Open Source Integrated Library System and Usability Issues: A Study of Koha Interfaces

Open Source Integrated Library System and Usability Issues: A Study of Koha Interfaces

By

Asma Khatun

Dhak University Library

467586

467586

A Dissertation Submitted in Partial Fulfilment of the Requirements of the Degree of

Master of Philosophy (MPhil)

Information Science and Library Management
University of Dhaka

July 2014

Dhaka University Institutional Repository

S.M. Zabed Ahmed, *PhD*
Professor
Department of Information Science and Library Management, University of Dhaka, Dhaka-1000

CERTIFICATE

This is to certify that the thesis entitled "Open Source Integrated Library System and Usability Issues: A Study of Koha Interfaces" submitted by Asma Khatun, for the degree of Master of Philosophy (MPhil) in Information Science and Library Management, University of Dhaka, is her original work carried out under my supervision and guidance, and is worthy of examination.

467586

S.M. Zabed Ahmed, *PhD*
Supervisor

Dhaka University Institutional Repository

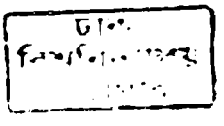
Abstract

This research examined the usability of Koha interface from user's perspective. It used the Koha OPAC interface available at library.bracu.ac.bd. A series of usability experiments were carried out. A set of search tasks was obtained from a user survey and was used in this research. The first experiment was carried out using both novice and experienced users to see their performance and satisfaction with the interface. The results showed that there were significant differences in the time taken to complete the tasks, success score and the number of errors that they were made. There was no significant difference in term of number of search terms used. There was also no significant difference in satisfaction with the interface between the groups.

The second experiment was conducted on novices' learning and retention with the Koha interface using the same equipment, tasks and environment. The results of the experiment showed that novices could readily pick up interface functionality when a brief training was provided.

467586

The result of the comparison of novices' initial performance, learning and retention sessions showed that there were significant differences in search performance in terms of time taken, number of error made and success score. The comparative analysis between novices' learning and experienced searchers showed no significant difference between the sessions. The outcome of the usability tests provided helpful information about Koha interface and its usability.



Dhaka University Institutional Repository

Acknowledgement

I would like to thank my supervisor, S.M. Zabed Ahmed *PhD*, Professor and Chair, Department of Information Science and Library Management, University of Dhaka, for the guidance and encouragement throughout this research work. I have been extremely lucky to have a Supervisor who cared so much about research works, and who responded to questions and queries so promptly.

I would also like to thank the volunteer students from various departments at BRAC University for their participation in the experiments. I am indebted to them for their help and support in making the usability experiments successful.

I would also like to thank my family, especially my mother and father for believing in me, and for their love and continuous support.

Dhaka University Institutional Repository

Table of Contents

Dhaka University Institutional Repository

Dhaka University Institutional Repository

Dhaka University Institutional Repository

Dhaka University Institutional Repository

List of Tables

Dhaka University Institutional Repository

List of Figures

Dhaka University Institutional Repository

Chapter 1:

Introduction

1.1 Introduction

Libraries have always relied on the evolution of technology to acquire, organize, and disseminate information. In particular, the growth and availability of access to information via the internet and associated technology has transformed the expectations of the library users as well as their service preferences. These new technologies and developments have altered the perceived link between information and libraries. An integrated library system (ILS), also known as library management system (LMS) is often being used in supporting business and technical functions of libraries. Since the introduction of Open Source Software (OSS), it has become a critical part of any software solutions for libraries. A typical library management system includes several modules: acquisitions, cataloguing, circulation, and administration. It also provides an Online Public Access Catalogue (OPAC) that can be searched by patrons through a web browser. Some well-known open source library management systems are Avanti, Koha, Openbiblio, Evergreen and Emilda. Among them, Koha is often considered as one the most dynamic and complete ILS packages. Including modules for circulation, cataloguing, acquisition, serial control, reservation, patron management, branch management, and more, Koha has been regarded as a true enterprise-class library management system comparable to those of commercial ILSs. Koha is now one of the popular integrated library systems among the open source ILSs currently being used in various libraries across the world (Koha Developer Wiki, 2007). Integrated library services of Koha are no doubt extremely handy but how much this software is usable depends on its user interface, particularly the OPAC. Usability experiments with Koha will reveal the real picture of usability of such an open source integrated library system from user perspective.

1.2 Open source integrated library system

Open source integrated library system is a cooperatively developed, web-based, and open source program. It is a system that provides access to the source code, meaning that users are free to see how the system is made. Additionally, librarians can modify the codes to transform it to suite local needs.

1.2.1 Reasons for using open source ILSs

In general, there are several reasons for using an open source library management system, including (Koha, 2014):

- It endorse inspired development;
- Libraries which cannot afford proprietary software can easily afford integrated library system without any cost;
- Sometimes the service of open source integrated library system is far better than that of proprietary library system;
- A librarian can easily modify the integrated library system according to user's need;
- Little to no upgrade costs;
- little to no viruses;
- It integrates all library services from acquisition to circulation in a one system; and
- It is free and easily customizable integrated library system, so a librarian has nothing to loss.

Open source integrated library system is an exciting technological innovation in library management system. The support of this system is not blocked to a single vendor or solution. The community of developers for a particular open source integrated library system usually provides strong support services. Open source software is typically created and maintained by developers crossing institutional and national boundaries, collaborating by using internet-based communications and development tools.

1.2.2 Usability of open source integrated library system

Usability testing of an open source integrated library system involves the collection of data on how users actually interact with the interface by performing information search tasks in a given environment or work-setting. This kind of testing enables librarians to assess the effectiveness of such interfaces.

Usability testing begins with a view of keeping the user first. The objective of the usability testing is to evaluate the interface from the user's perspective. It is important to enlist the test participants who are representative of the population intended to use the system interface and to involve the user in all facets of the design process.

Usability testing involves observing members of targeted user groups as they perform a series of tasks intended to address specific functions or portions of interface of an integrated library system. Observers look for repeated patterns of use to determine strengths and problems with the design. This systematic process of analysis provides information that can lead to a user-centered design as well as reveals information about how users interact with the system.

The usability testing of integrated library system interface should not be considered an option but a necessary facet of the system. The values of a usability test or interface testing are concepts presented by Wheat and Greenberg (1998), which provided several arguments in support of usability testing.

1. **Understand the difference between usability testing and a research study**: The two methods differ in that usability testing identifies problem areas, whereas research verifies the existence of a theory.
2. **Incorporate real users**: Interface testing involves users who are representative of the targeted audience. By engaging real users, developers can understand the specific needs of users.
3. **Employ real tasks:** Usability testing involves tasks that are representative of how the website is or should be used. The incorporation of real tasks may

provide a wealth of information on the areas that are in need of change or improvement.

4. **Observe and record meticulously:** The purpose of the test is to observe the participants' ability to perform the said tasks; therefore, record comments or questions about the interface as well as users' behaviours. This observation and recording distinguishes usability testing from focus groups, surveys, or beta testing.
5. **Inattention to data implications is risky:** The qualitative and quantitative data collected from the participants are analyzed and categorized, thus pinpointing the problems areas of the interface.

1.3 Open source integrated library system - Koha

An integrated library system is a system of keeping track of the operations of a library, such as order and purchases, and most importantly, keeping track of the various media being checked out by the library patrons. Koha is a full-featured open source ILS currently being used by libraries all over the world. Many libraries cannot afford to purchase, install, and maintain a proprietary ILS, and Koha is a perfect alternative for them. It has been built using library ILS standards and uses the OPAC interface. In addition, Koha has no vendor lock-in that means libraries can receive technical support from any developer they choose.

1.3.1 Benefits of Koha as an integrated library system

Koha is an open source integrated library system with a range of benefits, including (EIFL, 2014):

- Easy access to information for library staff and users due to effective searching and issuing of items;
- Automation of alerts to remind patrons and staff about, for example, overdue items or arrival of new items;
- Reduced time of processing of library items, due to MARC and z39.50 compatibility;

- Online supervision becomes possible, reducing the line management responsibilities of senior staff;
- Library management becomes easier through automated collection of data;
- Through the acquisition module budgets can be more effectively managed; and
- It brings together library users and staff, as both can see various aspects of the system and can work together more effectively to achieve each user's goals.

1.4 Background of the study

An Integrated Library System (ILS) or Library Management System (LMS) is a complex software package that automates facets of library services. In a word, ILS is an enterprise resource planning system for a library. An ILS is designed to coordinate and automate such library functions as the online catalogue, the circulation system, and the acquisitions system. An ILS improves the efficiency of housekeeping operations. Use of ILS requires only the one time entry of the data (bibliographic and user) and the same can be made use for all other purposes.

An ILS usually comprises a relational database, software to interact with that database, and two user interfaces (one for the patrons, and the other one for the staff). Most ILSs offer separate software functions into discrete programs called modules, each of them integrated with a unified user interface. Examples of such modules include:

- acquisitions (ordering, receiving, and invoicing materials);
- cataloguing (classifying and indexing materials);
- circulation (lending materials to patrons and receiving them back);
- serials (tracking magazine and newspaper holdings); and
- the OPAC (public interface for users)

Prior to computerization, library tasks were performed manually and independently from one another. Librarians ordered materials with ordering slips, cataloguers manually catalogued items and indexed them with the card catalogue system (in

which all bibliographic data was kept on a single index card), and users signed books out manually, indicating their name on cue cards which were then kept at the circulation desk. Early mechanization came in 1936, when the University of Texas began using a punch card system to manage library circulation. While the punch card system allowed for more efficient tracking of loans, library services were far from being integrated, and no other library task was affected by this change.

Following this, the next big innovation came with the advent of MARC standards in the 1960s, which coincided with the growth of computer technologies, library automation was born. From this point onwards, libraries began experimenting with computers, and, starting in the late 1960s and continuing into the 1970s, bibliographic services utilizing new online technology and the shared MARC vocabulary entered the market; these included OCLC (1967), Research Libraries Group (which has since merged with OCLC), and Washington Library Network (which became Western Library Network and is also now part of OCLC).

With the evolution of the internet throughout the 1990s and into the 2000s, ILSs began allowing users to more actively engage with their libraries through OPACs and online web-based portals. Users could log into their library accounts to reserve or renew books, as well as authenticate themselves for access to library-subscribed online databases. Inevitably, during this time, the ILS market grew exponentially. By 2002, the ILS industry averaged sales of approximately US$500 million annually, compared to just US$50 million in 1982.

By the mid to late 2000s, ILS vendors had increased not only the number of services offered but also their prices, leading to some dissatisfaction among many smaller libraries. At the same time, open source ILS was in its early stages of testing. Some libraries began turning to such open source ILSs as Koha and Evergreen. Common reasons noted were to avoid vendor lock in, avoid license fees, and participate in software development. Freedom from vendors also allowed libraries to prioritize needs according to urgency, as opposed to what their vendor can offer. Libraries which have moved to open source ILS have found that vendors are now more likely

to provide quality service in order to continue a partnership since they no longer have the power of owning the ILS software and tying down libraries to strict contracts. This has been the case with the SCLENDS consortium. Following the success of Evergreen for the Georgia PINES library consortium, the South Carolina State Library along with some local public libraries formed the SCLENDS consortium in order to share resources and to take advantage of the open source nature of the Evergreen ILS to meet their specific needs. Since 2007, the library management systems landscape has changed markedly, with a variety of open source systems (Breeding, 2008b) gaining an increasing share of the market (Breeding, 2008c). By October 2011, just 2 years after SCLENDS began operations, 13 public library systems across 15 counties had already joined the consortium, in addition to the South Carolina State Library. Librarytechnology.org does an annual survey of over 2,400 libraries and noted in 2008 2% of those surveyed used open source ILS, in 2009 the number increased to 8%, in 2010 12%, and in 2011 11% of the libraries polled had adopted open source ILSs.

The open source (OS) software model makes source code available to users, who can change the software to tailor it more closely to their own requirements. With many free and open source software applications now available for library and information management, organizations have a new option for acquiring and implementing systems, plus new opportunities for participating in OS projects. Examples of such systems include Koha, Greenstone, and MyLibrary. Factors associated with the successful adoption of OS applications for library and information management include the match with an organization's culture, technical infrastructure, staff skills, software functionality, and the extent of community support available.

The motivation of libraries considering an open source ILS appear to be both financial and a desire to tailor a system to more closely meet their requirements than the proprietary products allow. Studies have found that the libraries which have chosen an open source ILS indicated that while the smaller libraries focus more on potential cost savings, the large libraries focus on the possibility of tailoring functionality more closely to their needs.

For library schools, open source integrated library system is a boon. It is difficult for library schools to purchase commercial system. Even if they are purchased, their maintenance and updating would be difficult as they involve financial commitment from the schools. Experience shows that commercial vendors were not very supportive for library schools in offering their software at nominal cost/free of cost. With the emergence of open source system, library schools now have options to include the software training in their curriculum. They can also now stay updated by using the latest version of the integrated library management system.

Like proprietary software, the problems of open source ILS are typical of usability issues that frustrate novice users. Therefore, the central mechanism for achieving software quality in open source projects is extensive beta-testing. This 'bazaar-style' of development successfully encourages extensive functional testing of error-prone softwares to produce robust and reliable software such as the Apache web server. However, the elements of usability may not be equally well-supported by open source development, particularly when applied to software aimed at less technically-sophisticated users.

Usability is typically described in terms of five characteristics: ease of learning, efficiency of use, memorability, error frequency and severity, and subjective satisfaction (Nielsen, 1993). Usability is separate from the utility of software (whether it can perform some function) and from other characteristics such as reliability and cost. Software, such as compilers and source code editors, which is used by developers, does not appear to represent a significant usability problem for open source integrated library system.

As beauty is in the eye of the beholder, the interface of a catalogue can be appealing to one user but prohibitive to another. With this limitation in mind, the out-of-the box user interface at the demo sites was considered for each OPAC. All of the user interfaces are highly customizable. It largely depends on the library to make the user interface appealing and welcoming to users. Open source communities have successfully developed many pieces of software. Most of this software is used by

technically sophisticated users, in software development or as part of the larger computing infrastructure.

Since the original implementation in 1999, Koha functionality has been adopted by thousands of libraries worldwide, each adding features and functions, deepening the capability of the system. With the 3.0 release in 2005, and the integration of the powerful Zebra indexing engine, Koha became a viable, scalable solution for libraries of all kinds. LibLime Koha is built on this foundation. With its advanced feature set, LibLime Koha is the most functionally advanced open source ILS available today.

1.5 Research significance

To give people right information at the right time, library always plays a vital role from the ancient time. Libraries these days, like other institutions, are using modern technologies to provide information to their users. From the last few decades, libraries changed their knowledge preservation and distribution procedure with the help of computer and other modern technologies. They use integrated library management system instead of manual library management system. For the developed countries, this effort has been mostly successful because they have sufficient fund and necessary equipment to automate the libraries. However, for the developing countries, this attempt was difficult to materialize due to insufficient budget to acquire proprietary integrated library system or software. In that case, open source integrated library management systems play an important role to automate the libraries of developing countries. Integrated library management systems can cut costs and enhance the efficiency of library services and therefore are absolutely necessary for the management of housekeeping operations. Open source library management system is a software solution that users have the ability to run, copy, distribute, study, change, share and improve for any purpose. In order to determine the usability of how friendly these open source library systems, usability evaluation is highly recommended. In this research, open source integrated library system Koha is taken for the usability experiment. From the innovation in 2002 by Katipo Organization of New Zealand, its functions and services proved that it

is an ideal integrated system for libraries. Prominent libraries worldwide are now using Koha to automate their library services.

The main aim of a library to use ILS is to provide better services by providing enhanced access to library resources. In this regard, usability issues and user interface design are important for an ILS. Koha has fully user-oriented default search interface, but it is possible to customize the interface according to user needs. Koha development is steered by a growing community of libraries collaborating to achieve their technology goals. Its impressive features are continued to evolve and expand to meet the needs of its user base. In this research, usability experiment is implied on a customized version of Koha OPAC interface.

1.6 Objectives of the study

The aim of the research is to experiment the usability issues of user interfaces of Koha, a freeware library automation package. In Bangladesh, Koha is being used by different types of libraries in academic, national and special libraries. This study used the Koha interface available at library.bracu.ac.bd. This research aims to achieve three broad objectives:

1. to investigate the usability of Koha interface by naive and experienced users;
2. to compare their search performance and satisfaction with the interface with different levels of search knowledge; and
3. to identify the common problems of Koha interface as an integrated library system.

1.7 Conclusion

This is the introductory Chapter of this research. This Chapter has presented the background, overview and significant of this thesis. The next Chapter contains a detailed review of the literature on the subject.

Chapter 2:

Literature Review

2.1 Introduction

Literature review is an important part for any kind of research. The purpose of a systematic literature review is to evaluate and interpret the available research relevant to a particular research topic. This Chapter provides a brief review of major literature related to this thesis.

2.2 Area of the study

The literature reviewed for this research has been categorized under the following headings:

1. Open source integrated library system;
2. Usability of the open source integrated library system interfaces; and
3. Koha interface.

2.3 Open source integrated library system

There is a developing volume of literature on the subject of open source system in library-settings. From the history of open source integrated library system, scholars have produced a documentary history of library engagement with this relatively new technology resource. There are a lot of publications on open source library related software packages. However, many of these publications have either focused on user satisfactions or on usability of the software packages. These publications are reviewed below.

Breeding (2008) has written extensively on the subjects of OSS and library automation, which includes integrated library systems (ILS) and content management systems (CMS). Breeding described the atmosphere in which OSS is making inroads and comments upon the amalgamation of OSS and proprietary

applications in contemporary library-settings. Additionally, he explained the benefits of adopting OSS, such as the freedom of licensure, variety of computing solutions, liberty to examine the logic or workings of the application, and the ability to append or otherwise alter the OSS source code to meet specific user needs. Given these liberties, Breeding cautioned that OSS is not unilaterally free. He identified the differing licensure agreements that allow OSS developers to establish restrictions upon areas of use and distribution, such as the use of appended code for profit and the mandatory availability of altered code for the public (Breeding, 2008). Within the library context, Breeding's observations address concerns regarding information technology security, maintenance, and longevity. Libraries, therefore, may be hesitant to adopt OSS tools due to their changeable nature despite the observable benefits. Alternatively, as libraries are primarily unconcerned with profiting from their services, the restrictions placed upon the economics of OSS do little to affect library policies and procedures.

In recent years, there have been several substantial library implementation case studies published. Goh *et al.* (2006) introduced an evaluation of four open source digital library (DL) products with the intended result of a standardized methodology for the selection of OSS for DL. Digital library is a separate genre of the library institution, for this division solely exists through the workings of a virtual user interface. Additionally, digital library or DL holdings often consist of multimedia materials of varying size, format, and duration, so the software framework accounts for the full functionality of library services. They determined that a static methodology would help DL institutions find the best OSILS tool for their particular collection, representation, and storage needs.

Bissels (2008) contributed an article regarding OSILS installation at the Royal London Homeopathic Hospital (RLHH). This study described the transition to the Koha library management system (LMS) for use as the library's primary information access framework. Bissles found that Koha fulfilled the needs and goals of a specialized medical library institution. This paper proposed following criteria for the library's ILS

selection: an application which requires little training, is user-friendly, is compliant and able to accord with library standards, is inexpensive, and has the ability to adapt to a specialized environment. In the report, Bissels articulates the ease with which the application is accessed in a remote host setting and states, "all Koha needs on a client machine is an installation of Firefox". It is important to note here that Koha had not been publicly released at the time of Bissels' search for an ILS, so the program was virtually new and untested in the library community. Nevertheless, the RLHH library adopted Koha as their primary ILS. As further evidence of the RLHH library's success with OSS, Bissles concluded the report by stating, "I am confident that we have chosen a truly future-proof LMS."

Perhaps the most recently successful OSILS transition can be illustrated in the case of the Michigan Library Consortium (MLC) partnership with the Grand Rapids Public Library (GRPL). In 2008, the MLC, in conjunction with the GRPL, migrated from a proprietary ILS to an open source ILS which was then shared between seven sister's institutions. With the MLC providing the OSS support and administration and the GRPL providing server storage and maintenance, the project followed the lead of the Georgia Public Library System in changing to Evergreen, an open source solution.

Dykhuis (2009), in an article for collaborative librarianship, described the challenges, unexpected timeliness, and process of the open source installation. This paper also described the quality and affability of the Evergreen support staff, who were the original developers of the software, and explains the need for a formal policy regarding expansion, editing, and otherwise altercation of the software. As several libraries would be affected by system or code changes, the need for standardized processes in order to instigate change is highlighted in the MLC case study.

Payne and Singh (2011) examined the existing presence of OSS in libraries, the functionality and variety of OSS products. The aim was to provide a general context for library implementations of open source software. They aim to provide a broad overview of the deepening relationship between libraries and OSS. Libraries are

seeking alternatives to proprietary applications which may require specialized support and/or services. Moreover, OSS and proprietary products have a functional verisimilitude, and, as proprietary applications developers anticipate user needs, so too do OSS contributors. Finally their practical implications was the degree of variance between proprietary and OSS applications, features, support, and compatibility is continually lessening, so libraries are increasingly making use of less costly alternatives to subscription based tools.

Rafiq (2009) discussed the results of a comprehensive study targeted at the library community's reception of and perceptions regarding OSS. This study examined Library Information Science perceptions within the context of public vs private institutions, between that of academic, public, and special libraries, and of developing and developed countries. The analysis of the data provides compelling insights into the response to OSS by LIS professionals of international localities, including India, Pakistan, the United States, Canada, the United Kingdom, and Australia. The study represented an analysis of 370 contributed responses from 48 countries. Rafiq's conclusions underscore the progress of OSS in libraries as well as the knowledge gap in OSS-LIS studies.

Likewise, Krishnamurthy (2008) discussed the trends of OSS movement in DL environments. He calls the adoption of OSS technologies a "worldwide phenomenon" and includes the open access movement, or the availability of free online materials, in the library trend towards unrestricted applications and content. Krishnamurthy reports that over 700 repositories participate in open access; the Koha ILS alone is used in over one hundred institutions internationally, and E-Prints, an OSS application for document management, is employed by over 200 repository institutions. Krishnamurthy's contribution touches upon a core function of library institutions: to share intellectual works in a manner which best suits the user population. "Digital libraries, open access, and OSS," notes Krishnamurthy, "are a natural outgrowth of the open models of exchange that help societies grow and prosper" (Krishnamurthy, 2008).

Poulter (2010) described information technology trends which might affect the take up of open source and introduces open source comprehensively but succinctly. Poulter stated that open source aids libraries and has great potential but is hobbled by its intrinsically technical appeal and introduced the concept of open source in a way suitable for a non-technical audience and gives an overview of its current and potential prospects in libraries.

Müller (2011) presented the results of an analysis of 20 free and open source ILS platforms offered to the library community. The methodology applied involves three broad steps. The first step consists of evaluating all the available. ILS and keeping only those that qualify as truly open source or freely licensed software. The second step involves evaluating the community behind each open source or free ILS project, according to a set of 40 criteria in order to determine the attractiveness and sustainability of each project. The third step entails subjecting the remaining ILS to an analysis of almost 800 functions and features to determine which ILS are most suited to the needs of libraries. The final score is used to identify strengths, weaknesses and differentiating or similar features of each ILS. More than 20 open source ILS's were submitted to this methodology but only 3 passed all the steps: Evergreen, Koha, and PMB. The main goal is not to identify the best open source ILS, but rather to highlight which, from the batch of dozen open source ILS, librarians and decision makers can choose from without worrying about how perennial or sustainable each open or free project is, as well as understanding which ILS provides them with the functionalities to meet the needs of their institutions. Finally Muller offers a basic model so that librarians and decision makers can make their own analysis and adapt it to the needs of their libraries.

2.4 Usability of open source integrated library system

The literature discussed above shows only the evaluation of open source integrated library software; they do not directly describe the usability issues of OSILS. Besides these articles, there are some studies which directly or indirectly discuss about the usability and user interface aspects of open source integrated library systems.

Different researcher in different countries works on different aspect of usability and interface of OSILS.

Nichols and Twidale (2001) examined the usability issues of OSILS and noted that usability of open source software is often regarded as one of the reasons for their limited distribution. They reviewed the existing evidence of the usability of open source software and discussed how the characteristics of open source development influence usability and how existing human-computer interaction techniques can be used to leverage distributed networked communities, of developers and users, to address issues of usability.

Nichols, Thomson and Yeates (2001) discussed on how characteristics of open source software development influence the usability of resulting software products and present a usability study of the open source Greenstone Digital Library collection-building software. Nichols, Thomson and Yeates experience with Greenstone suggests that open source development methods may need to adapt if they are to produce software for the desktop of the typical user. A community of developers will not necessarily pay sufficient attention to issues of usability that they themselves do not experience. Actually they work on different usability issues of Greenstone opens source ILS.

Denton and Coysh (2011) tested usability issues of open source software VuFind and their purpose was to present the findings of an academic library's implementation of a discovery layer (VuFind 1.0 RC1) as a next-generation catalogue, based on usability testing and an online survey. Usability tests were performed on ten students (eight undergraduates, two graduates), asking a set of 14 task-oriented questions about the customized VuFind interface. An online survey was also run for three weeks, to which 75 people responded. Both the usability testing and survey demonstrated that users preferred VuFind's interface over the classic catalogue.

Jacso (2003) stated that 'not even the most intuitive search software can make the information content useful if the search result are displayed in an intuitive format. Jacso have worked on usability issues of different types of searching software which are used in different libraries.

Mitchell and Gilbertson (2008), two librarians investigate the use of social software applications in digital library environments. It examines the use of blogging software as an interface to digital library content stored in a separate repository. The article begins with a definition of digital library approaches and features, examines ways in which open source and social software applications can serve to fill digital library roles, and presents a case study of the use of blogging software as a public interface to a project called Digital Forsyth, a grant-funded project involving three institutions in Forsyth County, NC. The article concludes with a review of positive and negative outcomes from this approach and makes recommendations for further research.

Ivory and Hearst (2001) explained that usability evaluation is an increasingly important part of the user interface design process. Usability evaluation can be expensive in terms of time and human resources, and automation is therefore a promising way to augment existing approaches. This article presents an extensive survey of usability evaluation methods, organized according to a new taxonomy that emphasizes the role of automation. The survey analyzes existing techniques, identifies which aspects of usability evaluation automation are likely to be of use in future research, and suggests new ways to expand existing approaches to better support usability evaluation.

Ahmed, McKnight and Oppenheim (2004) examined users' performance and satisfaction with an IR interface. They showed an empirical study of users' performance and satisfaction with the Web of Science interface. Experiments have been conducted on performance and satisfaction with a web-based information retrieval interface by both novice and experienced users. Ahmed (2005), in a later study, examined a user-centered design and evaluation methodology for ensuring

the usability of IR interfaces. This study suggested some principles of interface design for information retrieval systems.

Kaner and Fiedler (2005) explained that usability testing cannot replace good usability design, but it can reveal errors in implementation. Usability testing can consume a lot of time and a large budget, or it can be done on a shoestring. They also describe user response testing, or simply user testing involves putting the product in the hand of users and watching what happens. A tester in a well-equipped usability laboratory may assign specific tasks to the user and record the user's keystrokes and mouse clicks, videotape the user and the computer screen, or watch the user through one-way mirror-windows.

Islam and Ahmed (2010) conducted a research on user satisfaction with Dhaka University Library's online public access catalogue. They showed that students are overwhelmingly satisfied with the DUL OPAC. Although there are some differences in students' perceptions of and satisfaction with the university OPAC, the study commented that a formal task-based usability testing and adopting a user-centered design can ensure the usability of the OPAC in the future. The paper suggested some heuristic guidelines for designing interfaces for online catalogues.

Dumas and Reddish (1999) explains usability means that the people who use the product can do so quickly and easily to accomplish their own tasks. User-centered design incorporates usability principles into product design and places the focus on the user during project development.

