User Behaviour in Resource Discovery:

Final Report

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Executive Summary

The report discusses the information-seeking behaviour of students and researchers working in the Business and Economics disciplines using subscribed and freely available Internet resource discovery systems in three UK HE institutions: Cranfield University, London School of Economics and Middlesex University. The institutions were chosen as examplars of the Russell Group, the 94 Group, and the Million+ groups of universities in the UK. The intention was to describe and gain a better understanding of: (i) how different users (undergraduates, postgraduates and researchers) currently seek information on the existing resource discovery systems, (ii) the roadmap used in a user's information seeking journey, and (iii) their expectations and needs based on their understanding and experience of using the Internet to find information resources for academic study.

In addition, we hope to inform JISC, publishers of electronic resources, and librarians working in the HE sector about user behaviours and the issues relating to resource discovery systems. The data was obtained from an observational study and in-depth interview of 34 participants. Each participant was studied on an individual basis and each session lasted up to two hours. The analysis of the data provided an insight on: resource discovery systems used by participants and what they found to be useful, users information search behaviour and strategies when seeking information, the issues that affect their searching behaviour, problems and difficulties users experienced with library resources, issues related to physical library services as well as recommendations for the publishers and librarians in order to improve the use of electronic resources.

Main Findings

The key findings are described next.

In the UBiRD study, we find that information literacy is often confused with information technology or digital literacy. Broadly, information literacy is about the abilities to know when to find, to search for, evaluate and make sense of the content. Information technology or digital literacy is about fluency with the procedures and knowledge of the underlying information technology. There is unfortunately some overlap between these definitions as the information that is sought is often contained within the systems. They closely intertwine, such that the way people formulate their queries to find information is highly dependent upon the functionality provided by the information technology. In addition, we have also found that the poor usability, high complexity, and lack of integration of many electronic resource discovery systems, have raised the entry threshold of information technology literacy. This acts as a barrier to information search and retrieval. This higher level of difficulty amongst electronic discovery systems distracts users from focusing on the content, analysis and evaluation that would help them learn and make sense of what they have discovered. In addition, we have also found evidence to suggest that information literacy skills are lacking. For example, at a simplistic level, many of the participants do not understand how to assess the quality of materials they find. Google or Google Scholar have lower thresholds of information technology literacy, and are considered their "… friends" because of the apparent higher yield or success rate. While we acknowledge that information literacy may not be a new or recent problem, the evidence suggests that it continues to be a problem. Being able to operate a search engine, does not mean that one is able to find the good quality information necessary to help us learn and to advance our society.

Students and researchers from Business and Economics use both those subscribed by the library and those freely available on the Internet when seeking information in the academic context. However, when the level of information literacy as well as the domain knowledge increases, there is an increased tendency to use better quality library

resources. The most common library resources used by Postgraduates and Experts in our study were EBSCO, ProQuest or Emerald. Whereas the Library Catalogue and federated search engines (CrossSearch at Cranfield, QuickSearch at London School of Economics and MultiSearch at Middlesex University) were observed to be more popular amongst Undergraduates. When using freely available Internet resources, Google is top of the list, followed by Google Scholar, Wikipedia and YouTube. Participants decisions about which resources to use were based on their prior knowledge and experience with a resource and a belief that resources provided by Google and Google Scholar are reliable and relevant and most of all always return a list of results. On the other hand, library resources were perceived as credible providing a quality material from a broad subject coverage.

Users find database structures hinder. They have to learn the procedural knowledge for using a particular database as well as have some basic knowledge of how the data table is organised and to what subject matter the built-in thesauri refers to, which has limited transferability. The participants did not appear to lack information technology or digital literacy, as they had demonstrated they were able to use other internet-based search and retrieval tools.

