualifiers and keywords in specific fields.
   - I used filter options on the left menu.
   - I clicked on the button “view full text”.

Others (please describe in your own words in the commenting box below).

5. Please indicate your degree of satisfaction with WCD in terms of the full-texts access.
   - Very dissatisfied
   - Dissatisfied
   - Neither satisfied nor dissatisfied
   - Satisfied
   - Very satisfied

6. What do you think is good about WCD in terms of the full-texts access?

7. What do you think is bad about WCD in terms of the full-texts access?

8. Do you have any suggestions to improve WCD in terms of the full-texts access?

Concluding remarks / feedback:

1. Do you think you will use WorldCat Discovery in the future?
   - Yes, for all purposes. (Please describe your motivation for this in the commenting box below)
   - Yes, for some purposes. (Please describe what these purposes might be and why you would use WCD for these in the commenting box below)
   - No. (Please describe your motivation for this in the commenting box below)

2. What services or tools do you normally use when searching for the type of material described here in these tasks?

3. If you compare WCD with the search services that you normally use, what advantages can you see with WCD?

4. If you compare WCD with the search services that you normally use, what disadvantages can you see with WCD?