Manzari and Trinidad (2013) described the life cycle of a library Web site created with a user-centered design process to serve a graduate school of library and information science (LIS).They say Usability testing is an empirical method for improving design and The interface should be designed for a specific community of users and set of tasks to be accomplished, with the goal of creating a consistent, usable product.

2.5 Koha interface

After the launching of Koha as an open source integrated library management software, many researchers have focused on different aspects of Koha. Several researchers concentrated on Koha and its functional activities, whereas some researcher compared Koha with other open source ILS.

Chang and Tsai (2009) work on Multi-language/multi-script functions of Koha. They explained that Koha is a mature integrated library system with good merits. Koha provides default MARC21 and UNIMARC templates. This implies that Koha is designed rather to be used for MARC21 or UNIMARC but not for multi-scripts like CMARC, Japanese MARC or Korean MARC which need special programming. For countries with lower information technology development, enormous library system technical work is quite complex and requires in institutions wishing to do this a certain level of computer expertise which is not found in many developing countries.

Yang and Hofmann (2012) compared online public access catalogues of Koha, Evergreen, and Voyager. This study aimed at answering the question of how much development has occurred in open source toward the next-generation catalogue compared to commercial systems by comparing the next-generation features of the OPACs of two open source ILSs (Koha and Evergreen) and one proprietary ILS (Voyager's WebVoyage).

Anuradha, Sivakaminathan and Kumar (2011) presented that there are many library automation packages available as open source software, comprising two modules: staff-client module and online public access catalogue (OPAC). Most of the available open source digital library software facilitates indexing and searching of full-text documents in different formats. This paper makes an effort to enable full-text search features in the widely used open source library automation package Koha, by integrating it with two open source digital library software packages, Greenstone Digital Library Software (GSDL) and Fedora Generic Search Service (FGSS), independently. The implementation is done by making use of the Search and

Retrieval by URL (SRU) feature available in Koha, GSDL and FGSS. Anuradha, Sivakaminathan and Kumar found out that full-text searching capability in Koha is achieved by integrating either GSDL or FGSS into Koha and by passing an SRU request to GSDL or FGSS from Koha. The full-text documents are indexed both in the library automation package (Koha) and digital library software (GSDL, FGSS).

Neelakandan *et al.* (2010) has shared their experience by a study on implementation of Automated Library Management System in the School of Chemistry Bharathidasan University using Koha Open open source software. Neelakandan *et al.* showed that how to implement automated system using Koha and. presented Koha administration, adding bibliography to Koha, adding new patron, circulation module, accounts and report module, OPAC module and lastly proved that Koha Software is more suitable for the library automation.

Pandey and Singh (2011) presented a case study with Koha. The study explored the idea of using Koha as digital library software. They explained that Koha is an integrated library automation software, which includes almost all modules which is requires for a library but it does not have the digital library functionality.

Espiau-Bechetoille *et al.* (2011) presented an example of inter-university cooperation for implementing Koha in libraries. The paper provided information for acquiring knowledge and expertise in an Open-ILS, and to minimize costs by cooperating and examined that implementing Koha on several university networks will increase the demand for information from other universities. They suggest a new way to acquire an open-ILS that meets collective expectations while responding well to institutional needs and describe library work and cooperation with the Koha open source ILS.

Jones and Cynthia (2011) compared the circulation module of Koha and Evergreen. In this comparative study, they took patron maintenance, check in/out, renewing items, bills-fines-payment, holds, changing status of items, changing load period of Koha and Evergreen software. This study showed that Koha's interface is friendlier

and more streamlined than that of Evergreen. Its modules integrate well with each other, as seen with automatic fine refunds and holds capture. It is generally more intuitive for users, even considering its sub-standard documentation for the 3.0 version since the 3.2 documentation can provide some support for users of earlier versions. The OPAC also has the added features of allowing patron tagging, comments, and reviews.

Walls (2012) explained the migration from a previous integrated library system Millennium to the open source ILS Koha based on New York University's Health Sciences Libraries. The study identified several areas of development for Koha, including electronic resource management, course reserves, and cataloguing client enhancements and proved that a migration from Millennium to Koha can be done very quickly, if the library is properly motivated.

Keast (2009) conducted a survey of Koha in Australian special libraries. The main reasons given for conversion to Koha were practical economic grounds, coupled with dissatisfaction with conventional library systems. Libraries found the conversion to Koha reasonably trouble-free. Satisfaction ratings on most aspects of Koha performance were "above average" to "good". Library expectations of value for money and overall cost savings appear to have been realised. Keast reported that Koha has proved well suited to small health libraries and commended Koha as an open source system worthy of consideration by librarians seeking a low cost web-based alternative to conventional library systems.

2.6 Conclusion

At the beginning of integrated library system, proprietary systems were the only field of research area. At that time, researchers made comparison with one proprietary system to another and the research topics were mostly limited to comparative service advantages of these systems. When open source systems entered in the library management arena, they opened up new thoughts and ideas not only in the service areas of library management but also in other research areas. Since the introduction of open source integrated library systems, different researchers worked on different aspects of the functionalities, usability issues, and drawbacks of these systems. The contribution of those researches enhanced the research area of library management system. This Chapter discussed the literature contributed by different scholars and researchers on open source integrated library systems (OSLIS), their usability issues and the Koha interface. However, there have been only a few in-depth studies conducted on Koha interface, and this research aims to fill in this gap by investigating the usability of the interface using real users and search tasks. The next Chapter will discuss the overview of the Koha interface.

Chapter 3:

An Overview of Koha Interface

3.1 Introduction

Koha is the first open source full-featured integrated library system (ILS) used by a considerable number of libraries both in developed and developing countries. It includes catalogue, OPAC, circulation, member management, and acquisitions modules. Koha is used by public libraries, private collectors, not-profit organizations, churches, schools, and corporate.

In 1999, the Horowhenua Library Trust (HLT) in New Zealand was looking for a Year 2000 (Y2K) compliant replacement for their library system. Katipo Communications proposed a new system using open source tools to be released under the General Public License (GPL). Koha (the Maori word for "gift" or "donation") went live at HLT in January 2000, and it has version for academic library, public library and special Library (small, mid-sized and large libraries). Koha has received awards in 2004 (joint winner of the Computerworld Excellence Award for the Use of IT in a Not-for-Profit Organization in Auckland NZ), 2003 (winner of the Trophees du Libre, Software for Public Administration category in Soissons, France, 2000 (3M Award for Innovation in Libraries), 2000 (TUANZ Interactive Award, Community/Not for Profit category). It is under GNU License and can be accessed its website address www.Koha.org (Koha, 2011a).

3.2 Koha interface - facilities and features

Koha is web-based ILS, with a SQL database (like MySql) backend with cataloguing data stored in MARC and accessible via Z39.50. The user interface is configurable and adaptable and has been translated into many languages. Koha has most of the features that would be expected in an ILS, including:

- Simple, clear interface for librarians and members (patrons);
- Various Web 2.0 facilities like tagging and RSS feeds;
- Union catalogue facility;
- Customizable search;
- Circulation and borrower management;
- Full acquisitions system including budgets and pricing information (including supplier and currency conversion);
- Simple acquisitions system for the smaller library;
- Ability to cope with any number of branches, patrons, patron categories, item categories, items, currencies and other data;
- Serials system for magazines or newspapers; and
- Reading lists for members.

Koha's interface is friendlier and more streamlined. Koha has two interfaces, one is patron and another is for library staff. It is generally more intuitive for users. As the staff client is web-based, there is also less maintenance needed.

Koha provides a full-functioned Online Public Access Catalogue (OPAC). OPAC users can carry out searches starting from ten fields (Keyword, Subject, Title, Class, Barcode, author, publisher, etc.). This interface also provides the facility to further access the resources alphabetically. As in the librarian interface, they can order the results according to several criteria. OPAC users who are logged-in members can place reservations on library items. Logged-in members can select records from an OPAC search and retrieve them by e-mail, either in human-readable form or in an ISO 2709-format file. An ISO 2709 file can be processed using bibliographic software like EndNote. OPAC users can submit suggestions for acquisition. Koha automatically informs the OPAC user (by e-mail) of the action taken on each suggestion.

Koha OPAC has both basic search and advanced search options. The OPAC provides advanced and innovative features including RSS feeds. Additionally, it allows users to add tags, comments, descriptions, and reviews. In Koha's OPAC, user-added tags

form tag clouds, and the font and size of each keyword or tag indicate that keyword or tag's frequency of use. All the tags in a tag cloud serve as hyperlinks to library materials. Users can write their own reviews to complement the Amazon reviews. All user-added reviews, descriptions, and comments have to be approved by a librarian before they are finalized for display in the OPAC.

3.3 Basic search

To search the catalogue from any computer with internet access at the library's website library.bracu.ac.bd, users will see an option to search the catalogue.

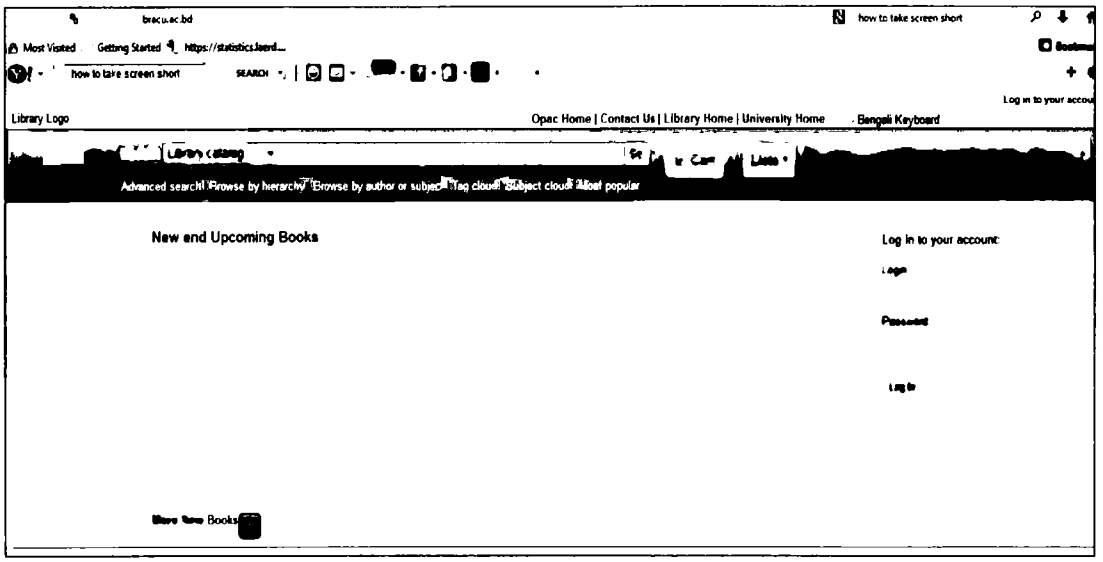


Figure 3.1: Basic Search

To start a search, user needs to enter a word or multiple words in the search box. When a single word is entered, a keyword search is performed. Users can check this out by typing one word into the form and note the number of results located. Then, repeat the search with a minor change. In front of the search word, type 'kw=' followed by the same search term. The results will be identical.

When users have more than one word in the search box, Koha will still do a keyword search, but a bit differently. Each word will be searched separately, and then the Boolean connector 'AND' will narrow the search to those items with all words contained in matching records.

3.4 Basic search - enhanced

Users can also search for a specific title, or only looking for items by a specific author from the main search bar. They can select the specific field from the main search window's drop down menu. Common fields that users would search are 'Title' and 'Author'.

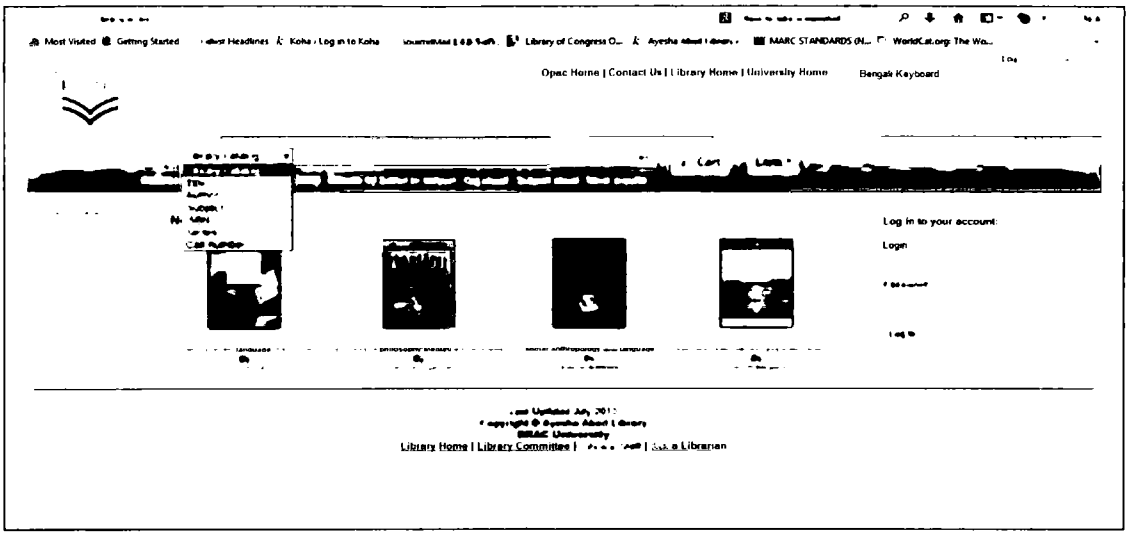


Figure 3.2: Koha Basic search –enhanced

3.5 Advanced search

When users can't find the most appropriate material with a general search, they can move to the Advanced Search page by clicking on the 'Advanced Search' link.

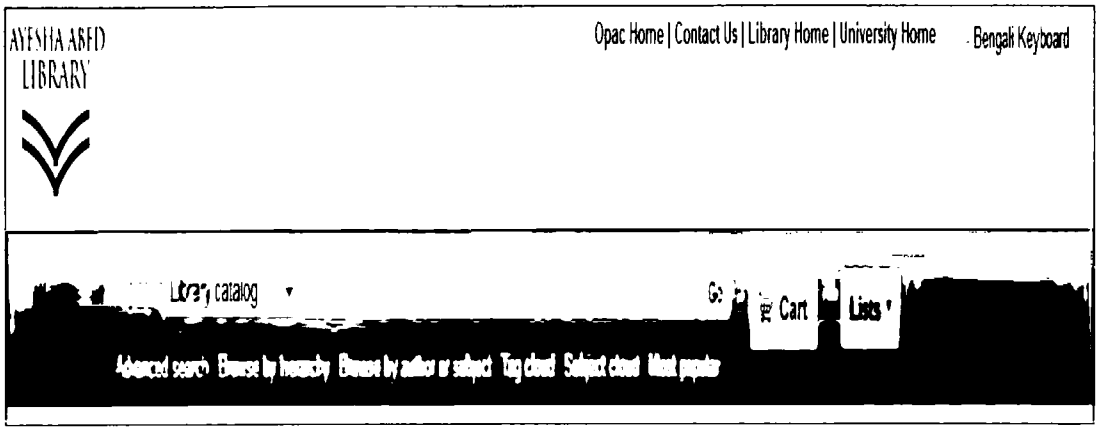


Figure 3.3: Koha Search Bar

3.5.1 Advanced search options

The Advanced Search page offers many ways to limit the results of the search. Patrons can limit them by using the drop down menus and a combination of the Boolean operators AND, OR, and NOT. In this section, they can choose among the many indexes by clicking on the arrow in the first box.

On the second line, they can choose the Boolean operator. The options are 'AND', 'OR', and 'NOT'. Then, users would again choose the index to search, followed by the second term or terms.

If users have more concepts which they want to include in their search, they can click the [+] to add another line for their search.

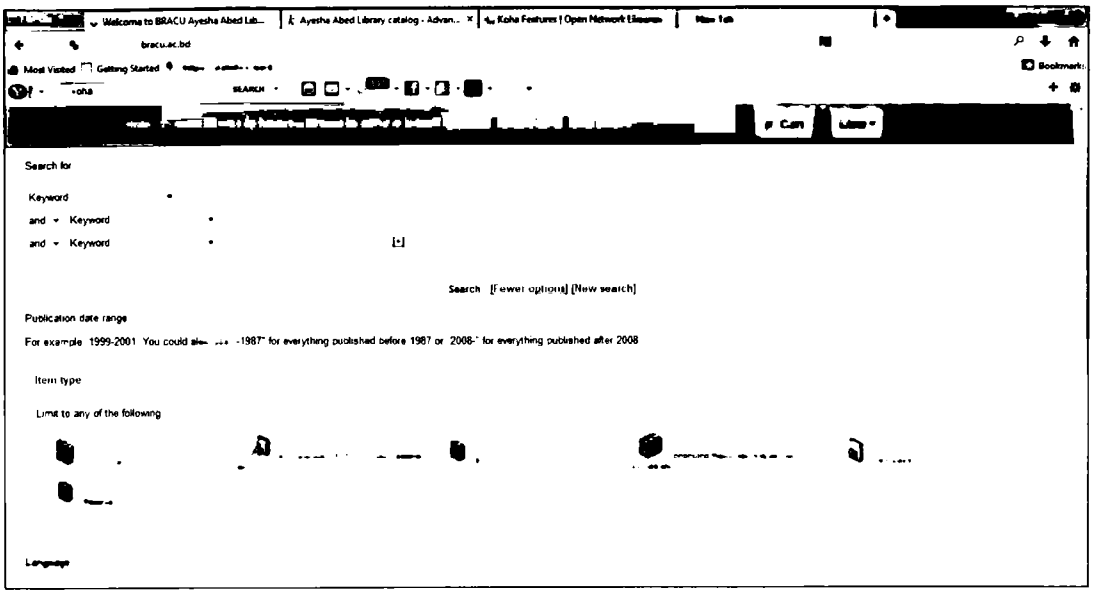


Figure 3.4: Advanced Search Option

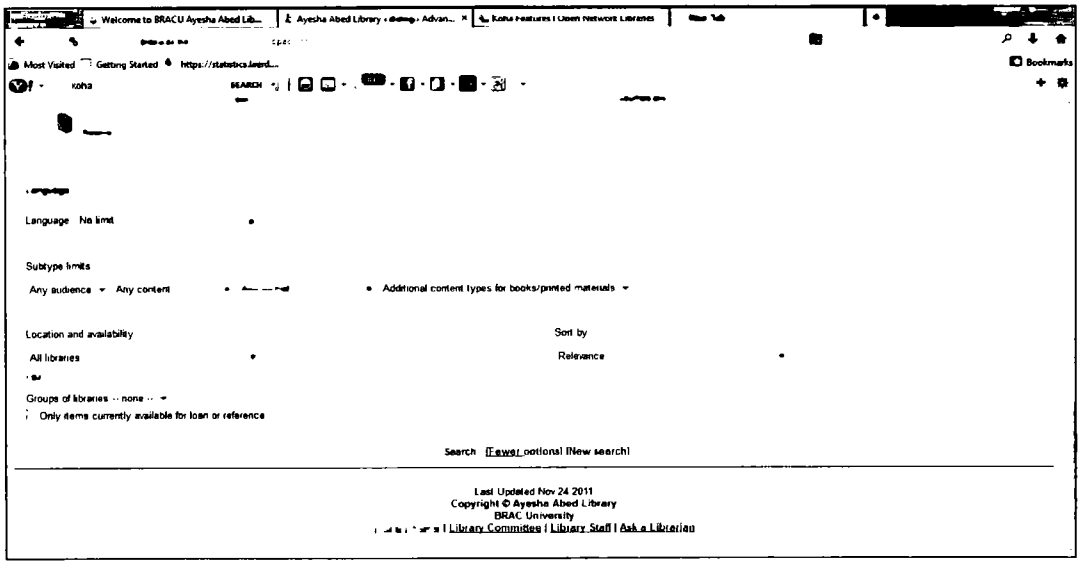


Figure 3.5: Advanced Search Option

The Advanced Search page also shows the multiple kinds of limits that can be applied to users search results. Either check a box or select from the drop down menus to narrow the search result. For date ranges, users can will type the year, a range, or a 'greater than (>)' or 'less than (<)' year.

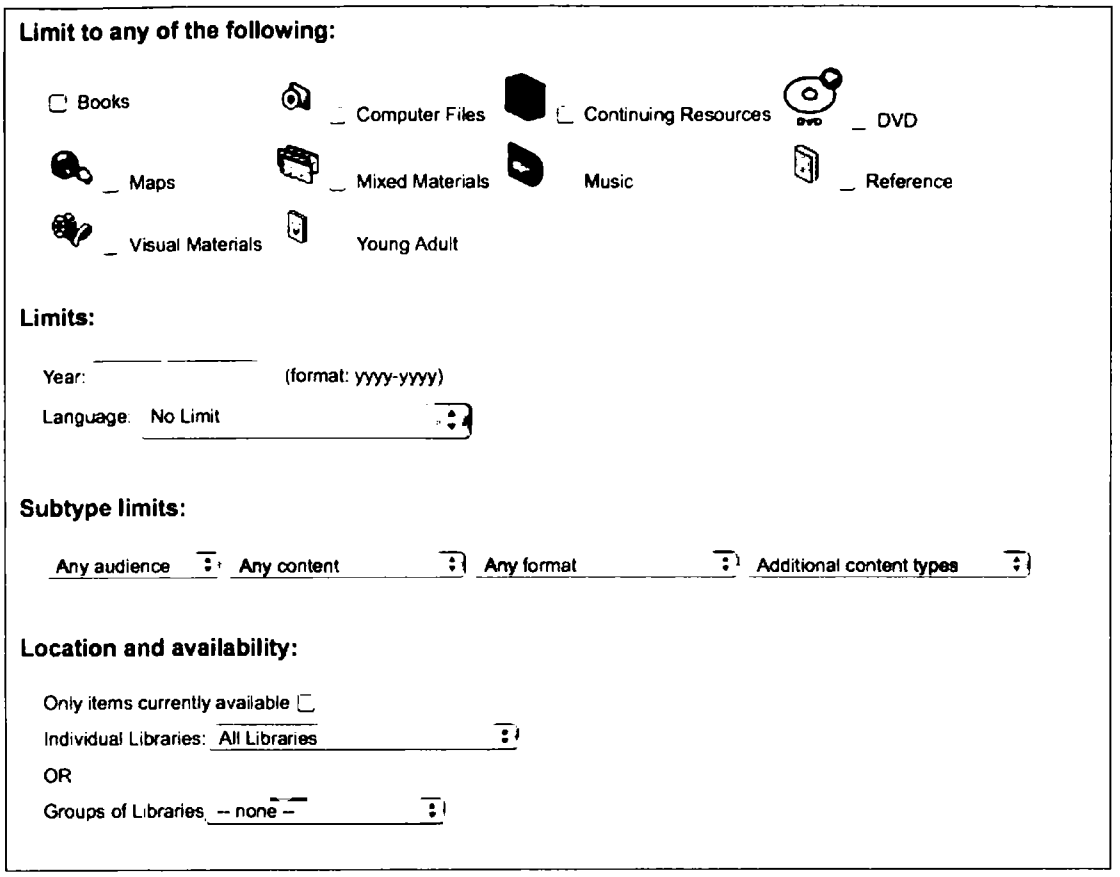


Figure 3.6: Advanced Search Option

3.6 Results overview

The number of results found after searching will appear above the results

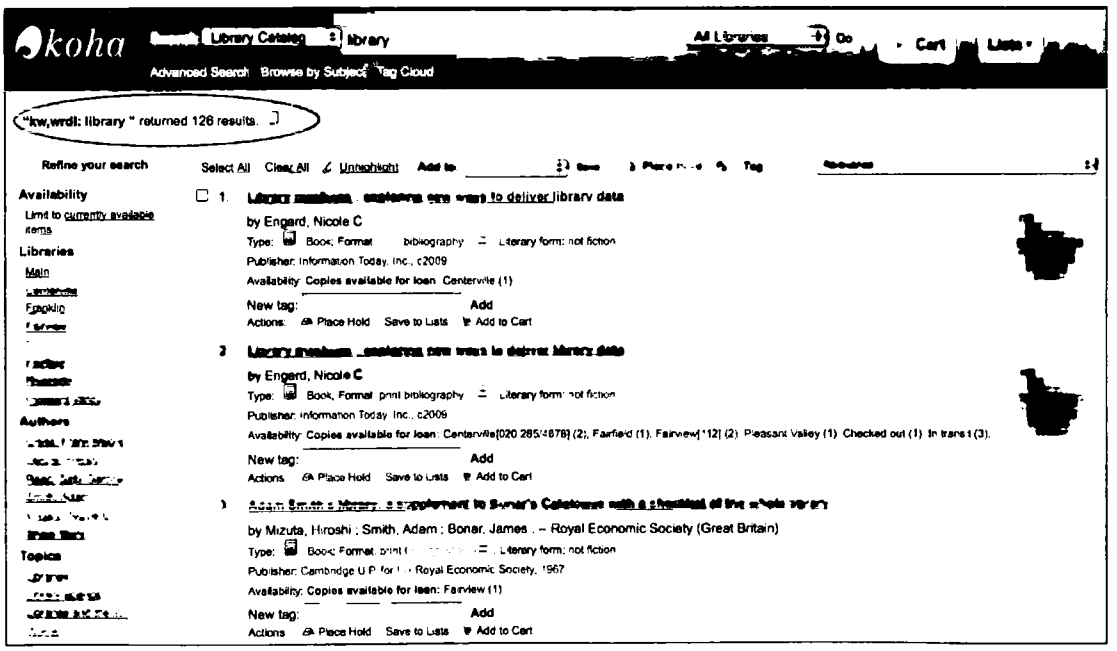


Figure 3.7: Results Overview

3.7 Sorting results

The results are sorted by relevance (as determined by the Koha software), although users can choose to sort by author, title, call number, dates, or by popularity.