The UBiRD study groups very rarely applied only one search strategy (e.g. Simple Search) but their strategy changed during the information seeking process in relation to the results obtained (i.e. refine or re-formulate search, abandon search or resource or change resource). Participants usually carried out combined searches. For instance, re-formulated search where terms or concepts extracted from a document were carried out to pursue a new search. This search was often combined with a link search that gave the opportunity to follow hyper-links and extract new queries that were used as an input for the search terms in multiple fields. This group of users also followed the help suggested by a system (e.g. 'Suggested Topics', or Results by Source'). There are considerable differences between the user groups; and the 'atomic' or basic search components combined during the information seeking activities depend on their level of information literacy and domain knowledge. Expert users are more inclined to use Re-formulated

Search, System Suggestions or Personal Knowledge and Experience, whereas UG groups tend to use more frequently a Link Search. Although, current systems functionally support these forms of searching, transitioning between them is currently not as "seamless" as it should be, making the search and retrieval process difficult and time consuming.

During information seeking activities, the groups we studied used different means of storing the material depending on the stage they were at. At the evaluation of results stage they store material temporarily using the web browser's tabs system. These tabs are then re-visited for quick evaluation and then the information may be stored permanently using other means (e.g. notes in a Word document, save downloaded material into a folder, bookmark using a browser's feature and use more sophisticated features provided by various resource discovery systems such as RefWorks, Endnotes, My Reasearch). The UBiRD study groups did not use the resource discovery systems storage features often, as they were not aware of their existence or how to use them. The current systems lack good ways of storing and retrieving documents allowing the users to create repositories of information that can be accessed easily and be transferable across different resources.

Publishers' embargos on different material raised an important issue for participants. They were irritated and frustrated when a promise to obtain a document was often not met. Cases like this lower the participants' level of trust towards academic resources. These practices of embargoes and 'free for the moment' have encouraged participants to turn to the external sources like Google Scholar, where despite having no promise of the article, and where the scholarly quality cannot be assured, one still has a much higher chance of finding the article to download. The current ways of doing business gets in the way of finding quality scholarly materials through the respective resources discovery systems.

Recommendations

Based on the findings from the UBiRD study we have suggested a number of recommendations that deal with problems and challenges that users faced during the interaction with the library resources. These recommendations relate to the four areas and are summarised below:

1. Usability and effectiveness of the Publishers electronic discovery systems

Since the participants faced a lot of irritation and frustration when trying to use the resources, as their structure, scope and the way they work varied across different resources a standardize platform for all types of resources are required.

Recommendation 1A: Produce a standardised platform for all types of resources

Recommendation 1B: Include spelling auto suggestions

Recommendation 1C: Ensure in-built dictionary or encyclopaedia

Recommendation 1D: Ensure keywords are present in every article

Recommendation 1E: Use Simple Interfaces

Recommendation 1F: Make users aware of changes to database functionality

Recommendation 1G: Address the "time out" issue

Recommendation 1H: Improve facilities to support dynamic searches, retrieval and re-access process

Recommendation 1I: Include facilities for annotation and analytical support functions

2. Usability of the Library's electronic resources discovery systems

As information on the value of using a resource is not always recognised, making it easier for users to identify appropriate resources for their study would improve/increase the usage of the resources. To facilitate this we recommend the following.

Recommendation 2A: Make it easier for users to the identify appropriate resources for their study

Recommendation 2B: Avoid confusion caused by multiple usernames and passwords

Recommendation 2C: Integrate Free Web Resources as part of the Mix in Resource Discovery

Recommendation 2D: Manage user expectations better

3. Poor understanding of the concept, scope and way the resources operate

Since users are not always aware of what information is available, contained, organised or stored, the need for making the underlying database structure visible is of high importance. The current systems need to be designed so that they cater for important but intangible attributes that help users understand them, find their way around, and find the information they require, by making the systems meaningful places, so that routes and access are clearly visible and easily followed allowing the smooth navigation of those systems.

Recommendation 3A: Make the underlying database structure visible
Recommendation 3B: Provide road-sign in virtual information spaces

4. Information and digital literacy

While we acknowledge that information literacy may not be a new or recent problem, the evidence suggests that it continues to be a problem. Being able to operate a search engine, does not mean that one is able to find the good quality information necessary to help us learn and to advance our society. The need for the development of a national strategy with an authoritative body defining the standards of information literacy and promoting good pedagogic practices are of paramount importance.