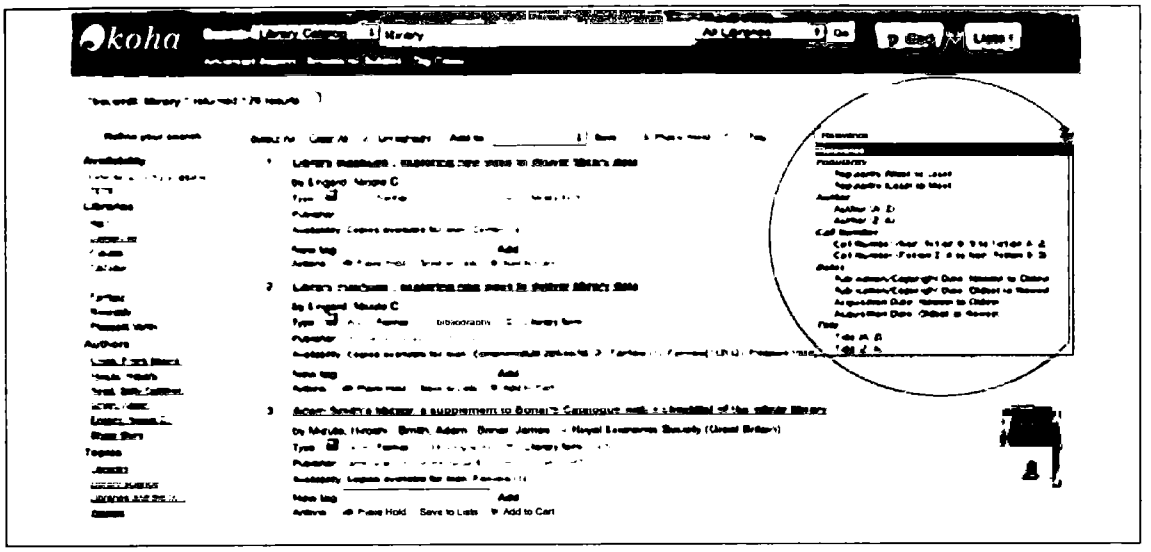


Figure 3.8: Sorting Results

3.8 Filters

To filter the search click on the links below the 'Refine Your Search' menu on the left of the screen

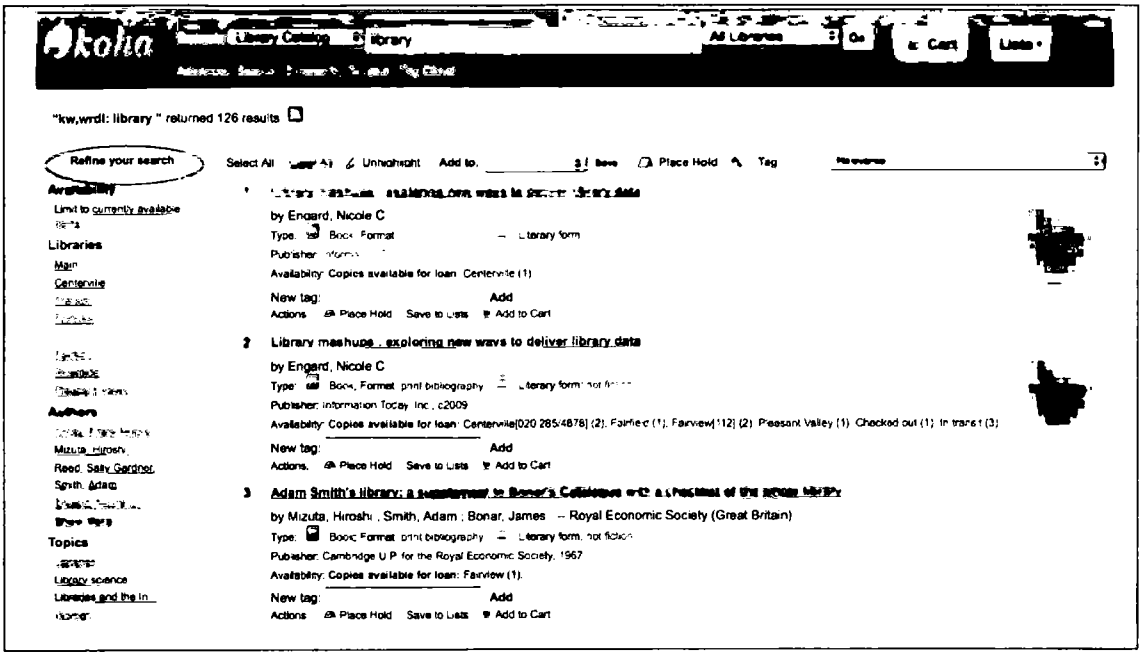


Figure 3.9: Filters

3.9 Item type information

Information about what type the item is (a book, an audio file, a video, etc.) will also be displayed.

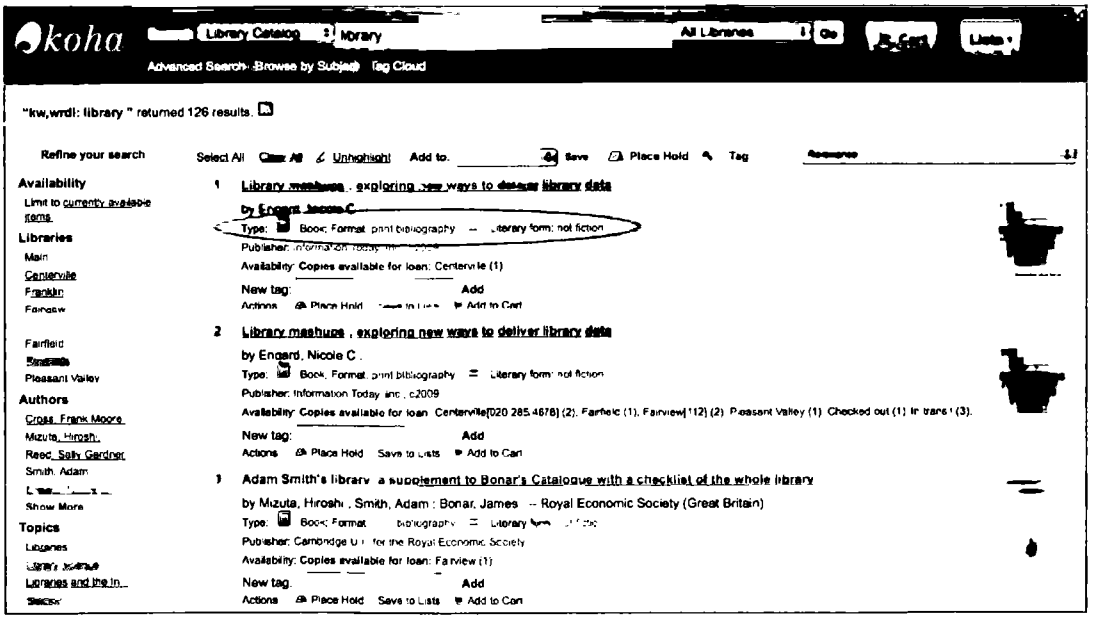


Figure 3.10: Item Type Information

3.10 Items availability

Users can check the availability for the items attached to the record. It should be noted here that that even if they filtered by location, all locations that contain the item will appear on the search results.

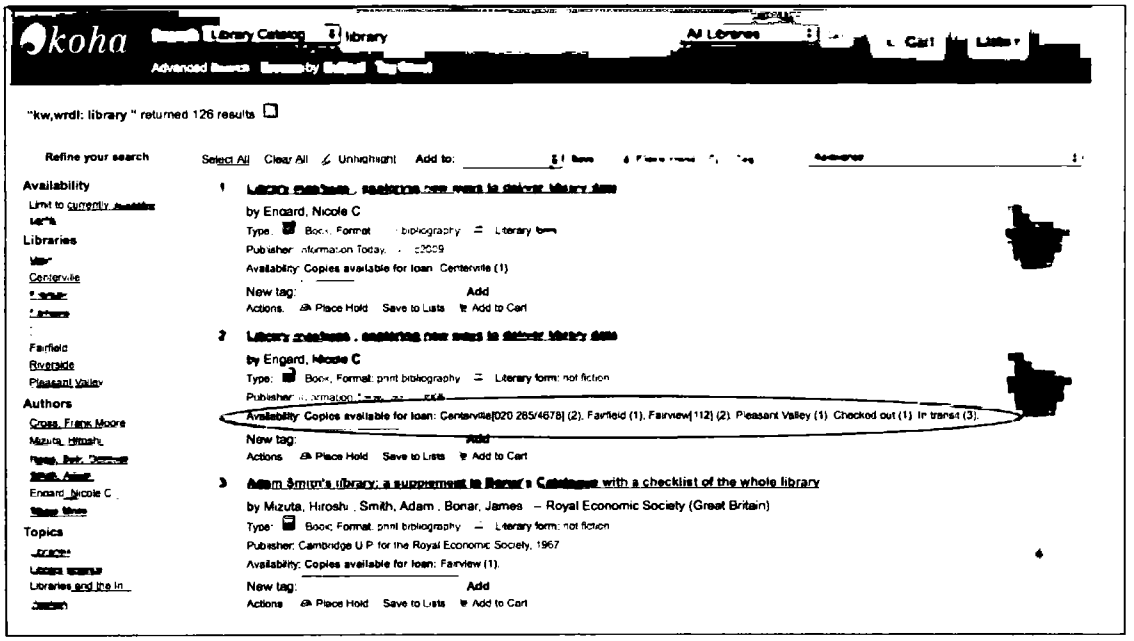


Figure 3.11: Items Availability

When users click on a title from the search results, they will see the bibliographic detail of the record.

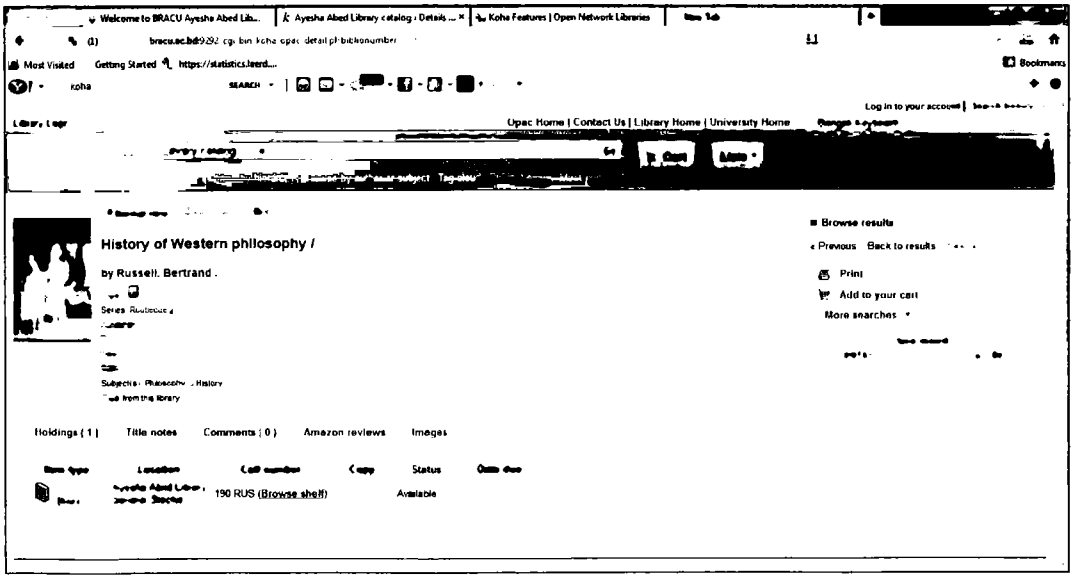


Figure 3.12: Search Result Page

After getting the exact search result user can collect call number, can see the book image all the necessary information which is needed can get from here. If anyone wants to know what types of books are available on this specific shelf, it is also possible because Koha provides virtual shelf for its users. So just click on browse shelf and users can check others book which are available on this specific shelf.

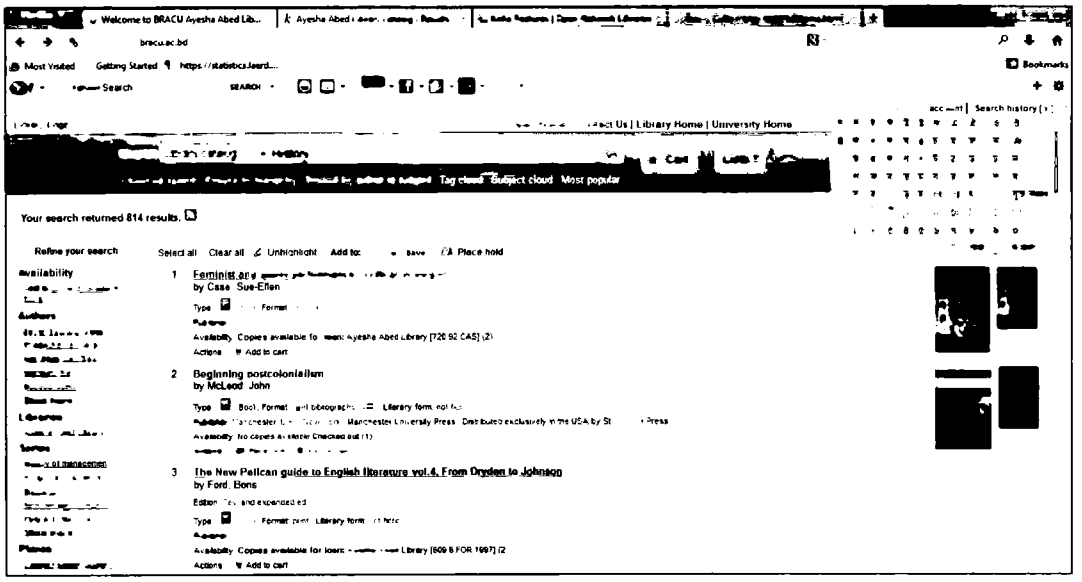


Figure 3.13: Virtual keyboard on Koha Interface

In Koha interface there are possible to create virtual keyboard which would help a user to search different language resource. KOHA supports Unicode, for that reason users can get multilingual searching.

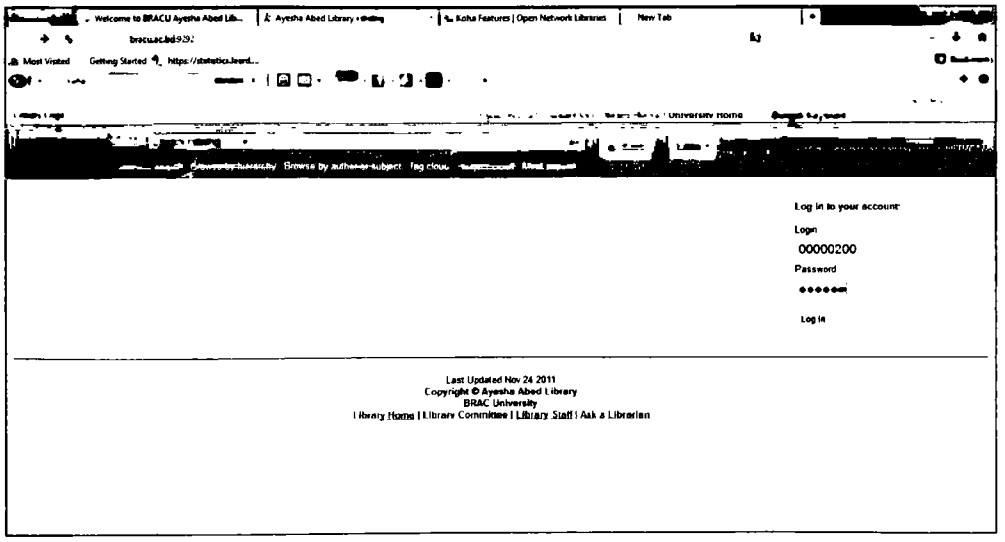


Figure 3.14: User Log in

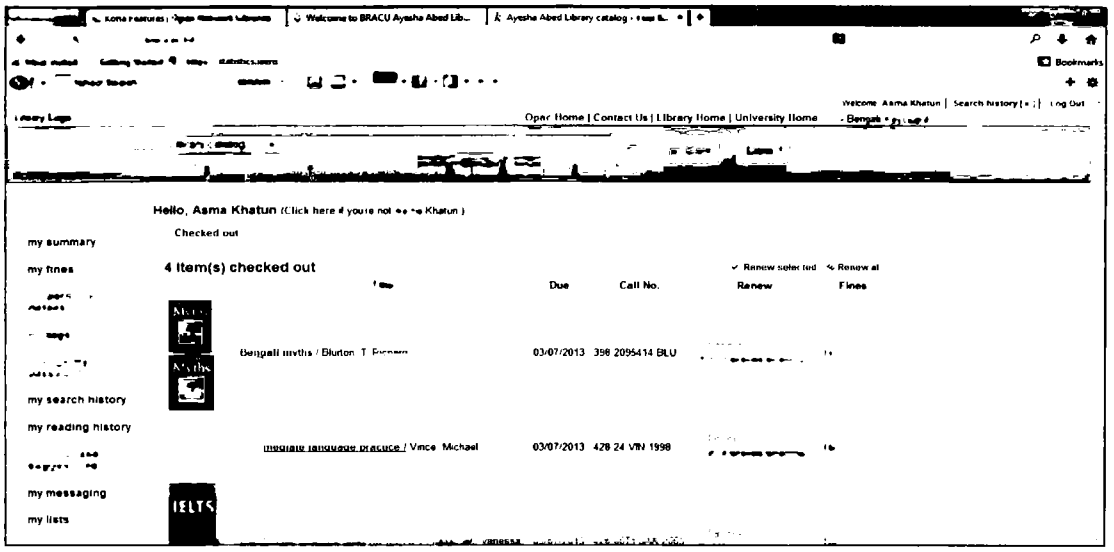


Figure 3.15: User Account Page

From Koha interface user can log in to their account. With the help of their account users can see how many books he borrowed from his library account, can renew their book, can give purchase suggestion, can see their fine amount, previous search history and also can hold book at his home.

Users can access their search history via the 'my search history' tab. The 'my reading history' tab will show their entire reading history. Koha provides two ways to keep track of the searches and wish list for resources: carts and lists.

3.11 Cart & List

A cart is a temporary holding place for records patrons or users interested in finding during this session. That means that once users log out or close the browser, they lose the items in the cart.

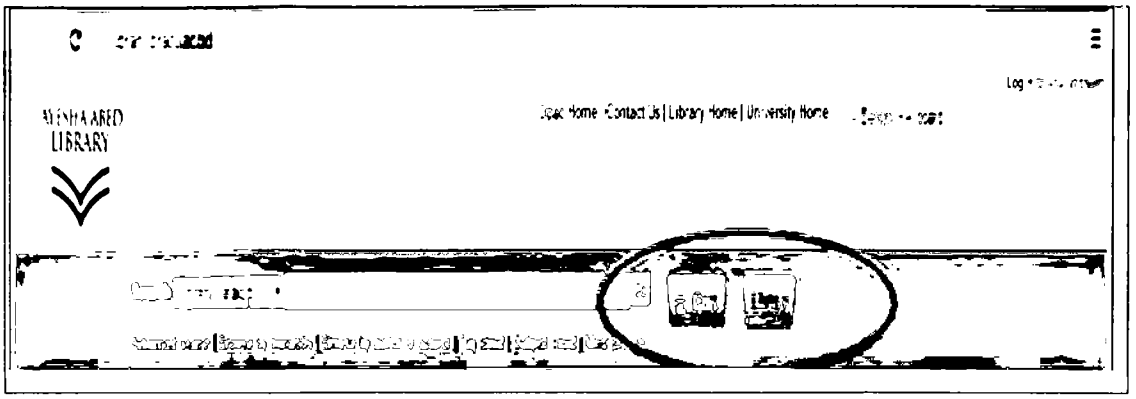


Figure 3.16: Cart & List

To do a list in cart, users have to search their desired document, and then there is the option to add to cart.

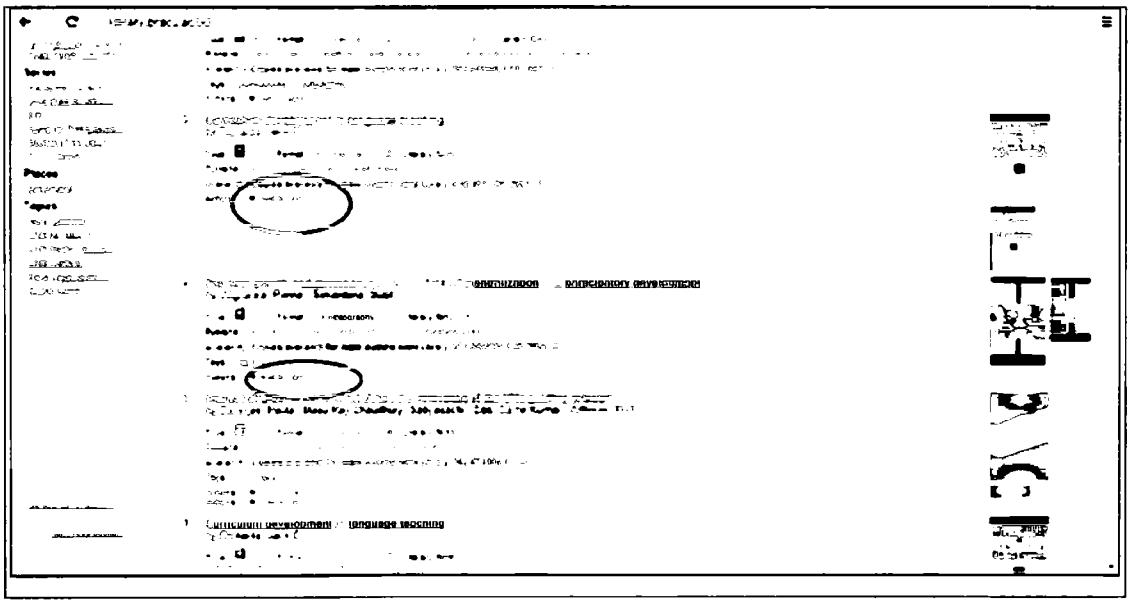


Figure 3.17: Add to Cart

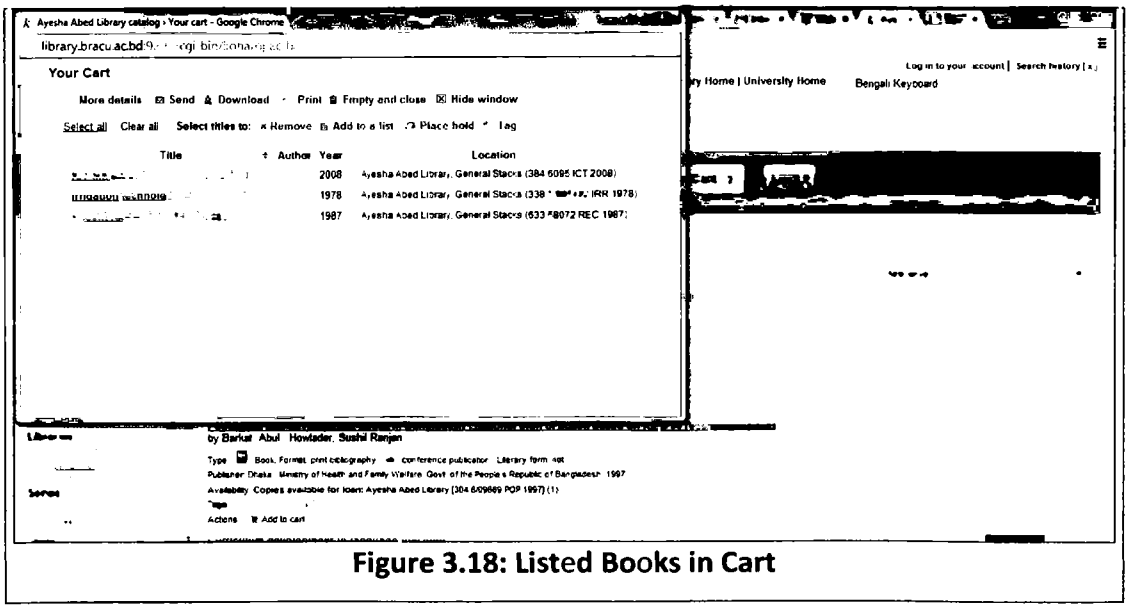


Figure 3.18: Listed Books in Cart

However, if any user wants a more permanent location for saving items use the List features. He can manage their own private lists by visiting the 'my lists' section of his account.

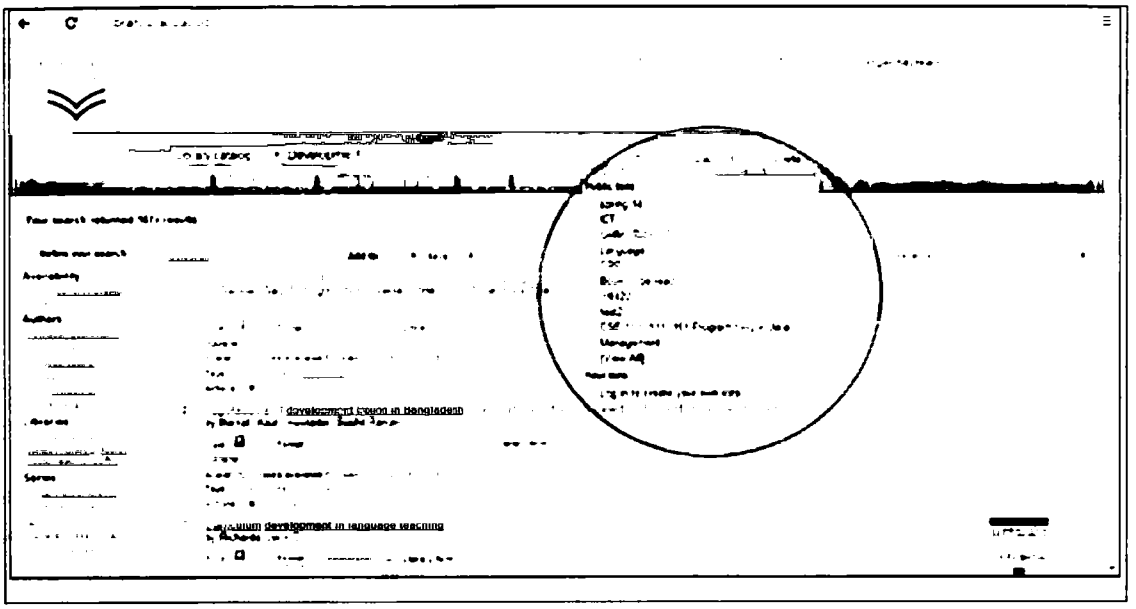


Figure 3.19: Books in List

3.13 Hold

Koha allows patrons to put things on hold. A 'Hold' is a way to reserve an item. Depending on the circulation and fine rules and hold preference settings patrons will be able to place items on hold for pickup at the library at a later date/time.

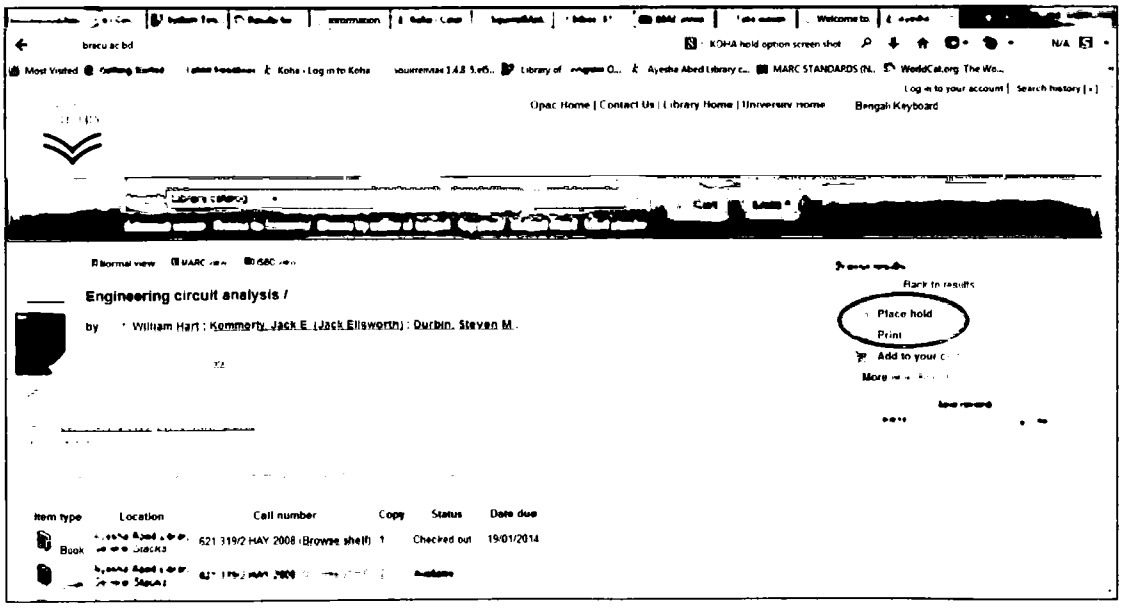


Figure 3.20: Hold

There are several ways to place holds from the staff client. The most obvious is using the 'Place Hold' button at the right corner any bibliographic record.