Recommendation 4A: Develop a coordinated information and digital literacy strategy

CIBER and UBiRD: Similarities and differences

In this section we briefly compare the findings of the CIBER project with those form the UBiRD study. The CIBER project was based on the study of transaction logs based on a very large number of users across the UK. These studies include the NEBO study, the RIN study, the Elsevier 'authors as users' study, and the MaxData study. It highlighted a number of characteristics about the usage of electronic resources during information search and retrieval activities. It was realised that while useful, it could not provide the additional insights that were potentially available through a richer qualitative and descriptive approach such as has been used in the UBiRD project. Some of these insights from the UBiRD project will be described further in this report. In this section, we will point out some of the key similarities and specific differences that may be found between the two projects.

CIBER Finding 1: Business and Economics students and academic staff use Google and Google Scholar.

The UBiRD study confirms this. However, the UG student group tended to use Google, Wikipedia and YouTube as the main source of finding information. Further, PG students and Experts used Google Scholar to gauge the range of resources available to them and then went back to e-resources to download material.

CIBER Finding 2: Business and Economics students and academic staff like simple searching.

The data shows that Simple Search (SS) was used by all groups of users. However, in the UBiRD study, it was observed that 'SS' searches were often carried out in combination with other search components such as Re-formulated Search, Link Search, System Suggestions, Database Selections and other components. UG preferred to use Link Search whereas Re-formulated Search, System Suggestions and Database Search was used more frequently by Experts. For more information refer to sections 3.3.2 and 3.3.3.

<u>CIBER Finding 3: Business and Economics students and academic staff tend to search off campus and out of office hours.</u>

While some participants reported using university electronic resources remotely, mainly from home, there were also some participants who preferred to access the library resources while at the university. The reason they gave were: (i) the convenience of being able to check if material that cannot be access on line can be viewed at the library, (ii) being at home creates too many distractions whereas the library is a quiet place ideal for study or work, (iii) keeping their work place separate from home.

<u>CIBER Finding 4: E-textbooks are mainly used for obtaining snippets of information and fact finding.</u>

In the UBiRD study only one undergraduate student from LSE attempted to use the 'Course Reading List' from the library collection but abandon the resource after failing to find any relevant information.

Participants used external resources such as Google, Wikipedia or an online dictionary, to help in understanding the subject. The reason for using these resources, often as their first port of call was to do with trust and reliability, and having previously had a positive experience in using this source. For more information refer to 'Initiating Behaviour and Strategy' (3.3.1) section.

The low usage of e-textbooks in UBiRD is simply a reflection of the tasks that the participants were instructed to carry out.

<u>CIBER Finding 5: Students are the majority users of digital information services, because there are simply many more of them – their use is lighter as they tend to view fewer pages.</u>

We discovered that there appears to be an inverse relationship between experience or seniority (UG- PG-EX) in the use of 'internal' resources such as EBSCO, ProQuest, Library catalogue, and 'external resources such as Google, YouTube, Yahoo. As

experience increases, their reliance on 'internal resources appears to increase, whereas their reliance on 'external' resources decreases.

CIBER Finding 6: In intense research institutions the use of databases is more – although spending less time on a visit, and using less of the functions on offer.

The data shows that databases were predominantly used by Experts from Cranfield and Postgraduate students from Middlesex University. However, these user groups were also more inclined to use other functions/features offered by the databases. These included Boolean Search and Multi-Field Search. It would appear that the reason for using these combinations of search components lays in the users' knowledge about the scope, structure and what kind of information these databases provide. For more information on the use of different search components refer to section 3.3.3 and 3.3.4.

CIBER Finding 7: Business and Economics students and academic staff prefer to view the abstract.