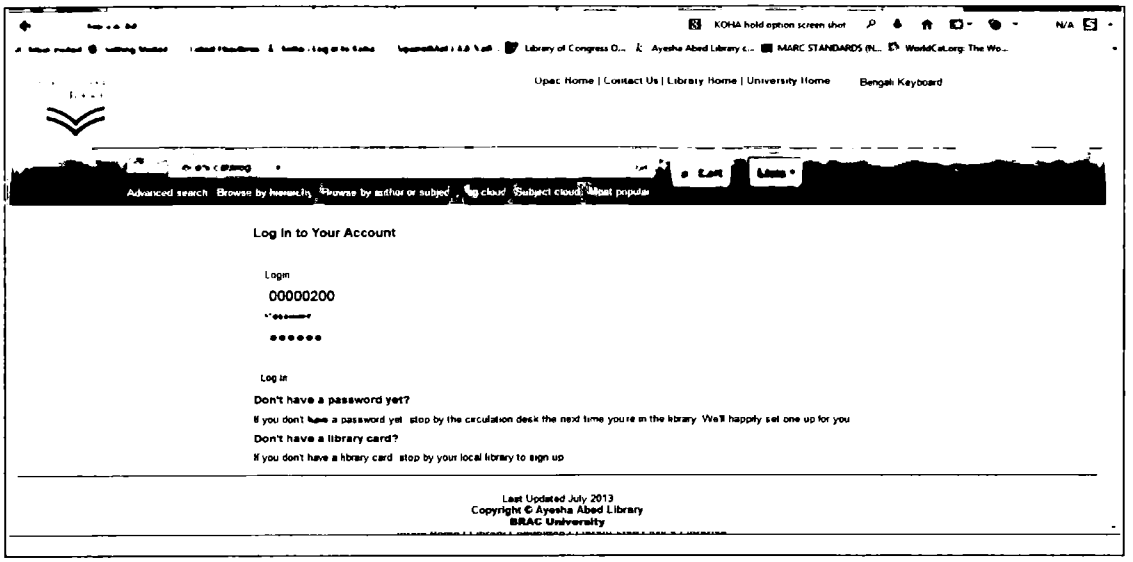


Figure 3.21: User ID & Password for Holding a Book

If a user wants to hold any book of the library, in that case he/she have to log in first then there is the option to click on the place hold option.

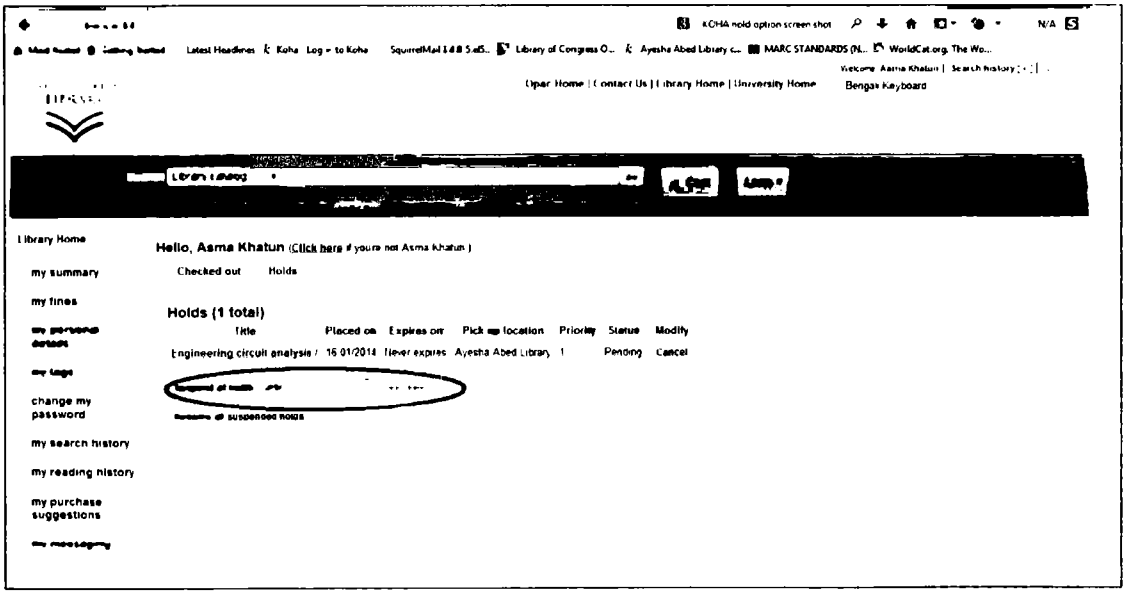


Figure 3.22: Holding Status

If the patron wants the hold to start on a date other than today, enter that in the 'Hold starts on date' field. If the patron has specified that they don't want the item after a certain date, or if patron has limits on hold lengths, he can enter an expiration date for the hold in the 'Hold expires on date.'

3.14 Purchase suggestion

Patrons have the option to make purchase suggestions in several areas in the Koha interface.

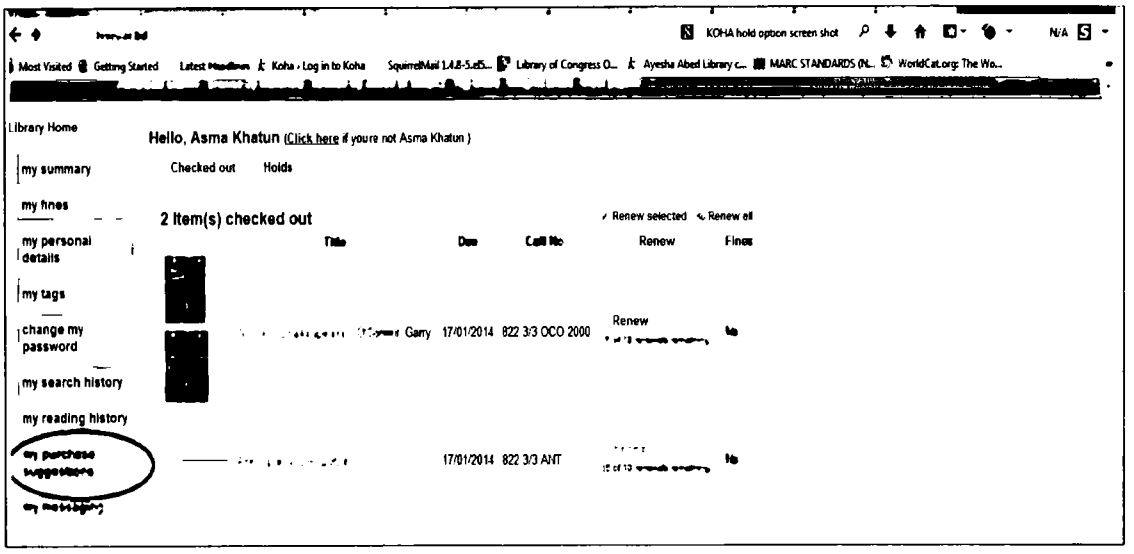


Figure 3.23: Purchase Suggestion

When a patron is logged into their account in the Online Public Access Catalogue, they can place a Purchase Suggestions from the "My purchase suggestions".

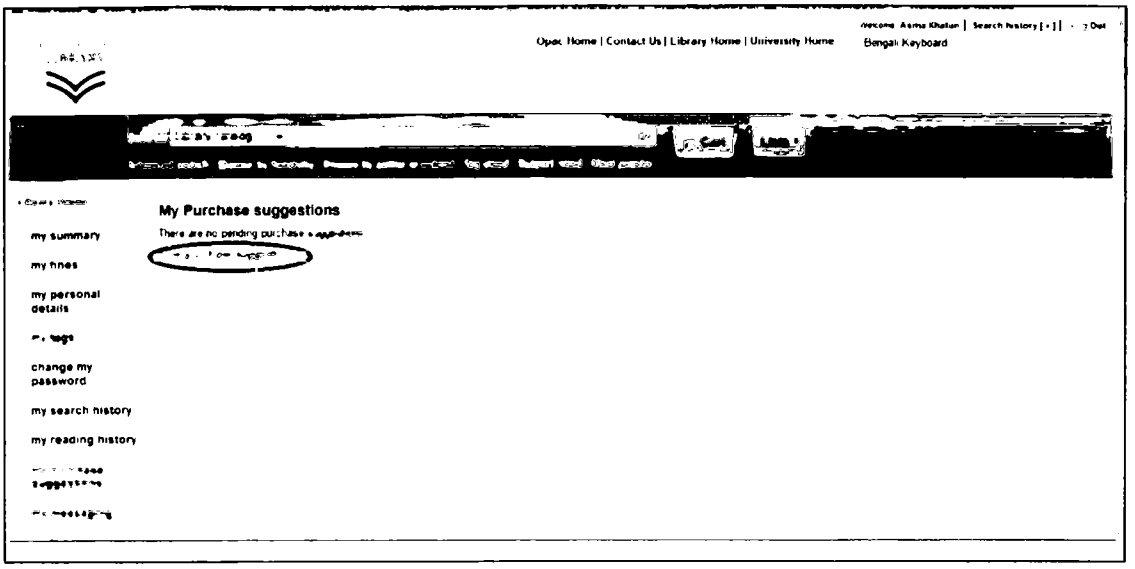


Figure 3.24: Purchase Suggestion

Users have to click on new purchase suggestion to give a specific book purchase suggestion.

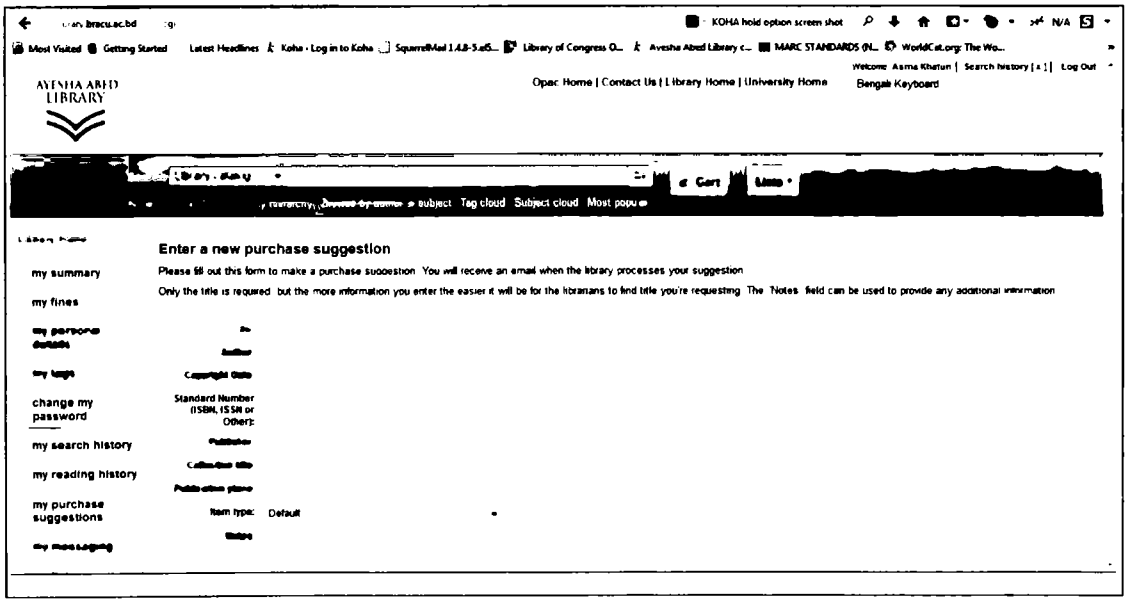


Figure 3.25: Purchase Suggestion

After that there is the option to fill up a form regarding the specific book which the user wants to purchase through the library. Only title option is mandatory for a user, because most of the users generally know the book's title and sometimes author name only.

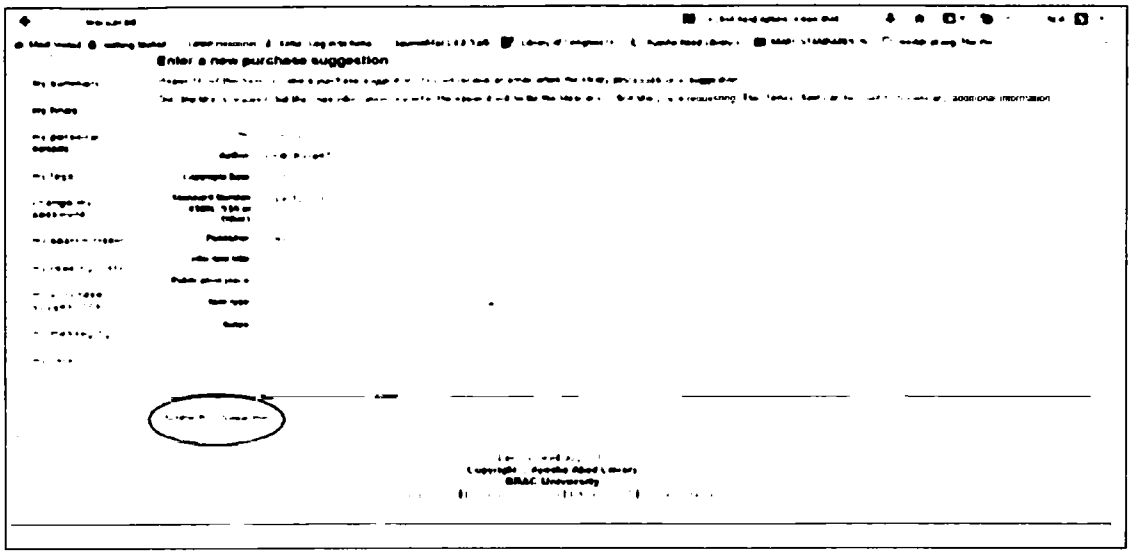


Figure 3.26: Purchase Suggestion

Then users have to send purchase suggestion option clicking on 'submit your suggestion'.

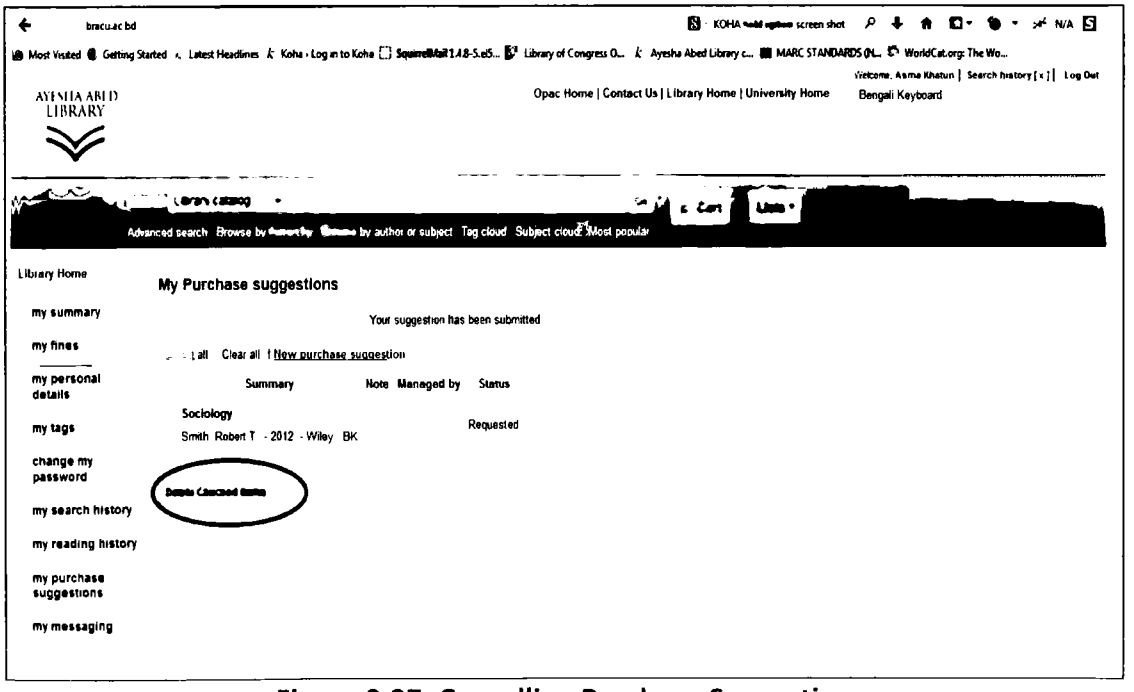


Figure 3.27: Cancelling Purchase Suggestion

After submitting purchase suggestion, users can see the update and if user wants to cancel his purchase suggestion, he can do it by clicking on 'Delete Checked Items.'

3.15 Conclusion

Koha interface provides both basic and advanced search options. In this Chapter, Koha OPAC features were discussed. The next Chapter will discuss the methodology used in this research.

Dhaka University Institutional Repository

Chapter 4:

Research Methodology

4.1 Introduction

Usability testing is an empirical method for improving design. Test tasks are gathered from representative users who will use the interface and are asked to perform real tasks using the system while their performance and reactions to the system are observed and recorded. This observation allows seeing when and where users become frustrated or confused. The goal is to uncover usability problems with the product, not to test the participants themselves. The data gathered during the usability tests are analyzed to recommend changes to fix usability problems. In addition to recording empirical data such as number of errors made or time taken to complete tasks, active intervention allows the interviewer to question participants about reasons for their actions as well as about their opinions regarding interface. In 'think-aloud' method, the participants are asked to verbalize their thought processes as they complete the tasks using the interface. The test participants are usually interviewed individually and are all given the same pre-test briefing from a script with a list of instructions followed by tasks representing actual use. The participants are also asked questions about their likes and dislikes. In most situations, payment or other incentives are offered to help recruit volunteers (Manzari and Trinidad, 2013).

This research performed a series of usability tests on Koha interface and presented a competitive analysis of the usability of Koha interface. The tests were designed to determine users' performance and satisfaction with the Koha interface. A number of search tasks were used in the usability experiments. In this Chapter, the usability testing procedure of Koha interface is described. The five most common attributes of usability experiments are:

- Time to learn;
- Speed of performance;
- Rate of errors by users;
- Retention over time; and
- Subjective Satisfaction.

In this research, three separate but similar usability tests were carried out. The first test was designed to find out users' performance and satisfaction with the Koha interface. Both experienced and novice users took part in this test. The experienced group had previous knowledge on Koha whereas novices had no prior experience of Koha or any other similar library management systems. The second test measured novices' learning and retention with the interface. The third test was designed to compare novice users' initial performance, learning and retention with the Koha interface and Novices' learning and experienced learning comparison was also made in third test. For the usability tests, times taken to complete each task, the number of errors made, number of search terms used and the success score were recorded through screen recording software. At the end of each session, all test participants were asked to complete a questionnaire to give their opinion on satisfaction with the Koha interface.

4.2 Experiments with Koha interface I: performance and satisfaction

4.2.1 Participants

Two distinct groups of users took part in this experiment. These two users groups were: novice and experienced. Each groups had twelve participants. The novice group (12 participants) had no prior experience of Koha or similar interfaces, and had never attended training on such systems. The experienced group (12 participants), on the other hand, were experienced in Koha. The participants were recruited from various departments at BRAC University

4.2.2 Experimental procedures

An announcement to different departments of BRAC University was sent asking for volunteers for the usability tests. All interested students were contacted through emails and over phone. The tests took place in computer lab of Ayesha Abed Library at BRAC University. The participants came one at a time for the usability test. At the start of each search session, each participant was given a brief description of the experimental procedures of the session that would be followed. Since novice users had not performed any searches before the usability experiment, they were given 10 minutes for free exploration of the Koha interface. The objective was to familiarize them with the interface so that they felt comfortable in performing the actual tasks. For experienced users, this preliminary exploration was not needed since they were already familiar with the search process.

All participants were then given the search tasks (see below) and told to try to work on their own. They were also told that if any task took more than 10 minutes to complete, they would be stopped and asked to proceed to the next task. If the participants felt that they would be unable to complete a task and wanted to move on, this would be allowed. After completion of all search tasks, participants were asked to complete a questionnaire on their satisfaction with the Koha interface.

4.2.3 Search Tasks

The first five out of the following seven search tasks were collected from a survey among the students of different departments and the remaining two tasks were selected based on the functionalities provided by Koha interface.

1. Find a book by Philip Kotler on Marketing Management;
2. Find out a book by the title of Introduction to business and collect its call number;
3. How would you find resources on Molecular Biology or Molecular Biotechnology;
4. Using advanced search option, find at least one book on climate change written by Ainun Nishat;
5. Find out how many books does the library have by the author Richard T. Schaefer;
6. Give a book purchase suggestion via library account; and
7. Hold a book from your library account.

4.2.4 Data collection

The usability testing used a combination of data collection methods. These were: computer screen recordings and a questionnaire.

4.2.4.1 Computer screen recordings

CamStudio is a simple, straightforward program to record screen activity. It records screen activity and sound into standard AVI video files for Windows. The original CamStudio was released as an open source product by RenderSoft software in October 2001.

In this research, CamStudio version 2.7 was used to record the screen activities during the usability experiments. It recorded how each participant was using the Koha interface. After capturing a search session, the recordings were analyzed.

4.2.4.2 Questionnaire for user interface satisfaction (QUIS)

After completing all seven search tasks, participants were asked to complete a questionnaire about the interface. The questionnaire was designed taking items from the Questionnaire for User Interface Satisfaction (QUIS) (Chin *et al.*, 1988). It measured satisfaction attributes on a 7-point scale. The questions included screen

design, terminology and system feedback, learning, system capabilities, navigation and overall reaction to the system.

The Questionnaire for User Interaction Satisfaction (QUIS) is a tool developed by a multi-disciplinary team of researchers in the Human-Computer Interaction Lab (HCIL) at the University of Maryland at College Park. The QUIS was designed to assess users' subjective satisfaction with specific aspects of the human-computer interface. The QUIS team successfully addressed the reliability and validity problems found in other satisfaction measures, creating a measure that is highly reliable across many types of interfaces.

4.2.5 Variables studied

The following variables were tested in the total three experiments on performance and satisfaction with the Koha:

4.2.5.1 The dependent variables

The two groups of dependent variables studied were the performance variables, and users' subjective satisfaction with the Koha interface.

4.2.5.2 Performance variables

Four performance measures were calculated for each task:

1. **Task completion time:** The total time taken to complete each task. These times were extracted from computer screen recordings;
2. **Search terms used:** The number of different search terms used for each task was calculated from computer screen recordings;
3. **Success score:** Successful completion of each search task, as well as requested termination, and termination as a result of the twenty-minute time limit was counted from screen recordings; and
4. **Error rates:** Number of errors made was tabulated from computer screen recordings.

4.2.6 Subjective satisfaction

The Questionnaire on User Interface Satisfaction (QUIS) was used to determine users' subjective satisfaction with the Koha interface. Responses to the open-ended items in the questionnaire were analyzed to find out both positive and negative aspects about the interface.

4.2.7 Data analysis techniques

The quantitative data were collected through questionnaire were analyzed using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel. Frequency counts were performed on data to obtain the descriptive measures.

4.2.7.1 The independent sample t-test

An independent samples *t*-test is used for comparing the means on an interval/ratio variable between two categories on a nominal/ordinal variable. It answers the question of whether the difference between means is statistically significant in the population of interest (assuming good sampling) or whether the difference is due to sampling error. To do this test, there are two variables, one population and sample. The independent variable is nominal/ordinal and the dependent is interval/ratio.

An independent samples *t*-test compares two groups of scores from two groups of individuals to assess whether the average score of one group is significantly higher than that of the other group. The basic theoretical assumption underlying the use of the *t*-test involves the characteristics of the null hypothesis about the equality of the two group means. If the test shows significance, the null hypothesis is rejected to conclude that there is a difference between the two group means.

For analyzing data using an independent *t*-test, the scores from two groups should be roughly similar in terms of the shapes of their distributions. It is important, therefore, to verify the data for anomalies before conducting the *t*-test. One way to check the normality is to plot the data with a histogram or a normal probability plot to visually inspect whether the distribution is approximately normal. In this study

independent sample t-tests were run between novice and experienced users, to see the difference between their search performance.

4.2.7.2 Mann-Whitney U test

The Mann-Whitney *U* test evaluates whether the medians on a test variable differ significantly between two groups. To conduct the Mann-Whitney *U* test, each case must have scores on two variables, the grouping variable (independent or categorical variable) and the test variable (dependent or quantitative variable). The grouping variable divides cases into two groups or categories, and the test variable assesses individuals on a variable with at least an ordinal scale. Unlike its parametric counterpart, the *t* test for two samples, this method does not assume that the difference between the samples has normality distributed, or that the variances of the two populations are equal. This test was conducted to compare the subjective satisfaction with the Koha between the novice and experienced users and novice and learning section.

4.3 Experiments with Koha interface II: learning and retention

The second experiment with Koha interface deliberated learning and retention with the Koha interface. The tools and the tasks used in the second experiment were same as those discussed in the first test. The experimental procedures were also same except this test presented a comparison of novice users' initial learning and retention.

4.3.1 Participants

Twelve novice users who participated in the first experiment also took part in the second test. In this test, novice users were given a brief 20-mintues training before they were asked to complete the search tasks.

4.3.2 Experimental procedures

The experimental procedure which was discussed in section 4.2.2 was similar to this experiment. The same set of tasks as outlined in the section 4.2.3 was used. The data collection method used was also similar to the one outlined and discussed in section 4.2.4. Unlike the first experiment, novices were then given a 20-minutes `hands-on' training to learn the basic conventions of the Koha interface. They worked through each task in the same order. After completion of all search tasks, they completed the same interface satisfaction questionnaire (QUIS). In the retention session, held four weeks later, the same procedure was followed except that the training tutorial was not repeated. The task set was the same as in the initial performance and learning sessions. Subjective satisfaction with the Koha interface was measured at the end of the session.

4.3.3 Variables studied

The similar performance and satisfaction variables discussed in the 4.2.5.1 and 4.2.5.2 were calculated in both search sessions (learning and retention).

4.3.4 Data analysis techniques

4.3.4.1 The related t-test

The related *t*-test is used to take a measurement from a sample and then take the same measurement again at a later time from the same sample. The related *t*-test compares the means of two related samples of scores to see whether the means of two samples differ significantly. The test was carried out to see the differences between learning and retention sessions in terms of task time, the number of different search terms used, success of the tasks performed, and the number of errors made.

4.3.4.2 The Wilcoxon matched Pairs test

The Wilcoxon test is a nonparametric test that compares two paired groups. The results of a Wilcoxon test only make sense when the pairs are independent – that whatever factor caused a difference (between paired values) to be too high or too low affects only that one pair. Prism cannot test this assumption. You must think about the experimental design. For example, the errors are not independent if you have six pairs of values, but these were obtained from three animals, with duplicate measurements in each animal. In this case, some factor may cause the after-before differences from one animal to be high or low. This factor would affect two of the pairs (but not the other four), so these two are not independent.

4.4 Comparison of Novices' Initial Performance, Learning and Retention and between Experienced and Novices' Learning

The comparison was made among novices' initial performance, learning and retention sessions as well as between novices' learning and experienced searchers. For comparison of novices' performance and satisfaction in three search sessions, ANOVA and Kruskal-Wallis tests were conducted, and for comparison between novices' learning and experienced users, independent sample *t*-test and Mann-Whitney test were carried out.

4.4.1 Data analysis techniques

4.4.1.1 Analysis of variance (ANOVA)

The one-way analysis of variance (ANOVA) is used to determine whether there are any significant differences between the means of two or more independent groups. Analysis of variance (ANOVA) is a method of testing the null hypothesis that several group means are equal in the population by comparing the sample variance estimated from the group means to that estimated within the groups. This test was conducted to see performance difference among different gender, age, computer experience, training, and status groups. To perform ANOVA, two assumptions regarding the data must hold:

- The variances of the groups are equal (test for homogeneity of variance); and
- Each group is an independent random sample from a normal population (test for normality).

Numerous tests are available to test the assumption that all groups come from populations with equal variances. Many of these tests, however, are dependent on the data being from normal population. The Levene test is homogeneity of variance test that is less dependent on the assumption of normality than most tests and thus is particularly useful with ANOVA. It is obtained by computing, in each case, the absolute difference from its cell mean and performing a one-way ANOVA on these differences. The Levene test is used to test the null hypothesis that the groups come from populations with unequal variance. If Levine's test result is significant, that is it has probability of $p<.05$, then the variances are unequal, and hence the null hypothesis is accepted that the groups have unequal variances. The test showed that the groups are from populations with equal variances. To test the normality of data, a one-sample Kolmogorov-Smirnov test was run. This result also showed that the data are from a normal distribution. Thus, it was possible to proceed with the ANOVA. Once the differences among the means were identified, post-hoc Duncan's tests were run using significance level. The test identified homogeneous subsets of means that are not different from each other.

4.4.1.2 The Kruskal-Wallis test

The Kruskal-Wallis test evaluates whether the population medians on a dependent variable are the same across all levels of a factor. To conduct the Kruskal-Wallis test, using the *K* independent samples procedure, cases must have scores on an independent or grouping variable and on a dependent variable. The independent or grouping variable divides individuals into two or more groups, and the dependent variable assesses individuals on at least an ordinal scale. If the independent variable has only two levels, no additional significance tests need to be conducted beyond the Kruskal-Wallis test. However, if a factor has more than two levels and the overall

test is significant, follow-up tests are usually conducted. These follow-up tests most frequently involve comparisons between pairs of group medians.

4.5 Conclusion

This Chapter described the research methodology for the usability experiments with the Koha user interface. The next Chapter will discuss the results of the first usability experiment on users' performance and satisfaction with the Koha interface.

Dhaka University Institutional Repository

Chapter 5:

Experiment with Koha Interface I: Performance and Satisfaction

5.1 Introduction

This chapter discusses the first usability test result with Koha interface. Students from different disciplines of BRAC University took part in this usability test. The purpose was to examine their performance and satisfaction with the Koha interface. A number of common search tasks were given to them for this usability test. User interaction with the interface was recorded by CAM Studio screen recorder which recorded the entire session. User's performance examined by their time taking rate, search terms used, success rate and errors rate, on the other hand their satisfaction measured by QUIS questionnaire.

5.2 User and usability test background

A total of twenty four students including novice and experienced took part in this usability test. Before each session, the participants were interviewed to assess their experience with computer and search systems as well as their age, gender and discipline.

The novice group (12 participants) consists of four female and eight male students. One of them was a postgraduate student. On the other hand, the experienced group (12 participants) comprised of six female and six male students and they all were graduate level students. They have prior experience in searching online public access catalogue including Koha interface.

5.3 Data analysis

According to following criteria, the data of this usability test were analyzed:

- Task completion time;
- Number of search terms used;
- Success Score;
- Number of error made; and
- Subjective satisfaction.

5.4 Test of hypotheses

The null hypotheses explored were:

H1 There is no difference between novice and experienced searchers in total time taken to complete search tasks;

H2 There is no difference between novice and experienced searchers in total number of search terms used;

H3 There is no difference between novice and experienced searchers in total success score of search tasks;

H4 There is no difference between novice and experienced searchers in total number of errors made; and

H5 There is no difference between novice and experienced searchers in subjective satisfaction with the Koha interface.

5.5 Results of the experiment

5.5.1 Task completion time

The time taken to complete each search task was rounded to the nearest minute. The task completion time included both task completion time, instances of requested termination, and termination as a result of the time limit. The following table shows the average time taken to complete each search task by both novice and experienced searchers.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Novice (*n*=12)	1.77 (1.03)	2.29 (1.90)	1.91 (1.44)	2.37 (1.83)	1.30 (0.92)	3.22 (1.23)	2.56 (1.67)
Experienced (*n*=12)	1.24 (0.44)	1.07 (0.38)	1.61 (0.95)	1.93 (1.24)	0.77 (0.52)	2.37 (1.79)	2.11 (0.85)

Table 5.1: Means and (standard deviations) of task completion time

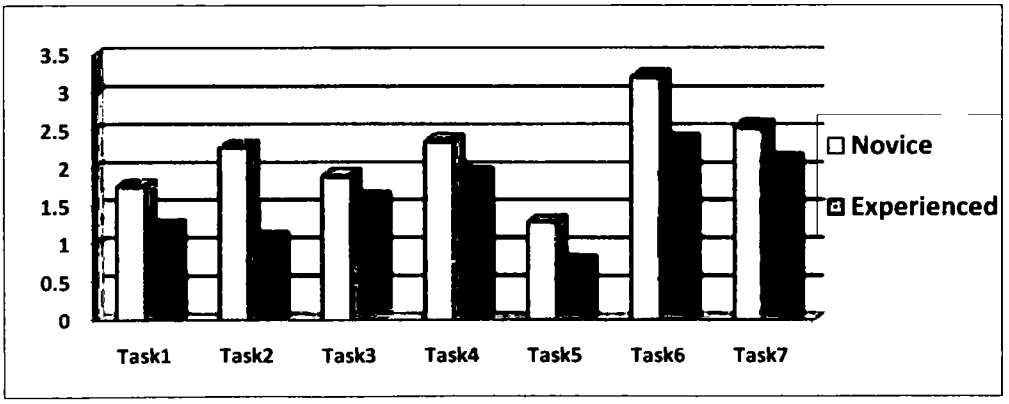


Figure 5.1: Average time taken to complete each task

This figure showed that in searching the entire tasks novice users' took more time than experienced users. Both user groups took less time to complete Task 5 and spend highest time to complete Task 6 and Task 7 respectively.

5.5.2 Number of search terms used

The number of search terms that were used by both novice and experienced groups was calculated. Table 2 shows the average number of search terms used by each group in completing each search task. Figure 2 shows the distribution.

	Task1	Task2	Task3	Task4	Task5
Novice (*n*=12)	1.25 (0.62)	1.25 (0.45)	1.50 (0.90)	1.33 (0.49)	1.00 (0.00)
Experienced (*n*=12)	1.41 (0.66)	1.00 (0.00)	1.25 (0.45)	1.75 (0.62)	1.00 (0.00)

Table 5.2: Means and (standard deviation) of search terms used

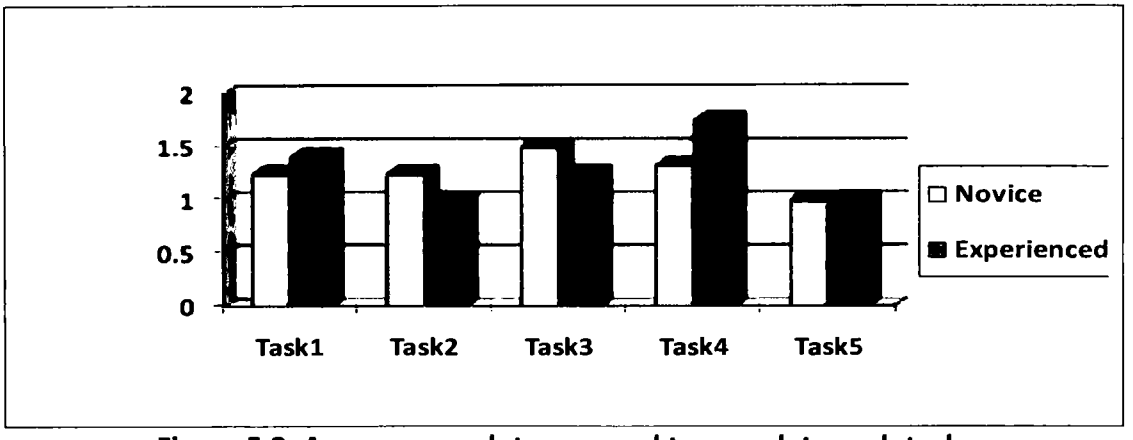


Figure 5.2: Average search terms used to complete each task

This figure showed that novice group used more search terms than the experienced group in searching Task 2 and Task 3. Experienced group used more search terms in searching Task 1 and Task 4. Both groups used same number of search terms in searching Task 5. The above figure are showing five tasks statistics because in Task 6 and Task 7 there were no search terms and theses tasks were user account based tasks.

5.5.3 Success score

"Success" of a search task was scored as 1 if the search task was successful or 0 if it unsuccessful. No partial credit was given. So, the maximum average success score for a task was 1, if all searchers in the group were successful. The following table shows the average score by each group. The following figure shows the distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Novice (*n*=12)	0.50 (0.00)	0.75 (0.00)	0.42 (0.00)	0.17 (0.51)	0.67 (0.00)	0.75 (0.00)	0.17 (0.45)
Experienced (*n*=12)	1.00 (0.52)	1.00 (0.45)	1.00 (0.51)	0.58 (0.39)	1.00 (0.49)	1.00 (0.45)	0.75 (0.39)

Table 5.3: Means and (standard deviation) of success score

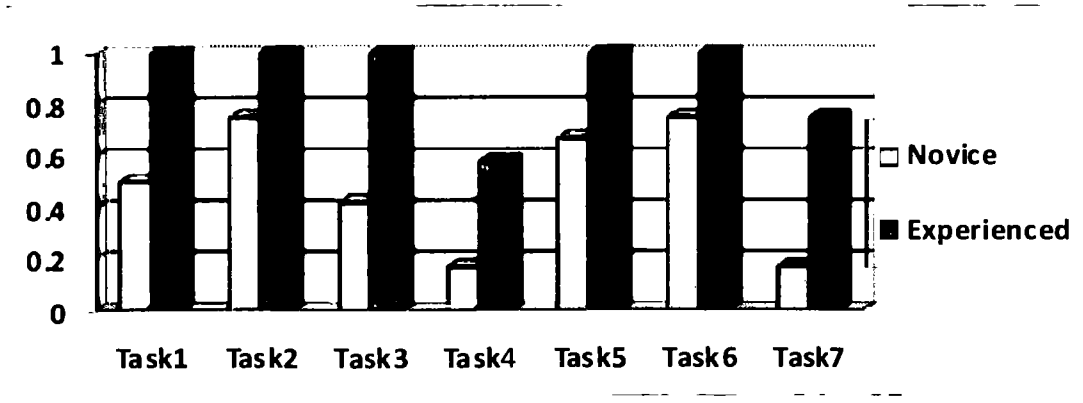


Figure 5.3: Average success score

A copy of the search tasks used in this experiment can be found in Chapter 4. The Task 2 and Task 5 were quite simple and straightforward. Except three participants in the novice group, all participants were able to do these tasks. Task 4 and Task 7 were the most challenging for both groups. They had to go advanced search option and use Boolean AND to search Task 4. In completing Task 7 their instruction was to hold book. But doing Task 7 only two participants of novice group and four participants of experienced group were succeeded.

5.5.4 Number of errors made

The number of errors made by two search groups was counted separately. Table 5.4 shows the average number of errors made by novice and experienced group. Figure 5.4 shows the actual distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Novice (*n*=12)	1.50 (1.08)	2.08 (1.56)	1.08 (0.99)	2.42 (0.79)	0.92 (0.51)	1.17 (1.26)	1.17 (0.83)
Experienced (*n*=12)	0.50 (0.67)	0.33 (0.49)	0.50 (0.79)	1.42 (1.08)	0.08 (0.29)	0.08 (0.29)	0.67 (0.98)

Table 5.4: Means and (standard deviation) of errors made

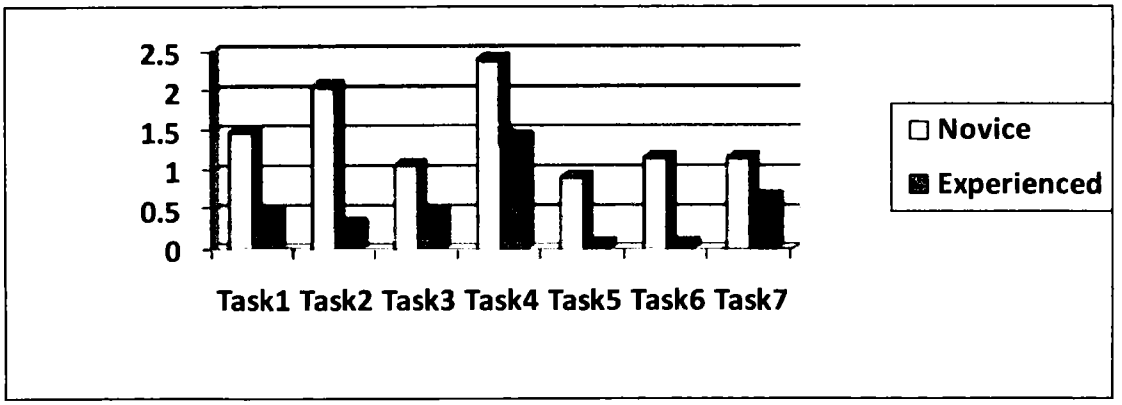


Figure 5.4: Average errors made

The novice group made more errors in completing the tasks than the experienced group. Novice group made most errors in completing Task 4. On the other hand, the experienced group did not make any error in completing Task 5 and Task 6.

Overall, experienced searchers performed better than the novice users. Table 5.5 presents overall performance data by both novice and experienced groups.

	Time taken (mins.)	Search terms	Success score	Number of error
Novice	15.41	6.33	3.42	10.33
Experienced	11.11	6.42	6.33	3.58

Table 5.5: Overall performance data

On average, the novice group took 15.41 minutes to complete all search tasks, whereas experienced group took 11.11 minutes. In terms of number of different search terms used, the novice group used 6.33 search terms on average while the experienced users used 6.42 search terms. Overall, experienced users were more successful than novice searchers. Experienced group scored 6.33 overall, whereas novice group scored 3.43. The novice group made 10.33 errors overall to complete search tasks whereas experienced users made 3.58 errors.

5.5.5 Subjective satisfaction with Koha

Means and standard deviations (in parentheses) of data collected through the Questionnaire for User Interface Satisfaction (QUIS) are shown in Table 5.6. Participants rated their satisfaction with the Koha on a 7-point scale.

Question	Novice (*n*=12)	Experienced (*n*=12)	Question	Novice (*n*=12)	Experienced (*n*=12)
Overall reactions			**Learning**		
Terrible vs. Wonderful	5.83 (0.94)	6.17 (0.83)	Learning to operate the interface	5.17 (1.75)	6.08 (1.00)
Frustrating vs. Satisfying	5.50 (1.31)	6.25 (0.75)	Exploring new features by trial and error	6.33 (1.77)	5.50 (1.17)
Difficult vs. Easy	5.92 (1.24)	6.00 (1.21)	Number of steps per task	5.42 (1.44)	5.67 (0.99)
Rigid vs. Flexible	5.75 (1.48)	6.00 (0.95)	Learning Advanced features	5.33 (1.30)	5.33 (1.67)
Screen			Time to learn to use the interface	5.51 (1.68)	5.75 (1.21)
Character on the interface	5.67 (0.78)	6.17 (0.94)	Performing tasks are straight forward	5.33 (1.07)	6.00 (1.04)
Amount of displayed Information	5.83 (1.03)	6.08 (0.90)	**System Capabilities**		
Arrangement of information	6.00 (1.28)	6.00 (0.74)	System Speed	5.50 (1.38)	5.33 (1.30)
Screen sequencing	5.67 (1.37)	5.33 (0.98)	System reliability	5.58 (1.16)	6.50 (0.90)
Next screen sequencing	5.58 (1.16)	5.50 (0.80)	Correcting Mistakes	6.33 (1.23)	5.92 (1.38)
Back to previous screen	6.33 (0.98)	6.08 (1.16)	Designed all levels of users	5.00 (1.35)	6.33 (0.89)
Terminology & System Feedback			**Navigation**		
Use of terms in Interface	5.42 (1.16)	5.83 (0.72)	Ease of navigation	5.58 (1.50)	6.17 (0.72)
Messages appeared on the interface	5.08 (1.93)	5.42 (1.24)	Link to library account	6.50 (0.52)	6.50 (1.00)
Length of delay between task searching	5.08 (1.73)	5.83 (1.11)	Back to search screen	5.42 (1.44)	6.17 (1.19)
Terms on the interface	5.17 (1.75)	5.92 (1.00)	Navigation from page to page	5.50 (0.80)	5.75 (1.60)
Error Messages	6.33 (1.77)	6.08 (1.78)	Arrangement of Navigational Menus	5.33 (1.56)	5.67 (0.98)
Overall Satisfaction		**Novice (*n*=12)**		**Experienced (*n*=12)**	
		5.75 (0.18)		6.11 (0.13)	

Table 5.6: Subjective satisfaction with Koha.

Analysis of the QUIS data revealed that users' perceptions are very high regarding Koha interface. The most favourable responses among novice searchers were related to link to library account (M=6.50, SD=0.52). The least favourable response was with regard to designed for all levels of users (M=5.00, SD=1.35). For the experienced group, the most favourable responses was about link to library account (M=6.50, SD=0.52). However, the most negative response were system speed and learning advanced features (M=5.33, SD=1.30). Experienced users' overall subjective satisfaction was higher than that of novice users. Novice users' overall satisfaction was M=5.75, SD=6.11; whereas experienced users' satisfaction was M=6.11, SD=0.13.

5.6 Tests for statistical significance

5.6.1 The independent sample *t*-test

5.6.1.1 Task completion time

The following Table shows the summary of the results between the novice and experienced searchers in terms of total task completion time.

	Novice Mean S.D.	Experienced Mean S.D.	*t*-value	df	2-tailed sig.
Task Time	15.41 4.66	11.11 3.84	-2.464	22	.022

Table 5.7: Independent sample *t*-test for task completion time

The result showed that there was significant difference in total time taken to complete search tasks between novice and experienced searchers. Thus, the null hypothesis (H1) was rejected.

5.6.1.2 Search terms used

Table 5.8 shows the summary of the results of the comparison between novice and experienced searchers in total number of different search terms used.

	Novice Mean S.D.	Experienced Mean S.D.	*t*-value	df	2-tailed sig.
Search Terms Used	6.33 1.50	6.42 1.16	.152	22	.880

Table 5.8: Independent sample *t*-test for search terms used

The results showed that there was no significant difference in total number of different search terms used by novice and experienced searchers (H2).

5.6.1.3 Success score

Table 5.9 shows the summary of the results of the comparison between novice and experienced searchers in success score.

	Novice Mean S.D.	Experienced Mean S.D.	*t*-value	df	2-tailed sig.
Success Score	3.42 1.60	6.33 .77	5.641	22	.000

Table 5.9: Independent sample *t*-test for success score

The results showed that there was a significant difference between novice and experienced searchers in terms of success score. Thus, the null hypothesis (H3) was rejected.

5.6.1.4 Number of errors made

The table below shows the summary of the results of the comparison between novice and experienced searchers with respect to total number of errors made.

	Novice Mean S.D.	Experienced Mean S.D.	*t*-value	df	2-tailed sig.
Errors made	10.33 1.92	3.58 1.24	10.220	22	.000

Table 5.10: Independent sample *t*-test for number of errors made

The results showed that there was significant difference between novice and experienced searchers in terms of total number of errors made. The null hypothesis (H4) was rejected.

5.6.2 Mann-Whitney *U* test

The Mann-Whitney *U* test was carried out to examine the difference between novice and experienced searchers regarding their subjective satisfaction with the Koha interface. The results of the test are shown in the table 5.11.

	Group	Mean Rank	Sum of Rank	Mann-Whitney U	Asymp. Sig. (2-tailed)
Subjective Satisfaction	Novice	2.50	26.00	.000	0.20
	Experienced	6.50	10.00		

Table 5.11: Mann-Whitney *U*-test for overall subjective satisfaction with the Koha interface

The results showed that there was no significant difference in subjective satisfaction by the novice and experienced users with regard to Koha interface (H5).

5.7 Conclusion

This Chapter presented the result of the first experiment with Koha interface. The purpose was to see whether there were significant differences between novice and experienced searchers' performance and satisfaction with the interface. The results showed that there were significant differences in terms of success score and number of errors made between the groups. The next Chapter will explore novices' learning and retention with the Koha interface.

Dhaka University Institutional Repository

Chapter 6:

Experiment with Koha Interface II: Learning & Retention

6.1 Introduction

The previous Chapter discussed the performance and satisfaction of novice and experienced searchers with the Koha interface. This Chapter presents the result of the experiments of novices' learning and retention with the interface. At the end of the learning experiment, novices were told not to use Koha interface for a month. After one month, they came back for the retention experiment. A similar experiment as that discussed in Chapter 5 was carried out using the same equipment, tasks and environment. Novices rated their satisfaction with the Koha interface at the end of both sessions.

6.2 User background

Only novices were the participants for this experiment. They also participated in the first experiment and their demographic characteristics are shown in Appendix 3.

6.3 Data analysis

The data of this usability test were analyzed according to the following criteria:

- Task completion time;
- Number of search terms used;
- Success Score;
- Number of error made; and
- Subjective satisfaction.

6.4 Test of hypotheses:

The null hypotheses explored were:

H1 There is no difference between novices' learning and retention in total time taken to complete search tasks;

H2 There is no difference between novices' learning and retention in total number of search terms used;

H3 There is no difference between novices' learning and retention in total success score of search tasks;

H4 There is no difference between novices' learning and retention in total number of errors made; and

H5 There is no difference between novices' learning and retention in subjective satisfaction with the Koha interfaces.

.

6.5 Results of the experiment

6.5.1 Task completion time

Similar to the previous experiment, in this experiment the time taken to complete each search task was rounded to the nearest minute. Table 6.1 shows the average time taken to complete each search task of novice group in their learning and retention while figure 6.1 shows the actual distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Learning (*n*=12)	1.45 (0.82)	0.94 (0.32)	0.99 (0.31)	1.67 (1.19)	0.54 (0.21)	1.65 (0.85)	1.53 (0.65)
Retention (*n*=12)	1.39 (0.68)	1.15 (0.73)	1.08 (0.63)	1.43 (1.29)	0.69 (0.19)	1.61 (0.70)	2.02 (1.04)

Table 6.1: Means and (standard deviation) of task completion time

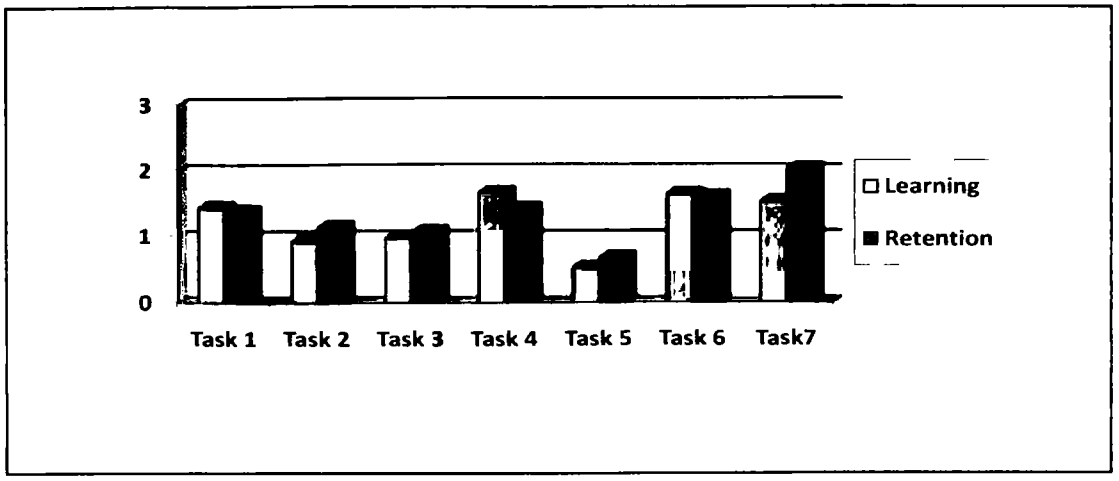


Figure 6.1: Average time taken to complete each task

This figure showed that novice group took highest time to complete Task 7 in both sessions. On the other hand, they took more time to finish Task 4 in learning than the retention session. In completing Task 2, Task 3 and Task 6, they spent almost same time in both sessions. To complete Task 5 was comparatively easy for novice group, because in both sessions they took least time in completing this task.

6.5.2 Number of search terms used

The number of search terms that were used by the novice group in their learning and retention sessions was calculated. Table 6.2 shows the average number of search terms used in completing each search task. Figure 6.2 shows the distribution.

	Task1	Task2	Task3	Task4	Task5
Learning (*n*=12)	1.25 (0.45)	1.00 (0.00)	1.08 (0.29)	2.00 (0.43)	1.00 (0.00)
Retention (*n*=12)	1.00 (0.00)	1.00 (0.00)	1.08 (0.29)	1.58 (0.51)	1.00 (0.00)

Table 6.2: Means and (standard deviation) of search terms used

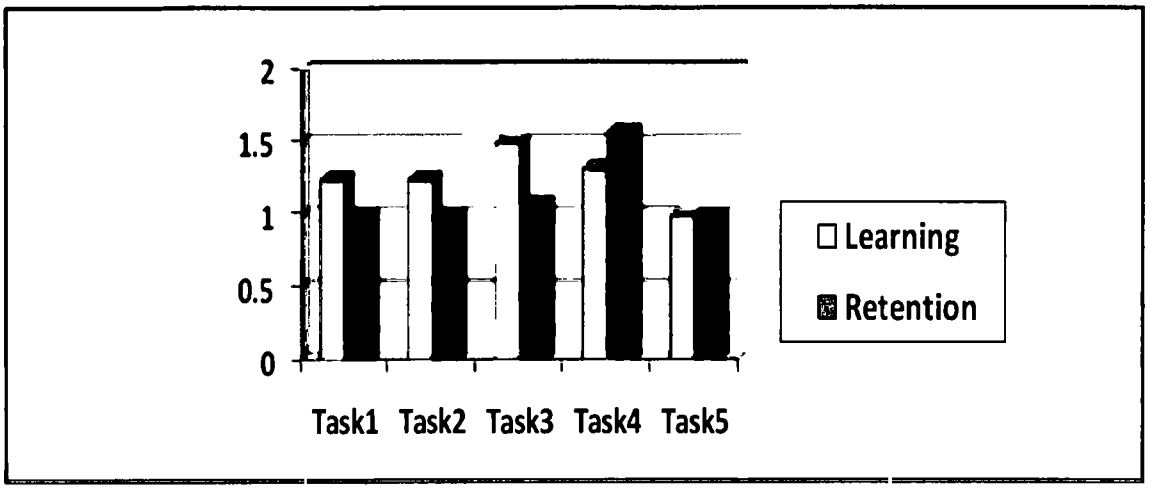


Figure 6.2: Average search terms used to complete each task

This figure shows that there was no difference between learning and retention sessions in searching Task 5. This means that novices used the same number of search terms for Task 5 in both sessions. Novice group used more search terms in retention session than learning session for completing Task 4. In completing Task 1, Task 2 and Task 3, novices used more terms in learning than the retention session. Task 6 and Task 7 do not require using search terms; these two tasks were not included for analysis.

6.5.3 Success score

Similar to the earlier experiment, "success" of a search task was scored as 1 if the search task was successful or 0 if it unsuccessful. No partial credit was given. So, the maximum average success score for a task was 1, if all searchers in the group were successful. Table 6.3 shows the average success score of learning session and retention sessions by the novice group. Figure 6.3 shows the distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Learning (*n*=12)	0.92 (0.29)	0.58 (0.51)	1.00 (0.00)	0.83 (0.39)	0.92 (0.29)	0.92 (0.29)	0.92 (0.29)
Retention (*n*=12)	0.58 (0.51)	0.42 (0.51)	1.00 (0.00)	0.83 (0.39)	0.75 (0.45)	1.00 (0.00)	0.83 (0.39)

Table 6.3: Means and (standard deviation) of success score

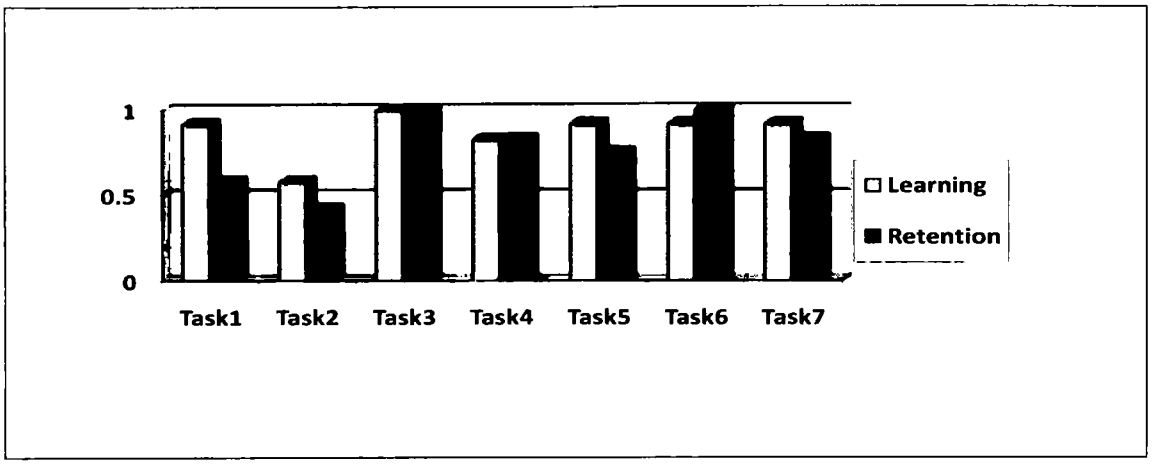


Figure 6.3: Average success score

As can be seen, novices' success rate was same in searching Task 3 and Task 4 in both learning and retention sessions. In completing Task 4, searchers need to use advanced search option. In both sessions, ten users could complete this task. In retention session, success score was poor in terms of completing Task 1 than the retention. Only one novice searcher failed to complete Task 7 in the learning session. On the other hand, ten novices were successful in completing Task 7 in retention. Novices' success rate was poor in completing Task 2 in both sessions.