In the UBiRD studies, all groups of students viewed abstracts in order to evaluate usefulness of what they had found. We also observed that the more experienced PG/Expert group tended to spend more time on reading the abstracts.

Although all groups wanted access to the full texts although the PG/Expert group persisted more in trying to access the full-text and were clearly annoyed when they could not access a PDF at first attempt.

There was no observed distinction between a preference for HTML or PDF in the UBiRD study.

CIBER Finding 8: Business and Economics students and academic staff have preferences for current material.

For the UBiRD study participants, currency of material was also relevant factor when evaluating information, although this may have been due in part because participants may have believed that it was one of the task requirements. They applied a variety of

approaches to limit their searches to the current material: (i) Date Limit Search (one of the feature within the internal systems' used), (ii) date was integrated as a part of a search terms, (iii) choice/selection of information sources (e.g. journal articles, report (current information) vs. books (older information).

CIBER Finding 9: Most students tend to print the material and then read it.

Not all students printed the materials. Those who did not print, expressed their concerns about the environment, whereas others had economical implications in mind and therefore they read the material on the screen. There were others however, that read from the screen because they are used to doing so.

However, it was also observed that students used different ways to store the material for future reading: (i) copy & paste into a Word document (including details about the author, the title, or URL address), (ii) save material in folders (iii) use systems' feature such as RefWorks, and (iv) use tabbing to keep the track of viewed documents during the information seeking activities before deciding if they are worth storing.

CIBER Finding 10: Economists/Business users are the archetypal 'bouncers', those users viewing just one page.

Many participants looked at no more than one/two pages of results from the library resources. However, we observed that some participants viewed more pages (up to 6). Many users spent a considerable amount of time looking through the search results, evaluating materials by reading abstracts and looking at bibliographies. There was a certain determination in how they searched. This is true mainly of PG and research students. The UG students also persisted in finding the right resources for the task.

CIBER Finding 11: LSE was the super-user both in e-books and e-journals, making more visits and viewing more pages.

In the UBiRD study there were only two participants from LSE (UG) who attempted to use e-books. However, they did not appear to understand the concept of the e-book and did not know what to do with them, hence they abandon the resource.

The UBiRD study did not investigate this further.

CIBER Finding 12: Business and Economics students and academic staff make short visits when looking for information, see only few pages and documents viewed.

The UBiRD study did not investigate this.

CIBER Finding 13: All the available evidence shows that people behave in very diverse ways when using electronic information resources.

This is true of UBiRD participants' information seeking behaviours too. There is not a standard although there are common processes used by all groups of users as demonstrated by the various ways in which the 'atomic' search components were combined.

CIBER Finding 14: Library users have rapidly become information customers who can switch instantly between commercial search engines, social networking site, wikis, bookmarked resources and electronic services provided by their library to satisfy their information needs.

In the UBiRD study participants used Google, Yahoo, Google Scholar, YouTube. There was no evidence of the use of social networking sites although a mention was made of going on 'chat' and electronic resources. What we observed was that UBiRD participants rapidly and dynamically changed resources when they 'hit the wall' or when they needed to find better terms or to re-formulate their queries.

CIBER Finding 15: Everyone exhibits a bouncing/flicking behaviour, which sees them searching horizontally rather then vertically. Power browsing and viewing is the norm for all.

Perhaps because the participants were set tasks, they were not observed to practice the bouncing/ flicking behaviour. On the contrary there was evidence of users going to sources such as Wikipedia that would give them background information on their task. This is particularly true of undergraduate students. What we did not see is a systematic manner of interrogating databases at the UG level – using the refining and limiting options.

CIBER Finding 16: Users assess authority and trust for themselves in a matter of seconds by dipping and cross-checking across different sites and by relying on favoured brands (e.g. Google).

There was certainly a reliance on Google and Google Scholar as a source of a full range of resources.