6.5.4 Number of errors made

The number of errors made by novice group in their learning session and retention sessions was counted separately. Table 6.4 shows the average number of errors made in learning and retention sessions. Figure 6.4 shows the actual distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Learning (*n*=12)	1.17 (1.34)	0.92 (0.10)	0.25 (0.45)	0.50 (1.00)	0.08 (0.29)	0.42 (0.67)	0.50 (0.10)
Retention (*n*=12)	0.67 (0.78)	0.97 (0.90)	0.17 (0.58)	0.58 (0.90)	0.33 (0.49)	0.17 (0.58)	1.33 (1.23)

Table 6.4: Means and (standard deviation) of errors made

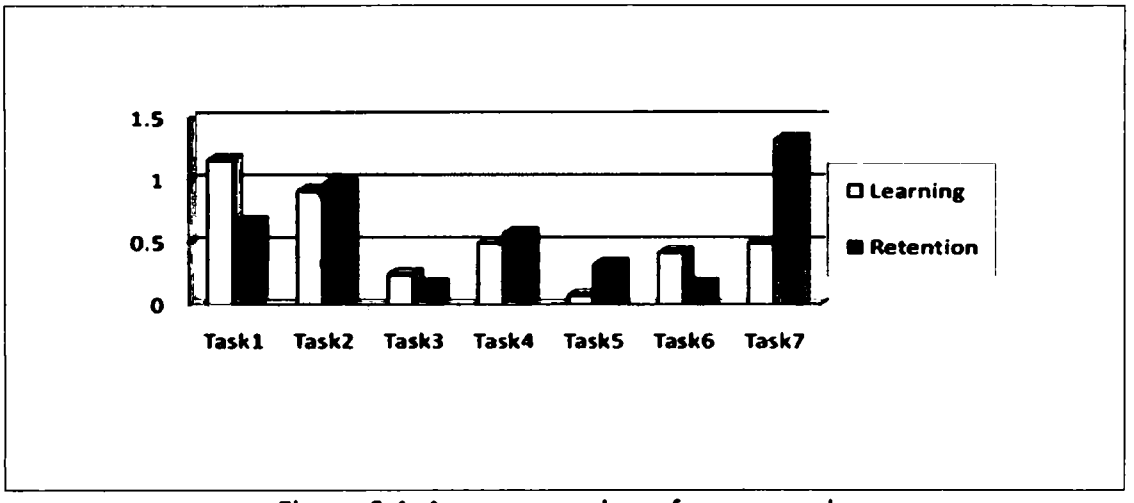


Figure 6.4: Average number of errors made

From the figure 6.4, it was found that novices made more errors in completing Task 1 in the learning session. However novices made highest number of errors in completing Task 7 in the retention session. Overall, novices made more error in the retention experiment. In the learning session, novices' error rate was lower for completing Task 5 than others tasks. Novices made almost same number of errors in completing Task 2 in both sessions. The figure showed that there were notable differences between the sessions in completing Task 1, Task 5, Task 6 and Task 7.

Overall, novice searchers performed better in the learning experiment. Table 6.5 presents the overall performance data by novice group in their both sessions.

	Time taken (mins.)	Search terms	Success score	Number of error
Learning	8.76	6.33	5.10	3.83
Retention	9.37	5.67	6.08	4.17

Table 6.5: Overall performance data

On average, the novice group took 8.76 minutes to complete all search tasks in the learning experiment, whereas they took 9.37 minutes in the retention session. In terms of number of different search terms used, novices used 6.33 search terms on average in learning, and 5.67 at the retention level. Overall, their success score was poor. In learning session from all novices only two users were successful to complete all task whereas one was successful in completing all task. Novice group made 3.83 errors in learning session whereas in retention level they made 4.17 errors.

6.5.5 Subjective satisfaction with Koha

Means and standard deviations (in parentheses) of data collected through the Questionnaire for User Interface Satisfaction (QUIS) are shown in Table 6.6. Participants rated their satisfaction with the Koha on a 7-point scale.

Question	Learning (*n*=12)	Retention (*n*=12)	Question	Learning (*n*=12)	Retention (*n*=12)
Overall reactions			**Learning**		
Terrible vs. Wonderful	6.08 (1.16)	5.75 (1.36)	Learning to operate the interface	6.17 (1.19)	5.92 (1.08)
Frustrating vs. Satisfying	6.17 (0.94)	6.08 (1.16)	Exploring new features by trial and error	6.08 (0.90)	5.83 (1.11)
Difficult vs. Easy	5.83 (1.47)	5.92 (1.00)	Number of steps per task	5.83 (1.47)	6.25 (0.62)
Rigid vs. Flexible	5.67 (1.43)	6.00 (0.95)	Learning Advanced features	6.08 (1.00)	5.92 (1.38)
Screen			Time to learn to use the interface	5.51 (1.68)	5.67 (1.15)
Character on the interface	5.92 (1.08)	5.92 (1.24)	Performing tasks are straight-forward	5.67 (1.07)	5.17 (1.75)
Amount of displayed Information	6.08 (1.16)	5.92 (1.44)	**System Capabilities**		
Arrangement of information	6.33 (1.43)	5.92 (1.08)	System Speed	5.75 (1.14)	5.67 (0.98)
Screen sequencing	5.58 (1.72)	5.42 (1.31)	System reliability	6.50 (1.62)	6.42 (1.08)
Next screen sequencing	6.50 (1.17)	6.33 (0.98)	Correcting Mistakes	5.00 (1.54)	5.17 (1.64)
Back to previous screen	5.75 (0.96)	6.00 (0.85)	Designed all levels of users	5.58 (1.73)	5.75 (1.42)
Terminology & System Feedback			**Navigation**		
Use of terms in interface	5.58 (1.38)	5.58 (1.16)	Ease of navigation	6.50 (0.52)	6.50 (0.51)
Messages appeared on the interface	6.00 (0.95)	5.17 (1.70)	Link to library account	6.25 (0.96)	6.17 (1.19)
Length of delay between task searching	5.92 (1.08)	5.17 (1.80)	Back to search screen	6.50 (0.67)	6.17 (0.94)
Terms on the interface	6.17 (1.75)	6.08 (1.68)	Navigation from page to page	5.75 (1.29)	5.50 (1.38)
Error Messages	6.08 (1.16)	5.83 (1.47)	Arrangement of Navigational Menus	7.25 (0.96)	7.00 (1.13)
Overall Satisfaction		**Learning (*n*=12)**		**Retention (*n*=12)**	
		5.94 (0.23)		5.94 (0.14)	

Table 6.6: Subjective satisfaction with the Koha interface

The QUIS data revealed that the most favourable responses were arrangement of navigational menus (M=7.25, SD=0.96) and (M=7.00, SD=1.13) in both sessions. The least favourable response was correcting mistakes (M=5.00, SD=1.54) and (M=5.17, SD=1.64). Novices' mean overall subjective satisfaction was the same in both sessions (M=5.94, SD=0.23) and (M=5.94, SD=0.14).

6.6 Tests for statistical significance

6.6.1 The related *t*- test

The test was carried out to see the differences between learning and retention sessions of novice group in terms of task completion time, the number of different search terms used, success of the tasks performed, and the number of errors made.

6.6.1.1 Task completion time

Table 6.7 shows the summary of the results of the comparison between learning and retention sessions in terms of total task completion time.

	Learning Mean S.D.	Retention Mean S.D.	*t*-value	df	Sig. (2-tailed)
Task Time	8.77 2.74	9.37 3.67	-.492	11	.632

Table 6.7: The related *t*-test for task completion time

The result of the *t*-test showed that there was no significant difference in total time taken to complete the search tasks between learning and retention sessions. The hypothesis (H1) was accepted.

6.6.1.2 Search terms used

Table 6.8 shows the summary of the results of the comparison between learning and retention sessions regarding the total number of different search terms used.

	Learning Mean S.D.	Retention Mean S.D.	*t*-value	df	Sig. (2-tailed)
Search Terms	6.17 0.39	5.67 0.65	2.171	11	.053

Table 6.8: The related *t*-test for search terms used

Again, there was no significant difference in total number of different search terms used by novice searchers in both sessions (H2).

6.6.1.3 Success score

Table 6.9 shows the summary of the results of the comparison between learning and retention sessions in terms of total success score of the search tasks.

	Learning Mean S.D.	Retention Mean S.D.	*t*-value	df	Sig. (2-tailed)
Success score	6.08 5.41	.067 1.00	1.925	22	.084

Table 6.9: The related *t*-test for success score

The results showed that there was no significant difference between the sessions in terms of success score of the search tasks (H3).

6.6.1.4 Number of errors made

Table 6.10 shows the summary of the results of the comparison between learning and retention sessions with respect to total number of errors made.

	Novice Mean S.D.	Learning Mean S.D.	*t*-value	df	Sig. (2-tailed)
Errors made	3.83 1.80	4.17 1.97	-.528	11	.608

Table 6.10: The related *t*-test for errors made

The results showed that there were no significant differences in terms of errors rate between learning and retention sessions. Thus the null hypothesis (H4) is accepted.

6.6.2 The Wilcoxon matched pairs test

The Wilcoxon Matched Pairs test was carried out to see the difference between learning and retention sessions in terms of subjective satisfaction with the Koha interface. The results of the test are shown table 6.11.

	Mean Rank	Sum of Ranks	Z	Asymp. Sig. (2-tailed)
Retention-Learning (Overall Satisfaction)	2.50	5.00	.000(a)	1.000
	2.50	5.00		

Table 6.11: Wilcoxon matched pairs test for subjective satisfaction with Koha

The results showed that there was no significant difference in term of subjective satisfaction between learning and retention of the novice group.

Dhaka University Institutional Repository

6.7 Conclusion

The purpose of this Chapter was to compare the results of novices' learning and retention experiments. The results showed that novices could pick up the search functionalities when some training was provided, and they can remember the interface as the differences were not significant between the sessions.

Dhaka University Institutional Repository

Chapter 7:

Comparison of Novices' Initial Performance, Learning and Retention and between Experienced and Novices' Learning sessions

7.1 Introduction

This Chapter discusses the results of the comparison of novices' initial performance, learning and retention sessions. It also compares the results of the experiments between experienced searchers and novices' learning session.

7.2 Novices' Initial Performance, Learning and Retention

In the first experiment, novices' initial performance was recorded. In the second test, they performed the same search tasks after a short training. They were told not to use Koha for a month. After one month, novices participated in the retention experiment with the same search tasks.

7.2.1 Data analysis

According to the following criteria, the data of this usability test were analyzed:

- Task completion time;
- Number of search terms used;
- Success Score;
- Number of error made; and
- Subjective satisfaction.

7.2.2 Test of hypotheses

The null hypotheses explored were:

H1 There is no difference in novices' initial performance, learning and retention sessions in total time taken to complete the search tasks;

H2 There is no difference in novices' initial performance, learning and retention in total number of search terms used;

H3 There is no difference in novices' initial performance, learning and retention experiments in total success score of the search tasks;

H4 There is no difference in novices' initial performance, learning and retention in terms of total number of errors made; and

H5 There is no difference in novices' initial performance, learning and retention sessions in subjective satisfaction with the Koha interface.

7.2.3 Results of the study

7.2.3.1 Task completion time

The time taken to complete each search task was rounded to the nearest minute. The task completion time included both task completion time, instances of requested termination, and termination as a result of the twenty minute time limit. Table 7.1 shows the average time taken to complete each search task by both novice and experienced searchers while Figure 7.1 shows the actual distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Initial (*n*=12)	1.77 (1.03)	2.29 (1.90)	1.91 (1.44)	2.37 (1.83)	1.30 (0.92)	3.22 (1.23)	2.56 (1.67)
Learning (*n*=12)	1.45 (0.82)	0.94 (0.32)	0.99 (0.31)	1.67 (1.19)	0.54 (0.21)	1.65 (0.85)	1.53 (0.65)
Retention (*n*=12)	1.39 (0.68)	1.15 (0.73)	1.08 (0.63)	1.43 (1.29)	0.69 (0.19)	1.61 (0.70)	2.02 (1.04)

Table: 7.1 Means and (standard deviation) of task completion time

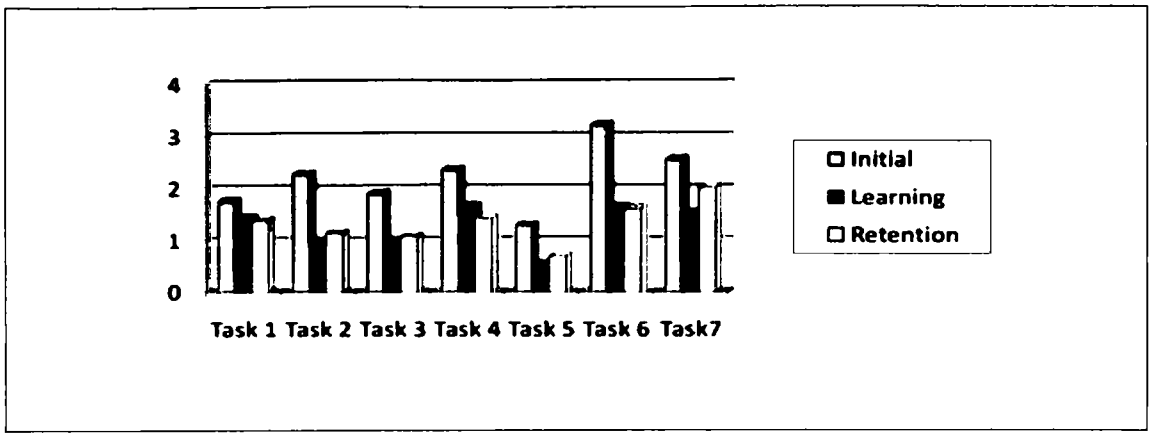


Figure 7.1: Average time taken to complete each task

This figure showed that the novice group took least time to complete Task 5. In completing Task 1, they took almost same time in all experiments. Novices took almost same time to complete Task 2, Task 3 and Task 6 in learning and retention, but in the initial test they took more times. Some differences were noticed in completing Task 7. In initial test, novices spent the highest time to complete this task. In the learning level, the time taken was lower but it was comparatively higher in the retention than the learning session but lower than the initial level.

7.2.3.2 *Number* of search terms used

The number of search terms that were used by the novice group during the three experiments was calculated. Table 7.2 shows the average number of search terms used by each session in completing each search task. Figure 7.2 shows the distribution.

	Task1	Task2	Task3	Task4	Task5
Novice (*n*=12)	1.25 (0.62)	1.25 (0.45)	1.50 (0.90)	1.33 (0.49)	1.00 (0.00)
Learning (*n*=12)	1.25 (0.45)	1.00 (0.00)	1.08 (0.29)	2.00 (0.43)	1.00 (0.00)
Retention (*n*=12)	1.00 (0.00)	1.00 (0.00)	1.08 (0.29)	1.58 (0.51)	1.00 (0.00)

Table 7.2: Means and (standard deviation) of search terms used

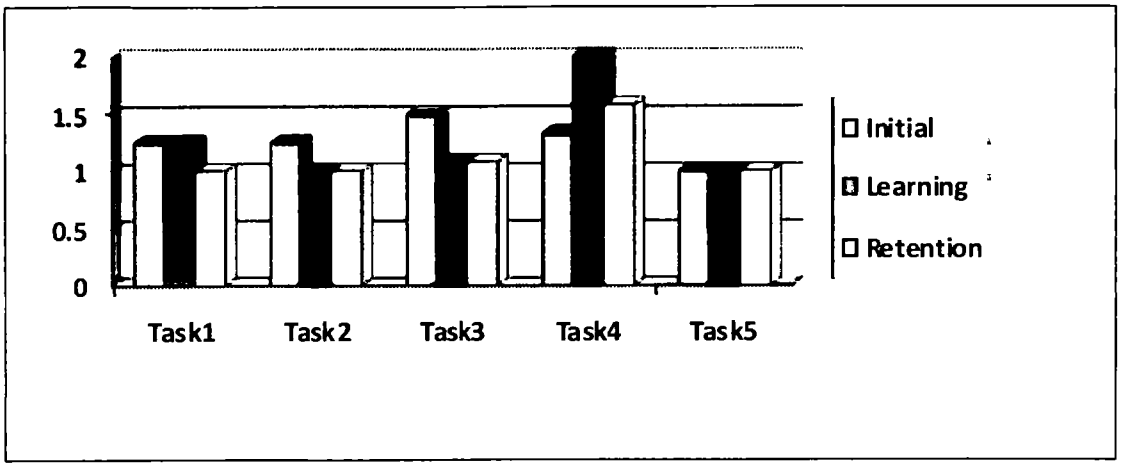


Figure 7.2: Average search terms used

From figure 7.2, it can be seen that the novice group used same number of search terms in searching Task 5 across the three search sessions. They used the same number of search terms for Task 1 in the initial and learning levels. For Task 1, they used less number of search terms in the retention session. In searching Task 2 and Task 3, the novice group used more terms in initial searching than the learning and retention. In initial searching, they used comparatively less number of terms in searching Task 4 than the other two search sessions. Task 6 and Task 7 were not search terms based. For this reason, these two tasks were not included for analysis.

7.2.3.3 Success score

"Success" of a search task was scored as 1 if the search task was successful or 0 if it unsuccessful. No partial credit was given. Therefore, the maximum average success score for a task was 1, if all searchers in the group were successful. Table 7.3 shows the average score of novice group in their initial, learning and retention period. Figure 7.3 shows the distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Novice (*n*=12)	0.50 (0.00)	0.75 (0.00)	0.42 (0.00)	0.17 (0.51)	0.67 (0.00)	0.75 (0.00)	0.17 (0.45)
Learning (*n*=12)	0.92 (0.29)	0.58 (0.51)	1.00 (0.00)	0.83 (0.39)	0.92 (0.29)	0.92 (0.29)	0.92 (0.29)
Retention (*n*=12)	0.58 (0.51)	0.42 (0.51)	1.00 (0.00)	0.83 (0.39)	0.75 (0.45)	1.00 (0.00)	0.83 (0.39)

Table 7.3: Means and (standard deviation) of success score

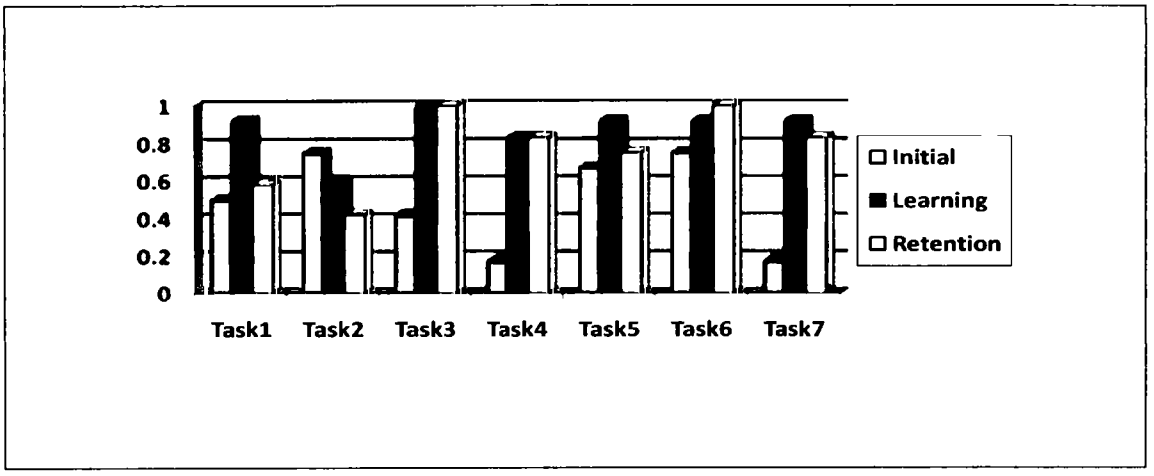


Figure 7.3: Average success score

The above figure 7.3 showed that novice group was more successful in learning and retention sessions than the initial session. In searching Task 3 and Task 4, novices' success score was same in learning and retention levels. In both sessions, all novice users were successful in completing Task 3, and ten users were successful in completing Task 4, whereas five users in Task 3 and two users in Task 4 were successful in initial session respectively. To complete Task 1 and Task 5, novice users were more successful in learning session than others two sessions. For Task 6, novices' success rate improved gradually from initial to retention. In completing Task 7, only two participants were successful in initial level, but the scenario changed in learning and retention sessions. Eleven participants were successful in learning session and ten participants were successful in retention session.

7.2.3.4 Number of errors made

The number of errors made by novice group during their three searching period was counted separately. Table 7.4 shows the average number of errors made and figure 7.4 shows the actual distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Novice (*n*=12)	1.50 (1.08)	2.08 (1.56)	1.08 (0.99)	2.42 (0.79)	0.92 (0.51)	1.17 (1.26)	1.17 (0.83)
Learning (*n*=12)	1.17 (1.34)	0.92 (0.10)	0.25 (0.45)	0.50 (1.00)	0.08 (0.29)	0.42 (0.67)	0.50 (0.10)
Retention (*n*=12)	0.67 (0.78)	0.97 (0.90)	0.17 (0.58)	0.58 (0.90)	0.33 (0.49)	0.17 (0.58)	1.33 (1.23)

Table 7.4: Means and (standard deviation) of errors made

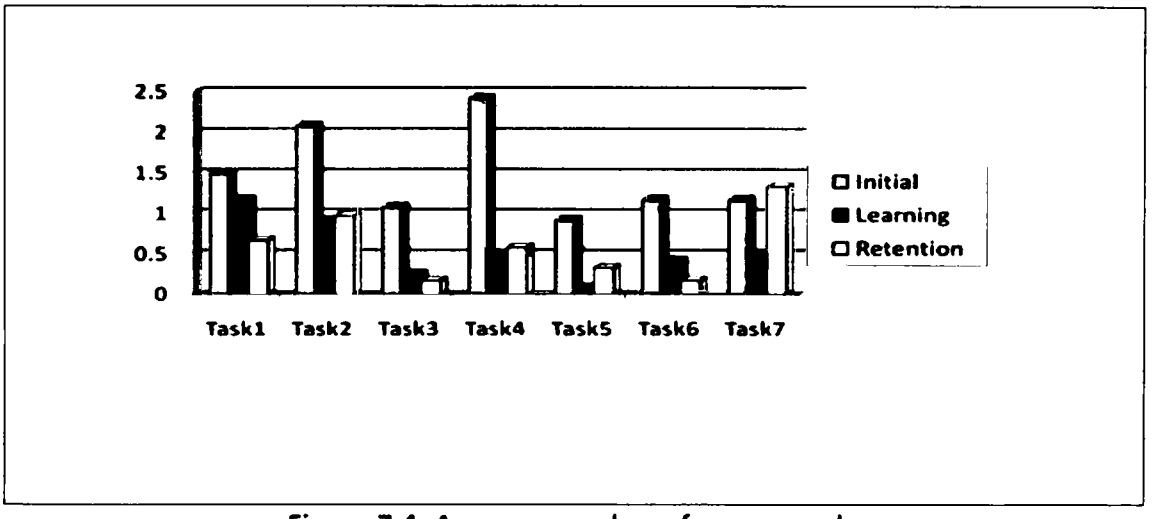


Figure 7.4: Average number of errors made

The novice group made more errors in completing all of the tasks in initial level than others two levels. The novice group made highest number of errors in completing Task 4 in the initial level and they did not make any mistake in searching Task 5 in the learning level. In the retention level, they made more errors in searching Task 7, and they made only few errors in completing Task 3. Novices' errors rate declined in completing Task 1 from initial to retention.

Overall, novice searchers performed better in learning level than the others level. Table 7.5 presents overall performance data of novice group.

	Time taken (mins.)	Number of error	Search terms	Success score
Initial	15.41	10.33	6.33	3.42
Learning	8.76	3.83	6.33	6.08
Retention	9.37	4.17	5.67	5.42

Table 7.5: Overall Performance data

On average, the novice group took 15.41 minutes to complete all search tasks in initial period, whereas they took 8.76 minutes in learning period and 9.37 minutes in retention period. In terms of number of different search terms used, 6.33 search terms on average in initial level and learning level and in retention level it was 5.67. Overall, novice users were more successful in learning searching period than other two periods. Learning level scored was 6.08 overall, whereas initial level scored was 3.42 and retention level was 5.42. The novice group made 10.33 errors in first level whereas they made 3.83 and 4.17 errors in learning and retention respectively.

7.2.3.5 Subjective satisfaction with the Koha

Means and standard deviations (in parentheses) of data collected through the Questionnaire for User Interface Satisfaction (QUIS) are shown in Table 7.6. Participants rated their satisfaction with the Koha on a 7-point scale.

Question	Initial (n=12)	Learning (n=12)	Retention (n=12)	Question	Initial (n=12)	Learning (n=12)	Retention (n=12)
Overall reactions				**Learning**			
Terrible vs. Wonderful	5.83 (0.94)	6.08 (1.16)	5.75 (1.36)	Learning to operate the interface	5.17 (1.75)	6.17 (1.19)	5.92 (1.08)
Frustrating vs. Satisfying	5.50 (1.31)	6.17 (0.94)	6.08 (1.16)	Exploring new features by trial and error	6.33 (1.77)	6.08 (0.90)	5.83 (1.11)
Difficult vs. Easy	5.92 (1.24)	5.83 (1.47)	5.92 (1.00)	Number of steps per task	5.42 (1.44)	5.83 (1.47)	6.25 (0.62)
Rigid vs. Flexible	5.75 (1.48)	5.67 (1.43)	6.00 (0.95)	Learning Advanced features	5.33 (1.30)	6.08 (1.00)	5.92 (1.38)
Screen				Time to learn to use the interface	5.51 (1.68)	5.67 (1.15)	5.67 (0.89)
Character on the interface	5.67 (0.78)	5.92 (1.08)	5.92 (1.24)	Performing tasks are straight	5.33 (1.07)	5.67 (1.07)	5.17 (1.75)
Amount of displayed Information	5.83 (1.03)	6.08 (1.16)	5.92 (1.44)	**System Capabilities**			
Arrangement of information	6.00 (1.28)	6.33 (1.43)	5.92 (1.08)	System Speed	5.50 (1.38)	5.75 (1.14)	5.67 (0.98)
Screen sequencing	5.67 (1.37)	5.58 (1.72)	5.42 (1.31)	System reliability	5.58 (1.16)	6.50 (1.62)	6.42 (1.08)
Next screen sequencing	5.58 (1.16)	6.50 (1.17)	6.33 (0.98)	Correcting Mistakes	6.33 (1.23)	5.00 (1.54)	5.17 (1.64)
Back to previous screen	6.33 (0.98)	5.75 (0.96)	6.00 (0.85)	Designed all levels of users	5.00 (1.35)	5.58 (1.73)	5.75 (1.42)
Terminology & System Feedback				**Navigation**			
Use of terms in interface	5.42 (1.16)	5.58 (1.38)	5.58 (1.16)	Ease of navigation	5.58 (1.50)	6.50 (0.52)	6.50 (0.51)
Messages appeared on the interface	5.08 (1.93)	6.00 (0.95)	5.17 (1.70)	Link to library account	6.50 (0.52)	6.25 (0.96)	6.17 (1.19)
Length of delay between task searching	5.08 (1.73)	5.92 (1.08)	5.17 (1.80)	Back to search screen	5.42 (1.44)	6.50 (0.67)	6.17 (0.94)
Terms on the interface	5.17 (1.75)	6.17 (1.75)	6.08 (1.68)	Navigation from page to page	5.50 (0.80)	5.75 (1.29)	5.5 (1.38)
Error Messages	6.33 (1.77)	6.08 (1.16)	5.83 (1.47)	Arrangement Navigational menus	5.33 (1.56)	7.25 (0.96)	7.00 (1.13)

Overall Satisfaction	**Initial**	**Learning**	**Retention**
	5.75 (0.18)	5.94 (0.23)	5.94 (0.14)

Table 7.6: Subjective satisfaction with the Koha interface

After analysis of the QUIS data, it is revealed that novice users were more satisfied with the interface during learning level than other two levels except correcting mistake. In initial searching, the most favourable responses among novice searchers were related to link to library account (M=6.50, SD=0.52). The least favourable response was designed for all levels of users (M=5.00, SD=1.35). For the novice group, the most favourable response was about arrangement of navigational menus (M=7.25, SD=0.96) in the learning experiment. However, the most negative response was correcting mistakes (M=5.00, SD=1.54). In the retention level, the most favourable response was again arrangement of navigational menus (M=7.00, SD=1.13) and the most negative responses were performing tasks are straightforward and correcting mistakes (M=5.17, SD=1.75). In the initial level, novice users' overall satisfaction was comparatively lower than other two levels. Their overall satisfactions in initial performance, learning and retention sessions were M=5.75, SD=0.18; M=5.94, SD=0.23; and M=5.94, SD=0.14 respectively.

7.2.4 Tests for statistical significance

7.2.4.1 Analysis of variance (ANOVA)

Numerous tests were carried out to check the homogeneity and normality of data before conducting the ANOVA. The homogeneity of variance test for different groups showed that there is not enough evidence to suspect that the variances are unequal. Based on this, it can be observed that the two assumptions regarding the data hold. These are that each group is an independent random sample from a normal population, and the variances of the groups are equal. This makes it possible to perform the analysis of variance. The test was carried out to see the difference in search performance among novices across three experimental conditions.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig
Total Time	Between Groups	323.459	2	161.730	11.355	.000
	Within Groups	470.035	33	14.243		
	Total	793.494	35			
Total Error	Between Groups	321.556	2	160.787	44.963	.000
	Within Groups	118.000	33	3.576		
	Total	439.556	35			
Search Term	Between Groups	3.556	2	1.778	1.725	.194
	Within Groups	34.000	33	1.030		
	Total	37.556	35			
Success Score	Between Groups	49.389	2	24.694	17.525	.000
	Within Groups	46.500	33	1.409		
	Total	95.889	35			

Table 7.7: One way ANOVA for novice's performance across experiments

The results showed there were statistical significant differences in the task completion time and the total error, although there were no significant differences in the success score and the number of search terms used by novice group made among their different experiments.

7.2.4.2 The Kruskal-Wallis test

The Kruskal-Wallis test evaluates whether the population medians on a dependent variable are the same across all levels of a factor. To conduct the Kruskal-Wallis test, using the *K* independent samples procedure, cases must have scores on an independent or grouping variable and on a dependent variable. The independent or grouping variable divides individuals into two or more groups, and the dependent variable assesses individuals on at least an ordinal scale. If the independent variable has only two levels, no additional significance tests need to be conducted beyond the Kruskal-Wallis test. However, if a factor has more than two levels and the overall test is significant, follow-up tests are usually conducted.

	Group	Mean Rank	Chi-Square	Asymp. Sig.	df
Subjective Satisfaction	Initial performance	4.38	2.116	.347	**2**
	Learning	7.50			
	Retention	7.63			

Table 7.8: The Kruskal-Wallis test for satisfaction with the Koha interface

The kruskal- wallis test result showed that there is no statistical significant difference among the novices' satisfaction with the interface across the three experimental conditions.

7.3 Comparison of performance and satisfaction between experienced and novices' learning sessions

This is a comparative analysis of previous experimental test results discussed in Chapter 5 and 6, and the beginning of this Chapter. From the first experiment, experienced users' performance and satisfaction data were obtained, whereas novices' data were gathered from their learning test.

The null hypotheses explored were:

H1 There is no difference between experienced and novices' learning in total time taken to complete search tasks.

H2 There is no difference between experienced and novices' learning in total number of search terms used.

H3 There is no difference between experienced and novices' learning session in total success score of search tasks.

H4 There is no difference between experienced and novices' learning in total number of errors made

H5 There is no difference between experienced and novices' learning in terms of subjective satisfaction with the Koha interface.

7.3.1 Results of the comparison

7.3.1.1 Task completion time

As similar to other usability tests, the time taken to complete each task was rounded the nearest minute. Table 7.9 gives the average time taken to complete each task by both experienced users and novice's learning users. Figure 7.5 shows the distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Learning (*n*=12)	1.45 (0.82)	0.94 (0.32)	0.99 (0.31)	1.67 (1.19)	0.54 (0.21)	1.65 (0.85)	1.53 (0.65)
Experienced (*n*=12)	1.24 (0.44)	1.07 (0.38)	1.61 (0.95)	1.93 (1.24)	0.77 (0.52)	2.37 (1.79)	2.11 (0.85)

Table: 7.9 Means and (standard deviation) of task completion time

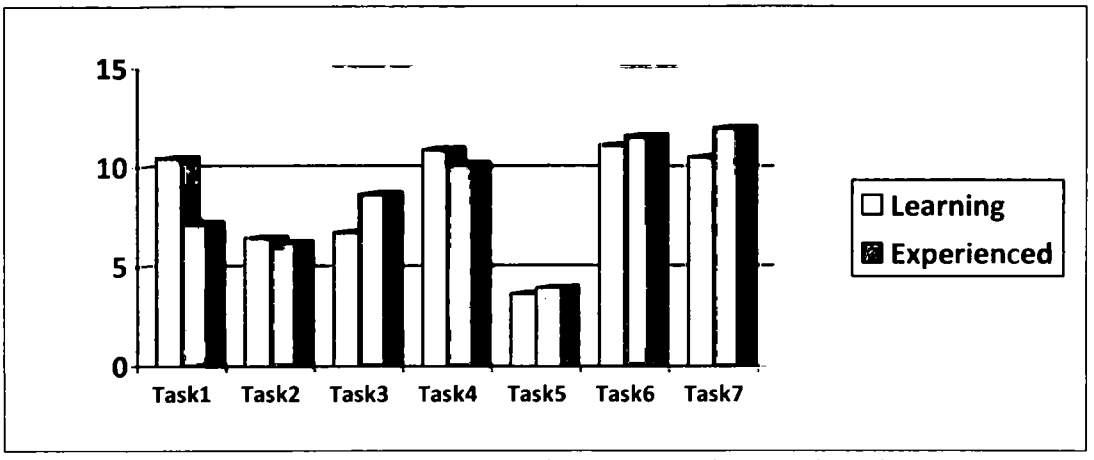


Figure 7.5: Average time taken to complete each task.

This figure showed that in searching the entire tasks novice users in learning test and experienced users took all most same time in completing Task 2, Task 4, Task 5 and Task 6. Some differences were noticed in completing Task 3 and Task 7. Only in case of Task 1, novices took more time than experienced group.

7.3.1.2 Number of search terms used

The number of search terms that were used by novice users in learning session and experienced groups was calculated. Table 7.10 shows the average number of search terms used by each group in completing each search task. Figure 7.6 shows the distribution.

	Task1	Task2	Task3	Task4	Task5
Learning (*n*=12)	1.25 (0.45)	1.00 (0.00)	1.08 (0.29)	2.00 (0.43)	1.00 (0.00)
Experienced (*n*=12)	1.41 (0.66)	1.00 (0.00)	1.25 (0.45)	1.75 (0.62)	1.00 (0.00)

Table: 7.10 Means and (standard deviation) of terms used

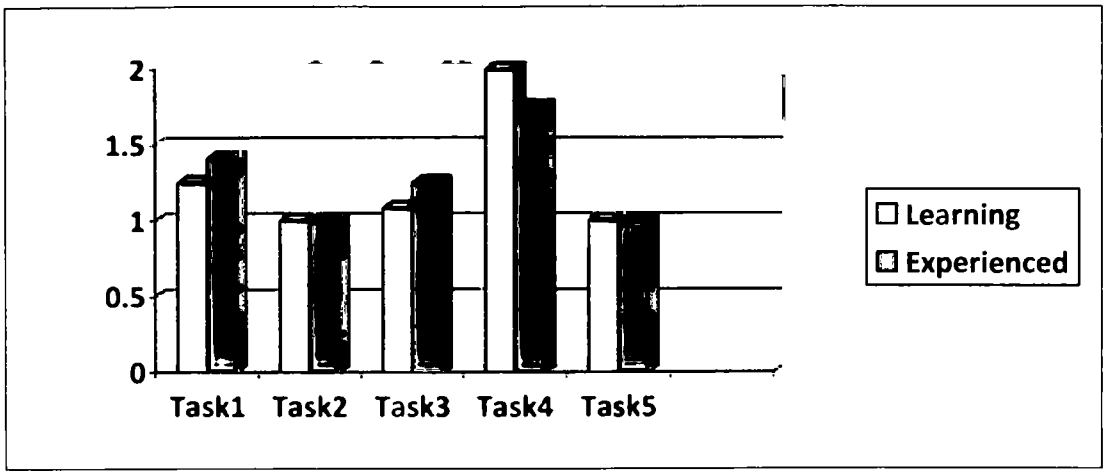


Figure 7.6: Average search terms used

This figure showed that novice group and experienced group used same number of searching tasks in searching two out of five tasks. There were showing some diminutive differences in completing Task 1 and Task 3. Novice group used more search terms in searching Task 4 than experienced group.

7.3.1.3 Success score

Keeping similarity with other usability tests, "success" of a search task was scored as 1 if the search task was successful or 0 if it unsuccessful. No partial credit was given. So, the maximum average success score for a task was 1, if all searchers in the group were successful. The following Table shows the average score by each group. The following figure shows the distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Learning (*n*=12)	0.92 (0.29)	0.58 (0.51)	1.00 (0.00)	0.83 (0.39)	0.92 (0.29)	0.92 (0.29)	0.92 (0.29)
Experienced (*n*=12)	1.00 (0.52)	1.00 (0.45)	1.00 (0.51)	0.58 (0.39)	1.00 (0.49)	1.00 (0.45)	0.75 (0.39)

Table: 7.11 Means and (standard deviation) of success score

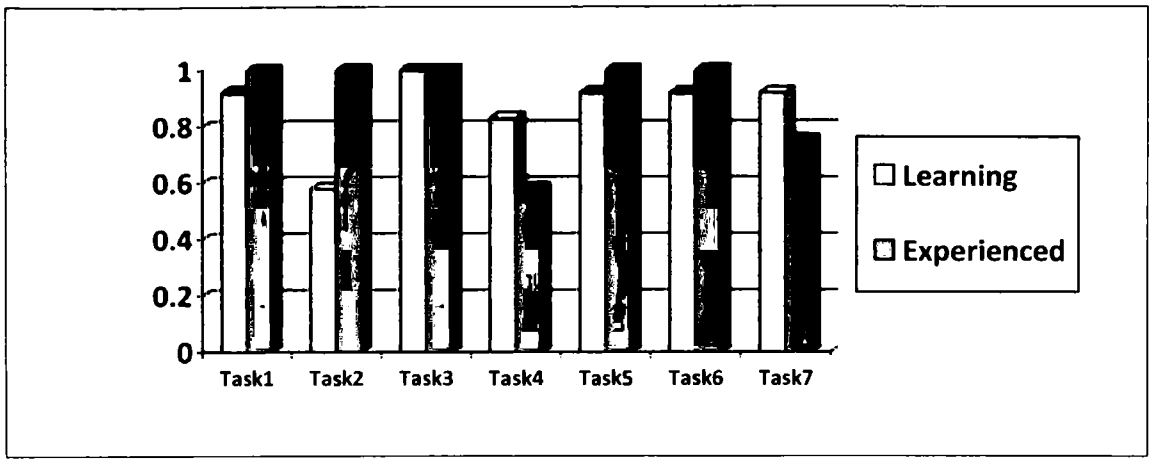


Figure 7.7: Average success score

As can be seen from the Table 7.11 both search group's success score was same in completing Task 3. In completing Task 1, Task 2, Task 5, and Task 6, experienced users were more successful than novice's learning success on average whereas novices were more successful in doing Task 4 and Task 7.

7.3.1.4 Number of errors made

The number of errors made by two search groups was counted separately. Table 7.12 shows the average number of errors made by novice and experienced group. Figure 7.8 shows the actual distribution.

	Task1	Task2	Task3	Task4	Task5	Task6	Task7
Learning (*n*=12)	1.17 (1.34)	0.92 (0.10)	0.25 (0.45)	0.50 (1.00)	0.08 (0.29)	0.42 (0.67)	0.50 (0.10)
Experienced (*n*=12)	0.50 (0.67)	0.33 (0.49)	0.50 (0.79)	1.42 (1.08)	0.08 (0.29)	0.08 (0.29)	0.67 (0.98)

Table: 7.12 Means and (standard deviation) of errors made

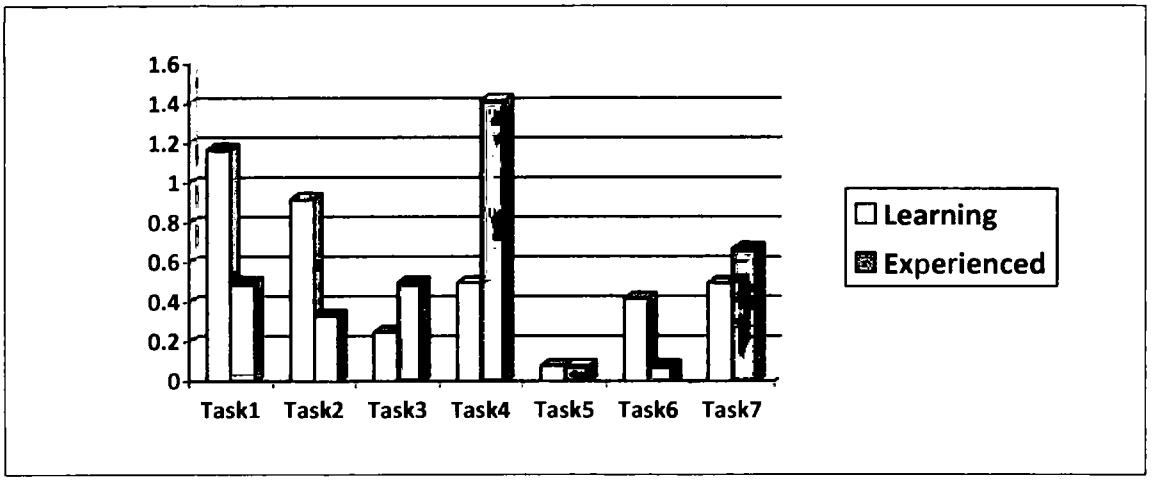


Figure 7.8: Errors made

The novice group made more errors in completing three out of seven tasks than the experienced group. On the other hand, experienced users also made more errors in completing three out of seven tasks. Both groups of users made the same number of errors in completing Task 5.

Table 7.13 presents the overall comparison of performance data between experienced searchers and novices' learning session.

	Time taken (mins.)	Search terms	Success score	Number of error
Learning	8.76	6.33	5.10	3.83
Experienced	11.11	6.42	6.33	3.58

Table: 7.13 Overall performance data

On average, the novice group took 8.76 minutes to complete all search tasks after learning, whereas experienced group took 11.11 minutes. In terms of number of different search terms used, the novice group used 6.33 search terms on average while the experienced users used 6.42 search terms. Overall, experienced users were more successful than the novice searchers. Experienced group scored 6.33 overall, whereas novice group scored 5.10. The novice group made 3.83 errors overall to complete search tasks whereas experienced users made 3.58 errors.

7.3.1.5 Subjective satisfaction with Koha

Means and standard deviations (in parentheses) of data collected through the Questionnaire for User Interface Satisfaction (QUIS) are shown in Table 7.14. Participants rated their satisfaction with Koha on a 7-point scale.

467586

Question	Learning (*n*=12)	Experienced (*n*=12)	Question	Learning (*n*=12)	Experienced (*n*=12)
Overall reactions			**Learning**		
Terrible vs. Wonderful	6.08 (1.16)	6.17 (0.83)	Learning to operate the interface	6.17 (1.19)	6.08 (1.00)
Frustrating vs. Satisfying	6.17 (0.94)	6.25 (0.75)	Exploring new features by trial and error	6.08 (0.90)	5.50 (1.17)
Difficult vs. Easy	5.83 (1.47)	6.00 (1.21)	Number of steps per task	5.83 (1.47)	5.67 (0.99)
Rigid vs. Flexible	5.67 (1.43)	6.00 (0.95)	Learning Advanced features	6.08 (1.00)	5.33 (1.67)
Screen			Time to learn to use the interface	5.51 (1.68)	5.75 (1.21)
Character on the interface	5.92 (1.08)	6.17 (0.94)	Performing tasks are straight forward	5.67 (1.07)	6.00 (1.04)
Amount of displayed Information	6.08 (1.16)	6.08 (0.90)	**System Capabilities**		
Arrangement of information	6.33 (1.43)	6.00 (0.74)	System Speed	5.75 (1.14)	5.33 (1.30)
Screen sequencing	5.58 (1.72)	5.33 (0.98)	System reliability	6.50 (1.62)	6.50 (0.90)
Next screen sequencing	6.50 (1.17)	5.50 (0.80)	Correcting Mistakes	5.00 (1.54)	5.92 (1.38)
Back to previous screen	5.75 (0.96)	6.08 (1.16)	Designed all levels of users	5.58 (1.73)	6.33 (0.89)
Terminology & System Feedback			**Navigation**		
Use of terms in interface	5.58 (1.38)	5.83 (0.72)	Ease of navigation	6.50 (0.52)	6.17 (0.72)
Messages appeared on the interface	6.00 (0.95)	5.42 (1.24)	Link to library account	6.25 (0.96)	6.50 (1.00)
Length of delay between task searching	5.92 (1.08)	5.83 (1.11)	Back to search screen	6.50 (0.67)	6.17 (1.19)
Terms on the interface	6.17 (1.75)	5.92 (1.00)	Navigation from page to page	5.75 (1.29)	5.75 (1.60)
Error Messages	6.08 (1.16)	6.08 (1.78)	Arrangement of Navigational menu	7.25 (0.96)	5.67 (0.98)
Overall Satisfaction			**Learning**	**Experienced**	
			5.94 (0.23)	**6.11 (0.13)**	

Table 7.14: Subjective satisfaction with Koha

The subjective satisfaction questionnaire showed that novice group's most favourable response was related to link to library account (M=7.5, SD=0.96), and the lowest response was for correcting mistakes (M=5, SD=1.54). For the experienced group, the most favourable responses was about link to library account (M=6.5, SD=0.52), in term of overall subjective satisfaction, experienced searchers' (M=6.11, SD=0.13) were comparatively more satisfied than the novices' learning session (M=5.94, SD=0.23).

7.3.2 Statistical significance result for the independent sample *t*-test

Similar to previous usability test discussed in Chapter 5, numerous tests were conducted to check the normality of data before conducting the *t*-tests.

7.3.2.1 Task completion time

The following Table shows the summary of the results between the novice and experienced searchers in terms of total task completion time.

	Learning Mean S.D.	Experienced Mean S.D.	*t*-value	df	2-tailed sig.
Task Time	8.77 2.74	11.11 3.84	-1.725	22	.099

Table 7.15: Independent sample *t*-test for task completion time

The result showed that there was no significant difference in total time taken to complete search tasks between novices' learning and experienced searchers. Therefore, the hypothesis (H1) was accepted.

7.3.2.2 Search terms used

Table 7.16 shows the summary of the results of the comparison between novices' learning and experienced searchers in total number of different search terms used.

	Learning Mean S.D.	Experienced Mean S.D.	*t*-value	df	2-tailed sig.
Search Terms Used	6.16 -.389	6.42 1.16	.705	22	.488

Table 7.16: Independent sample *t*-test for search terms used

The results showed that there was no significant difference in total number of different search terms used by novice learning and experienced searchers (H2).

7.3.2.3 Success score

Table shows the summary of the results of the comparison between novice learning and experienced searchers in success score.

	Learning Mean S.D.	Experienced Mean S.D.	*t*-value	df	2-tailed sig.
Success Score	6.08 0.67	6.33 0.78	.844	22	.408

Table 7.17: Independent sample *t*-test for success score

The results showed that there was no significant difference between novices' learning and experienced searchers in terms of success score. Thus, the null hypothesis (H3) was accepted.

7.3.2.4 Number of errors made

Table 7.18 shows the summary of the results of the comparison between novice learning and experienced searchers with respect to total number of errors made.

	Learning Mean S.D.	Experienced Mean S.D.	*t*-value	df	2-tailed sig.
Errors made	3.83 1.80	3.58 1.24	-.396	22	.696

Table 7.18: Independent sample *t*-test for number of errors made

The results showed that there was no significant difference between novice learning and experienced searchers in terms of total number of errors made. Thus, the null hypothesis (H4) was accepted.

7.3.3 Statistical significance result for the Mann-Whitney *u*-test

Similar to experiment discussed in Chapter 5, Mann-Whitney *U*-test was carried out to test the significance of difference between novices' learning test and experienced searchers regarding overall subjective satisfaction with Koha interface. The result of the test is shown in Table 7.19.

	Group	Mean Rank	Sum of Rank	Mann-Whitney *U*	Asymp. Sig. (2-tailed)
Subjective Satisfaction	Learning	3.63	14.50	4.500	.306
	Experienced	5.38	21.50		

Table 7.19: Mann-Whitney *U*-test for satisfaction with Koha

The results showed that there was no significant difference between novices' learning and experienced searchers in terms of subjective satisfaction with the Koha interface (H5).

7.4 Conclusion

This Chapter showed the comparative analysis of novices' search performance and satisfaction across three search sessions (initial performance, learning and retention), and also made comparison between novices' learning and experienced search sessions. The next Chapter will discuss and summarize the results of this research.

Chapter 8:

Discussion and Conclusion

8.1 Introduction

This Chapter discusses the result of the usability tests with Koha interface. The overall findings of this research indicate that Koha interfaces are designed with usability in mind and are extremely user-friendly.

8.2 Koha interfaces - positive features

After attending the usability tests, both novice and experienced participants gave some unique but common positive features about the Koha interfaces. Most of the users agreed that Koha provided a user-friendly interface to search for library resources. They mentioned that the system was generally usable and was not difficult to learn as a beginner. Some of the users noted the systems as flexible. They commented that there is a range of input options available to address the typical needs of the users.

Users were generally satisfied with the navigation, graphics and layout of the Koha interface. The OPAC screen has the provision for searching title, keywords, author, subject, class or document type and item number. Most users liked the OPAC options, although many naive searchers had no idea about ISBN and call number.

Novice users had no idea about any kind of library software and its features, they commented on the search facilities of Koha interfaces. Novices searched the tasks and after getting the search results they were impressed by the refine search and relevance options. These two options helped them to find other relevant items on the topics which are available in the library. Users, especially novice users, were highly satisfied with the library account and hold options. They noted that these options were helpful. Some of them are computer science students, and they praised the Koha interface for providing these facilities.

Some experienced users commented on Koha home page. They commented that the Koha home page provided all necessary information about where to search for library resources and how to log in to library account. They mentioned the interface followed standard conventions, and most information appeared in a natural and logical order. The use of graphics was also conservative, minimizing the time needed to download pages. They commented that patrons can view a bibliographic record in the online catalogue and also can see whether the book has been checked out and when it is due back to be back to the library. They commented that they did not have any difficulty finding the status of a book. They can easily identify the call number and the location of an item.

In the experiments, users were asked to carry out five search tasks, hold book and give purchase suggestion. Some novice and experienced searchers were interested about cart, list, and browse by hierarchy, and browse by author, title, tag cloud, subject cloud, and most popular and other options of the Koha interface. Whenever novice users log in to their account, they saw there were the options for their search history, overdue fines, and their personal history. They said that they did not know such kinds of features are available in library software. They were also pleased to see that they can renew their borrowed item easily.

8.3 Koha interfaces: negative features

Participants also mentioned some negative features about Koha interface. Some of novice users argued that Koha interface should be easier for the beginners. As they had no knowledge of any kind of integrated library system or online public access catalogue, they said if there was a manual searching it would be better for novice users. It was noticed that most novice participants made spelling mistakes at least once in their search sessions. After finishing the tests, they complained that there was no spelling suggestion and therefore they faced problem during the search experiments.

Some participants commented about the use of Boolean operators. They mentioned that users must know about Boolean operators to get the most out of the Koha

interface. Although the Boolean search option is available as default in the advanced search, they also wanted to see Boolean option in basic searching.

Novice users were unaware about the hold option in the Koha interface. They did not know that the hold option is only for unavailable book in the library, and the users cannot hold any issued book. In this study, there was a task on holding a book. All novice users in their first experiment were unsuccessful in did this task. In the first experiment, novices had no idea about how to give purchase suggestion. After their first experiment, they suggested that a brief tutorial on the management of library account functionalities would be useful.

Experienced users commented that they were unsure about how to search different language books. They suggested adding an option for searching different language materials in the Koha interface. They also noted that using Boolean operators in general search option sometimes gave irrelevant result list. Clicking on relevance for narrowing down the search result also caused inconsistent results.

8.4 Discussions of the results

The overall result of the study showed the performance and satisfaction with the Koha interface by both novice and experienced groups. The novice user participated in three occasions. The primary goal of the tests was to determine how effectively users were able to understand and use the Koha interface.

8.4.1 Tasks analysis result

Vocabulary problem in information retrieval occurred at least once for all novice and experienced participants. They entered a variety of terms to represent the same concept, and the terms chosen affected the outcome of the search task. For example, Task 1 required finding the book on marketing management by Philip Kotler. Some users, especially novice users, did spelling mistakes and they did not get any result. Most of the novice users added prepositions to search their assigned task, i.e., marketing management of Philip Kotler or Marketing Management by Philip

Kotler. After the first usability test, a short training was given to the novice users on how to search the Koha interface. However, some novice users repeated the mistakes in the successive tests.

The second task was to find the book titled *Introduction to business* and to collect its call number. For experienced users, it was very easy. On the other hand, novices found this task very difficult during their initial performance test as they had no idea about call number. Most novice users entered the second task as it is, for example, introduction to business and collect its call number. However, most novices were successful after the training and they did not repeat this mistake in the second and third experiments.

The third task was to find a book on molecular biology or molecular biotechnology. Both novice and experienced groups were confused about how to search for this task. When they got the result list, they also could not explain which would be the exact result. However, almost all of them were successful in searching the Task 3.

The fourth task was comparatively difficult than the first three tasks. To complete this task, all users took more time, did more mistakes, used more search terms, and were less successful than the others tasks. In completing this task, users were asked to use advanced search option to search a book on climate change by Ainun Nishat. But some users did not use advanced searched option. In general search option, they tried this search. Those users who used advanced search option, some of them could not use the interface properly. They did mistakes repeatedly, and only a few users were successful in this task.

The fifth task was very easy for both groups. They were comparatively more successful in this task. The task was to find out the books by Richard T. Schaefer. Some of the users did not select author option to search this task. However, both novice and experienced groups took least time, did lowest number of errors, and were most successful in completing this task.

The last two tasks (task 6 and task 7) were related to functionality of the Koha interface. The sixth task required users to give purchase suggestion. In the initial performance experiment, novice users went to their respective library accounts but could not understand how to give purchase suggestion. Some novice users wrote down the purchase suggestion in general search box. Some experienced users also did this mistake. Overall, experienced users had knowledge on how to give purchase suggestion and most of them were successful in this task. After learning the procedure for purchase suggestion, most novice searchers performed this task successfully in their second and third experiments.

The last task was difficult for both novice and experienced users across the experiments. In this task, users were told to hold a book from library catalogue using their own library account. For novices in general and for some experienced users, it was found difficult. They tried to hold available book which was not the right way. Experienced users who knew about this task, they tried once or twice and finally they succeeded. But novice users were not successful in this task in their initial experiment. However, some novices were successful in completing this task in the learning and retention sessions.

8.4.2 Test for statistical significance

8.4.2.1 First experiment

The main aim of the first experiment was to see the difference between novice and experienced users in terms of performance and satisfaction with the Koha interface. The results showed that the novice group took more time, made more error and was less successful compared with experienced users. , but in terms of search terms used all of the tasks experienced users were not former. In completing task one and four they used more terms.

The independent sample *t*-test results showed significant performance differences subsist between novice and experienced searchers in terms of total time, total error

and success score. However, there were no significant differences in search terms used between the two groups.

It was expected that users who are more proficient with the system are more likely to be satisfied with the user interface (Simon *et al.*, 1996). The Mann- Whitney test result, however, showed that there were no significant differences between the groups in terms of their subjective satisfaction with the interface.

8.4.2.2 Second experiment

This experiment was carried out to see whether there are any difference exists between novice users' learning and retention sessions. After the learning test, novices were requested not to use Koha interface for a month. The aim was to see how much they can remember after the learning session. They followed the instruction, and after one month they came back for the retention experiment.

The related *t*-test result showed that there were no significant differences between learning and retention. It was evident that the brief training made them successful searchers. Their search performance was almost same in both sessions. The Wilcoxon Matched Pairs test for subjective satisfaction also showed no significant difference between the sessions.

8.4.2.3 Comparison of novices' performance and satisfaction across three search sessions

The aim of this comparison was to find out the differences in novices' search performance and satisfaction across the three experimental conditions: initial performance, learning and retention levels. At the initial level, novices' had no idea about how to search Koha interface or any kind of library software. They participated in the usability test, and overall they took longer time, and were less successful in performing the search tasks. After the initial session, they received hands-on training on Koha. They took part in the learning session and after 20-minutes of training they performed comparatively better. The retention test was carried out to see how far the novices' could remember the interface after their learning session.

The Analysis of Variances (ANOVA) results showed that there were significant differences in terms of time taken, success scores and errors across the three experimental conditions. For subjective satisfaction, novices completed the QUIS questionnaire after each test session. The Kruskal-Wallis test results showed that there was no significance among the initial performance, learning and retention levels.

8.4.2.4 Comparison of the novices' searching after learning and experienced users searching

The purpose of this comparison is to see the differences between novices' performance after learning to use the interface and the experienced searchers. It is true that there were some differences but the overall difference was not significant. The independent sample *t*-test results showed that there were no significant differences in terms of task completion time, search terms used, success score and numbers of errors made. For subjective satisfaction, Mann Whiteney test results also showed no significant difference between their ratings with the interface

8.5 Conclusion

From the analysis of the results, it can be said that Koha has a user-friendly interface. The results indicate that there were statistical significant differences between novice and experienced users' in terms of time, success score and number of error made, and experienced users were more successful than novice users. It is clear that in order to a successful searcher, a user should have some knowledge about Koha interface. That means for an entry level user, Koha should be easier and there should be a manual on how to do search. The test results showed that many experienced users were also unsuccessful in completing the tasks. This suggests that Koha interface also had some difficulties for the experienced group. It was found that the experienced group faced problem using advanced search option and holding books. They also suggested adding a user manual and spelling suggestions option. It was significant that after gaining knowledge on Koha interface novice group did better in their learning session. In the comparative analysis, novice users remembered the interface, and their success score was higher than the initial performance and the learning sessions. It is remarkable that both novice and experienced searchers were satisfied with the interface. However, in order to be successful Koha interface needs some modification to keep in mind users' needs and their expectations.

Dhaka University Institutional Repository

Chapter 9:

Limitations and Future Research Directions

9.1 Introduction

This Chapter discussed the limitations, future research directions and conclusion of the research. This research was intended to find out the differences between novice and experienced users and also to discover if there are any differences existed in search performance and satisfaction among the novice users in terms of their initial performance, learning and retention levels.

9.2 Limitations

This research had several limitations in terms of designing the usability experiments. The usability tests were conducted only with several participants at BRAC University. It was difficult to recruit participants, especially the novices for the experiments. However, the number of participants was adequate to obtain statistically sound results.

Another limitation was that the participants were undergraduate and postgraduate students at BRAC University. Recruitment of other user groups such as research students or faculty members as participants of this study might yield more sound results from this study.

The search tasks used in the experiments were chosen from a user survey at BRAC University. Several participants, especially naive users complained that the search tasks were too complicated. On the other hand, some experienced users opined that the tasks were very easy and they thought that most users should be able to do the searches.

Internet speed was another limitation. During the experiments, most participants complained about the slow internet speed and several users gave up the search tasks due to time constraints.

Dhaka University Institutional Repository

9.3 Future research directions

This is the first time an effort has been made to measure the usability of Koha using real tasks and real users. It is believed that this research will trigger more research on the usability of similar systems using more diverse group of users and tasks. Future research should also accommodate more variations in terms of participants' demographic and individual characteristics.

This research work is largely based on Koha's default OPAC interface. Researcher should carry out similar experiments with customized Koha interface which could result in more usable interfaces.

Task analysis is essential to create a better adaptation between a user's knowledge, tasks and goals. Researchers' needs to explore what are the different kinds of tasks and how they affect user behavior. This research recognized the tasks from a user survey. More such task-oriented research is needed.

In many usability experiments, transaction logs were used together with screen recording and questionnaire methods. Future research should employ transaction logging to automatically capture user's performance data. Researchers can also use other usability evaluation methods such as guidelines review, heuristic evaluation and cognitive walkthrough to develop more user-centered interfaces.

Dhaka University Institutional Repository

9.4 Conclusion

At the beginning of this study, there were discussions on library technology, library software, open source integrated library systems, etc. From the findings of this study it can be said that usability of an integrated library system like Koha is not easy to be measured. The effectiveness or user-friendliness of an open source integrated library system depends on its usability. Koha is the first open source integrated library system which is being used by millions of users worldwide today. It is believed that this study will encourage other researchers to conduct usability studies with similar systems and interfaces.

References:

Ahmed, S. M. Z. (2004). A study of users' performance and satisfaction with the Web of Science IR interface. *Journal of Information Science*, *30*(5), 459-468.

Ahmed, S. M. Z. (2005). A study of learning and retention with a web-based IR interface. *Journal of librarianship and information science*, *37*(1), 7-16.

Ahmed, S. M. Z. (2006). A user-centred design and evaluation of IR interfaces. *Journal of Librarianship and Information Science*, *38*(3), 157-172.

Ahmed, S. M. Z. (2008). A comparison of usability techniques for evaluating information retrieval system interfaces. *Performance Measurement and Metrics*, *9*(1), 48-58.

Ahmed, S. M. Z. (2013). A survey of students' use of and satisfaction with university subscribed online resources in two specialized universities in a developing country. *Library Hi Tech News*, *30*(3), 6-8.

Allen, M. (2002). A case study of the usability testing of the University of South Florida's virtual library interface design. *Online Information Review*, *26*(1), 40-53.

Anuradha, K. T., Sivakaminathan, R., & Kumar, P. A. (2011). Open-source tools for enhancing full-text searching of OPACs: Use of Koha, Greenstone and Fedora. *Program: electronic library and information systems*, *45*(2), 231-239.

Augustine, S., & Greene, C. (2002). Discovering how students search a library web site: a usability case study. *College & Research Libraries*, *63*(4), 354-365.

Ballard, T., & Blaine, A. (2011). User search-limiting behavior in online catalogs: comparing classic catalog use to search behavior in next-generation catalogs. *New Library World*, *112*(5/6), 261-273.

Batchelor, C., Chow, L., Matthias, C., & Rutner, J. (2010). Accessibility / Usability survey of the American Library Association (ALA) Website. *American Library Association,* 1-19.

Battleson, B., Booth, A., & Weintrop, J. (2001). Usability testing of an academic library web site: a case study. *The Journal of Academic Librarianship*, *27*(3), 188-198.

Bente, B., Rathje, D., Mcgrory, M., Pollitt, C., Rathje, B. D., Pollitt, C., & Owen, V. (2005). Designing and Building Integrated Digital Library Systems - Guidelines. *International Federation of Library Associations and Institutions,* IFLA Professional Reports, No. 90, 1-65.

Borgman, C. L. (2003). Designing digital libraries for usability. In Bishop, A.P.; Van House, N.: & Buttenfield, B.P. (Eds.), *Digital Library Use: Social Practice in Design and Evaluation* (pp. 85-118).Cambridge, MA: The MIT Press,

Breeding, M. (2008). Chapter 1: Open Source Library Automation. *Library Technology Reports*, *44*(8), 5-10.

Bretthauer, D. (2001). Open source software in libraries. *Library Hi Tech News*, 18(5), 8-9.

Chang, N., & Tsai, Y. (2009). An evaluation of multi-language/multi-script functions in KOHA. In *World Library and Information Congress: 75th IFLA General Conference and Council*, August 23-27, 2009, Milan, Italy. Retrieved December 15, 2011, from http://www.ifla.org/files/hq/papers/ifla75/135-chang-en.pdf

Chawner, B. (2005, May). F/OSS in the library world: an exploration in ACM SIGSOFT KOHA, *Software Engineering Notes,* 30 (4), 1-4.

Chowdhury, S., Landoni, M., & Gibb, F. (2006). Usability and impact of digital libraries: a review. *Online Information Review*, *30*(6), 656-680.

Denton, W., & Coysh, S. J. (2011). Usability testing of VuFind at an academic library. *Library Hi Tech*, *29*(2), 301-319.

Denton, W., & Coysh, S. J. (2011).Usability Testing of VuFind at an Academic Library, *Library Hi Tech*, *29*(2), 301-319.

Denton, W., & Coysh, S. J. (2011).Usability testing of VuFind at an academic library, *Library Hi Tech, 29(2),* 301-319.

Dickstein, R., & Mills, V. (2000). Usability testing at the University of Arizona library: how to let the users in on the design. *Information technology and libraries*, *19*(3), 144-51.

Dumas, J. S., & Redish, J. C. (1999). *A Practical Guide to Usability Testing*. Westport: Greenwood Publishing Group Inc.

Egunjobi, R. A., & Awoyemi, R. A. (2012). Library automation with Koha. *Library Hi Tech News*, *29*(3), 12-15.

Emanuel, J. (2011). Usability of the VuFind next-generation online catalog. *Information Technology and Libraries*, *30*(1), 44-52.

Espiau-Bechetoille, C., Bernon, J., Bruley, C., & Mousin, S. (2011). An example of inter-university cooperation for implementing Koha in libraries: collective approach and institutional needs. *OCLC Systems & Services*, *27*(1), 40–44.

Eyler, P. (2003). Koha: a gift to libraries from New Zealand. *Linux Journal*, *2003*(106), 1.

Fagan, J. C. (2006). Usability testing of a large, multidisciplinary library database: basic search and visual search. *Information technology and libraries*, *25*(3), 140-150.

Fagan, J. C., Mandernach, M. A., Nelson, C. S., Paulo, J. R., & Saunders, G. (2012). Usability test results for a discovery tool in an academic library. *Information technology and libraries*, *31*(1), 83-112.

Foott, S. & Huggard, S. (2006), A usability study of the library catalogue at Monash University Library. Retrieved November 30, 2011, from http:// arrow.monash.edu.au/hdl/1959.1/42818

France, R. K., Nowell, L. T., Fox, E. A., Saad, R. A., & Zhao, J. (1999). Use and usability in digital library search system. Retrieved February 10, 2012, from http://opac3.cc.vt.edu/Papers/Use_usability.html.

Fuhr, N., Tsakonas, G., Aalberg, T., Agosti, M., Hansen, P., Kapidakis, S. & Sølvberg, I. (2007). Evaluation of digital libraries. *International Journal on Digital Libraries*, *8*(1), 21-38.

Ghosh, M. (2009).Information professionals in the open access era: the competencies, challenges and new roles. *Information Development*, *25*(1), 33-42.

Goh, D. H. L., Chua, A., Khoo, D. A., Khoo, E. B. H., Mak, E. B. T., & Ng, M. W. M. (2006). A checklist for evaluating open source digital library software. *Online Information Review*, *30*(4), 360-379.

Graves, S. J. (2006). Usability Testing and Instruction Librarians: a perfect pair, *Internet reference services quarterly*, 11(4), 99-116.

Hammill, S. J. (2003). Usability testing at Florida International University Libraries: what we learned. *Electronic Journal of Academic and Special Librarianship*, *4*(1). Retrieved February 10, 2012, from http://southernlibrarianship.icaap.org/content/v04n01/Hammill_s01.htm

Hofmann, M. a., & Yang, S. Q. (2012). "Discovering" what's changed: a revisit of the OPACs of 260 academic libraries. *Library Hi Tech*, *30*(2), 253-274.

Islam, M. M., & Ahmed, S. Z. (2011). Measuring Dhaka University students' perceptions of ease-of-use and their satisfaction with University Library's online public access catalogue. *Performance Measurement and Metrics*, *12*(3), 142-156.

Islam, M. S., Alam, M. S., & Sultana, S. (2012). Access and usage of electronic journals in Dhaka University Library (DUL): an empirical study. *Journal of the Bangladesh Association of Young Researchers*, *1*(2), 30–47.

Ivory, M. Y., & Hearst, M. A. (2001). The State of the Art in Automating Usability Evaluation of User Interfaces. *ACM Computing Surveys*, *33*(4), 470–516.

Jacso, P. (2003). Search softwares in libraries. *Computers in Libraries*, *53.*

Jeng, J. (2005). Usability assessment of academic digital libraries: effectiveness, efficiency, satisfaction, and learnability. *Libri*, *55*(2-3), 96-121.

Jeng, J. (2013). What is usability in the context of the digital library and how can it be measured. *Information technology and libraries*, *24*(2), 47-56.

Johnson, F. C., & Craven, J. (2010). Beyond usability: the study of functionality of the 2.0 Online Catalogue (OPAC). *New Review of Academic Librarianship*, *16*(2), 228-250.

Jones, A. and Cynthia N. (2011). Comparing Open Source Integrated Library Systems. *LIBR 551: Library Automation & Systems.* Retrieved March 05, 2012, from http://cynng.files.wordpress.com/2011/11/551-koha-evergreen-comparison-final.pdf

Kaner, C., & Fiedler, R. (2005). Testing library web sites for usability. *Knowledge Quest*, *33*(3), 29-31.

Keast, D. (2011). A survey of Koha in Australian special libraries: open source brings new opportunities to the outback. *OCLC Systems & Services*, *27*(1), 23-39.

Keats, D. (2009). Free and Open Source Software for librarians and libraries. *Innovation*, *36*, 1-6.

Koha Developer Wiki. (2007). Koha users around the world. Retrieved December12, 2011, from http://wiki.koha.org,/doku.php?id=kohausers

Krishnamurthy, M. (2008). Open access, open source and digital libraries: a current trend in university libraries around the world. *Program*, *42*(1), 48-55.

Kaul, Sangeeta (2010). Open source ILS software: Koha an experience [ppt file]. Retrieved December 03, 2013, from www.naclin.org/KohaPresentation 2010. ppt.

Lee, J. M. (2004). Usability assessment of integrated cataloging and metadata services: an exploratory study of the OCLC Connexion system (Doctorall dissertation, The Florida State University, 2007). Retrieved March 04, 2012, from http://diginole.lib.fsu.edu/etd/3201/.

Lochhaas, S., & Moore, M. (2010). Open Source Software Libraries. *SLIS Journal B Sides,* 17, 1-14.

Manzari, L., & Trinidad-Christensen, J. (2013). User-centered design of a web site for library and information science students: Heuristic evaluation and usability testing. *Information technology and libraries*, *25*(3), 163-169.

McGinnis, W., & Ransom, J. (2010). Kete and Koha: integration built on open standards. *OCLC Systems & Services*, *26*(2), 114-122.

McMullen, S. (2001). Usability testing in a library web site redesign project. *Reference Services Review*, *29*(1), 7-22.

Mitcehll, E., & Gilbertson, K. (2008). Using open source social software as digital library interface. *D-Lib Magazine*, *14*(3), 6.

Morgan, E. L. (2003). Open Source Software in Libraries: A Workshop. *Infomotions.* Retrieved January 2012, from http://infomotions.com.

Morshed, M. (2008). *Open source library management system* (Masters Dissertation, School of Engineering and Computer Science (SECS), BRAC University, 2008). Retrieved December 20, 2011, from http://dspace.bracu.ac.bd/bitstream/handle//10361/176/Open%20source%20library%20management%20system.pdf?sequence=1

Müller, T. (2011). How to choose a free and open source integrated library system. *OCLC Systems & Services*, *27*(1), 57-78.

Neelakandan, B., Duraisekar, S., Balasubramani, R., & S, S. R. (2010).Implementation of aAutomated library management system in the School of Chemistry Bharathidasan University Using Koha Open Source Software. *International Journal of Applied Engineering Research, 1*(2), 149-167.

Nichols, D. M., Thomson, K., & Yeates, S. A. (2001, July). Usability and open-source software development: in proceedings of the symposium on computer human interaction. *Association for Computing Machinery, 49-54,* Retrieved March 20, 2012, from http://dx.doi.org/10.1145/2331812.2331822.

Nielsen, J., and Landauer, T. K. (1993). A mathematical model of the finding of usability problems. *Proc. ACM INTERCHI'93 Conf.* (Amsterdam, the Netherlands, 24-29 April), 206-213. Retrieved from http://people.cs.uct.ac.za/~ dnunez/reading/papers/p206-nielsen.pdf.

Nicole, Engard (2012). Koha 3.2 manual. Water Solutions/BibLibre. Retrieved Januaray 03, 2012, from http://docs.prosentient.com.au/prosentientjspui/ handle/1/79

Norlin, E., & Winters, C. (2002). *Usability testing for library web sites: a hands on guide.* Chicago: American Library Association. 4-5.

Olmsted-Hawala, E. L., Murphy, E. D., Hawala, S., & Ashenfelter, K. T. (2010, April). Think-aloud protocols: a comparison of three think-aloud protocols for use in testing data-dissemination web sites for usability. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems,* 2381-2390. Retrieved February 20, 2012, from http://dl.acm.org/citation.cfm?id=1753685.

Pandey, Shri Ram, and Singh, Pankaj Kumar, (2011). Enabling ILAP as Digital Library Software: A case study with KOHA, *8th International CALIBER.* Retrieved January 03, 2012, from http://ir.inflibnet.ac.in/dxml/bitstream/handle/1944/ 1616/26.pdf?sequence=1

Payne, A., & Singh, V. (2010). Open source software use in libraries. *Library Review*, *59*(9), 708-717.

Poulter, A. (2010). Open source in libraries: an introduction and overview. *Library Review*, *59*(9), 655-661.

Raza, A., Capretz, L. F., & Ahmed, F. (2012). Usability bugs in open-source software and online forums. *IET software*, *6*(3), 226-230.

Reidsma, Matthew (2011). GVSU Libraries Website Usability Testing. Retrieved February 05, 2012, from matthew.reidsrow.com/files/ GVSU_Test_Protocol.pdf.

Ruzegea, M. (2012). The Usability of OPAC Interface Features: The Perspective of Postgraduate Students at International Islamic University Malaysia (IIUM). *Library Philosophy and Practice,* Paper691. Retrieved January 03, 2013, from http://digitalcommons.unl.edu/ libphilprac/691.

Sadler, E. (Bess). (2009). Project Blacklight: a next generation library catalog at a first generation university. *Library Hi Tech*, *27*(1), 57-67.

Samoladas, I., & Stamelos, I. (2003). Assessing free/open source software quality. *Free Open Source research Community*. Retrieved February 12, 2012, from http://opensource.mit.edu/

Seffah, A., Donyaee, M., Kline, R. B., & Padda, H. K. (2006). Usability measurement and metrics: a consolidated model, *Software Quality Journal*, *14*(2), 159-178.

Shneiderman, B. (2000). Universal usability. *Communications of the ACM*, *43*(5), 84-91.

Singh, M. (2012). Open source integrated library management systems: comparative analysis of Koha and NewGenLib. *The Electronic Library, 30*(6), 809-832.

Sonker, S. K., & Jayakanth, F. (2003). KOHA: an open source integrated library automation system. *SRELS Journal of Information Management*, *40*(2), 135-146.

Tam, W., Cox, A. M., & Bussey, A. (2009). Student user preferences for features of next-generation OPACs: a case study of university of Sheffield international students. *Program: electronic library and information systems*, *43*(4), 349-374.

Thomas, B., & Buck, S. (2010). OCLC's WorldCat local versus III's WebPAC: Which interface is better at supporting common user tasks? *Library Hi Tech*, *28*(4), 648-671.

Tsakonas, G., & Papatheodorou, C. (2008). Exploring usefulness and usability in the evaluation of open access digital libraries. *Information Processing & Management*, *44*(3), 1234-1250.

Van den Haak, M. J., de Jong, M. D., & Schellens, P. J. (2004). Employing think-aloud protocols and constructive interaction to test the usability of online library

Dhaka University Institutional Repository

catalogues: a methodological comparison. *Interacting with Computers*, *16*(6), 1153-1170.

Van den Haak, M., De Jong, M., & Jan Schellens, P. (2003). Retrospective vs. concurrent think-aloud protocols: testing the usability of an online library catalogue. *Behaviour & Information Technology*, *22*(5), 339–351.

Vasupongayya, S., Keawneam, K., Sengloilaun, K., & Emmawat, P. (2011). Open source library management system software: a review. *International Science Index,* 5(5), 860-865.

Walls, I. (2011). Migrating from innovative interfaces' Millennium to Koha: the NYU health sciences libraries' experiences. *OCLC systems & services*, *27*(1), 51-56.

Wan, G. (2009). An open source alternative for libraries. *Chinese Librarianship: an International Electronic Journal, 23.* Retrieved December 28, 2011, from http://www.white-clouds.com/iclc/cliej/cl23wan.

Wang, Y., & Dawes, T. A. (2012). The Next generation integrated library system: a promise fulfilled? *Information Technology and Libraries*, 31(3), 76-84.

Dhaka University Institutional Repository

Appendix-1

Search tasks used in the experiments

1. Find a book by Philip Kotler on Marketing Management;
2. Find out a book by the title of Introduction to business and collect its call number;
3. How would you find resources on Molecular Biology or Molecular Biotechnology;
4. Using advanced search option,find out at least one book on climate change written by Ainun Nishat;
5. Find out how many books does the library have by the author Richard T. Schaefer;
6. Give a book purchase suggestion via your library account; and
7. Hold a book from your library account.

Dhaka University Institutional Repository

Appendix-2

Demographic Characteristics of Experienced Participants

Participant	Department	Status	Age (Years)	Gender	Experience with Koha
1.	EEE	9th semester student	23	Male	2 years to more than 3 years
2.	EEE	8th semester Student	21	Female	2 years to more than 3 years
3.	Law	8th semester Student	22	Female	1 year to less than 2 years
4.	English	12th semester Student	23	Female	2 years to more than 3 years
5.	BBA	4th semester student	21	Female	less than 1 year
6.	EEE	9th semester student	24	Male	2 years to more than 3 years
7.	BBA	7th semester student	22	Male	less than 1 year
8.	BBA	12th semester Student	22	Male	2 years to more than 3 years
9.	CSE	9th semester student	22	Female	2 years to more than 3 years
10.	BBA	10th semester Student	22	Male	less than 1 year
11.	BBA	8th semester Student	23	Male	1 year to less than 2 years
12.	English	M.A. Student	29	Female	2 years to more than 3 years

Dhaka University Institutional Repository

Appendix-3

Demographic Characteristics of Novice Participants

Participant	Department	Status	Age (Years)	Gender	Experience with Koha or similar systems
1.	CSE	3rd semester student	19	Male	None
2.	BBA	1st semester Student	18	Male	None
3.	MBA	2nd semester Student	25	Female	None
4.	CSE	3rd semester Student	19	Female	None
5.	CSE	3rd semester Student	19	Male	None
6.	CSE	3rd semester student	18	Female	None
7.	EEE	2nd semester student	21	Male	None
8.	CSE	1st semester Student	20	Male	None
9.	BBA	5th semester student	22	Male	None
10.	CSE	1st semester Student	18	Male	None
11.	Law	4th semester Student	23	Male	None
12.	Economics	1st semester Student	18	Female	None

Dhaka University Institutional Repository

Appendix-4

Open Source Integrated Library System and Usability issues: a study of Koha Interfaces

Questionnaire for user Interface Satisfaction

Student Name: _____

Student ID: _____

Semester: _____

Department: _____

Mobile: _____, **e-mail:** _____

Age: _____, **Gender :** _____

Place of Origin: _____

1. How long have you worked on this system?

__ less than 1 hour
__ 1 hour to less than 1 day
__ 1 day to less than 1 week
__ 1 week to less than 1 month
__ 1 month to less than 6 months
__ 6 months to less than 1 year
__ 1 year to less than 2 years
__ 2 years to less than 3 years
__ 3 years or more

2. On the average, how much time do you spend per week on this interface?

__ less than one hour
__ one to less than 4 hours
__ 4 to less than 10 hours
__ over 10 hours

Dhaka University Institutional Repository

Please circle the numbers, which most appropriately reflect your impressions about using the system. Try to respond to all the items and for items that are not applicable, use: **NA**.

Screen

10. Character on the interface	hard	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	NA
11. Amount of displayed information	inadequate	**1**	**2**	**3**	**4**	**5**	**6**	**7**	adequate	**NA**
12. Arrangement of information	illogical	**1**	**2**	**3**	**4**	**5**	**6**	**7**	logical	**NA**
14. Screen sequencing	confusing	**1**	**2**	**3**	**4**	**5**	**6**	**7**	clear	**NA**
15. Next screen sequencing	unpredictable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	predictable	**NA**
16. Back to the previous screen	impossible	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**

Terminology and System feedback

19. Use of terms throughout the interface	inconsistent	**1**	**2**	**3**	**4**	**5**	**6**	**7**	consistent	**NA**
20. Messages appeared on the interface	inconsistent	**1**	**2**	**3**	**4**	**5**	**6**	**7**	consistent	**NA**
23. Length of delay between task searching	unacceptable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	acceptable	**NA**
24. Terms on the interface	ambiguous	**1**	**2**	**3**	**4**	**5**	**6**	**7**	precise	**NA**

Dhaka University Institutional Repository

24. Error Messages	unhelpful	**1**	**2**	**3**	**4**	**5**	**6**	**7**	helpful	**NA**

Learning

25. Learning to operate the interface	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
26. Exploring new features by trial and error	discouraging	**1**	**2**	**3**	**4**	**5**	**6**	**7**	encouraging	**NA**
27. Number of steps per task	too many	**1**	**2**	**3**	**4**	**5**	**6**	**7**	just right	**NA**
28. Learning Advanced features	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	just right	**NA**
29. Time to learn to use the interface	slow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	fast	**NA**
30. Performing tasks are straight-forward	never	**1**	**2**	**3**	**4**	**5**	**6**	**7**	always	**NA**

System Capabilities

29. System speed	too slow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	fast enough	**NA**
30. System reliability	unreliable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	reliable	**NA**
31. Correcting mistakes	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
32. Designed for all levels of users	never	**1**	**2**	**3**	**4**	**5**	**6**	**7**	always	**NA**

Dhaka University Institutional Repository

Navigation

33. Ease of navigation	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
34. Link to my library account	difficult	1	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
35. Back to search screen	dissatisfied	1	**2**	**3**	**4**	**5**	**6**	**7**	satisfied	**NA**
36. Navigation from page to page	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
37. Arrangement of navigational menus	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**

Technical Manuals

38. Technical manuals are	confusing	**1**	**2**	**3**	**4**	**5**	**6**	**7**	clear	**NA**
39. Amount of help given	inadequate	**1**	**2**	**3**	**4**	**5**	**6**	**7**	adequate	**NA**
40. Accessing Help messages	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**