CIBER Finding 17: The average times that users spend on e-book and e-journal sites are very short: typically four to eight minutes respectively. It is clear that users are not reading online in the traditional sense, indeed there are signs that new forms of 'reading' are emerging as users 'power browse' horizontally through titles, contents pages and abstracts going for quick wins. It almost seems that they go online to avoid reading in the traditional sense.

This was difficult to gauge accurately in our study as we had a set allocated time to observe. The study revealed, however, that users spent time evaluating the use of an article by reading the abstract or summary, skim reading and scanning the other parts of a document such as 'Table of content', 'Introduction', 'Conclusion', the list of references and if deemed relevant, they would store the article.

Chapter 1 Introduction

1.1 Aims

The UBiRD (User Behaviour in Resource Discovery) project aims to identify, understand and compare the information-seeking behaviours of students and researches working in the disciplines of Business and Economics using subscribed and free resource discovery systems available in three UK HE institutions (Cranfield, LSE and Middlesex University).

It is envisaged that the results of this study will inform the following on issues relating to resource discovery systems and user behaviour:

- JISC;
- Publishers of Electronic Resources; and
- Librarians working in the HE sector.

It is intended that this project will lead to a better understanding of:

- how the user currently seeks information on the existing resource discovery systems;
- the roadmap used in a user's information seeking journey; and
- their expectations and needs based on their understanding and experience of using the Internet to find information resources for academic study.

It is also intended that the project will lead to recommendations on:

- how library-subscribed resource discovery systems can better meet the needs and expectations of users; and

- the importance of ensuring information literacy (and digital literacy[1]) is at forefront of curriculum development in HE.

1.2 Preamble

HE libraries are spending a significant proportion of their learning materials budgets on electronic resources: full-text databases, back copies of e-journals, and e-books. It is generally perceived by librarians and teaching staff in HE that users are not accessing the scholarly material that is available through the library and are indeed more than ever using Google as their first port of call to obtain their information. There are many reasons for this – and the information seeking behaviour of the 'Google Generation' is adequately described in the jointly commissioned JISC-BL CIBER report (2008)[2]. Research into the behaviour of users, especially research that leads to practical proposals for promoting academic alternatives to Google and increasing the information searching and evaluation skills of users within HE institutions, is urgently required.

'Information Literacy' is now a commonly used term – and addressing the skills required by students to reach a high level of competence in searching for and evaluating information materials should become more central to the teaching and learning strategies of many universities. The Chartered Institute of Library and Information Professionals (CILIP, 2004) and the American Library Association (ALA, 2005) and have usefully contributed to these discussions by defining the term 'information literacy' while The Society of College, National and University Libraries (SCONUL) has identified the 'Seven Pillars of Information Literacy' in its bid to identify the information skills required of users engaged in HE study and life-long learning. The importance of information literacy is also beginning to be acknowledged in the wider socio-political

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[1] In the context of this report, by digital literacy we mean user expertise in using and understanding different resource discovery systems from access and authentication issues to system capabilities such as searching and storage/exporting options.

[2] Accessible from:

http://www.jisc.ac.uk/whatwedo/programmes/resourcediscovery/googlegen.aspx

world. To this end, October 2009 was declared the 'Information Literacy Awareness Month' in America by President Barack Obama.

In broad terms, libraries are responding to the challenges presented by new technologies and the plethora of resources now available online (subscribed and free) by purchasing meta-search and link resolver systems, vertical search engines and/or third-generation OPAC software and many HE institutions have also eased access to online resources through a single sign-on so that students can authenticate and access resources from their Virtual Learning Environments (VLE) without the need to click through more than once. Despite developments such as these, the overall picture is a confusing one, often characterised by a reactive and fragmented approach rather than one based on a coordinated strategy with a clear vision. Some of these issues have been highlighted in the JISC SCONUL LMS Report[3].

Figure 1 illustrates conceptually the different systems that an information seeker in HE needs to understand in order to locate appropriate resources for study and research. It may be expecting too much for users to take the time to understand various access points (and as many as four different ways to access a resource) and get a hold of quality resources appropriate for academic study. Many of these users tend to rely on free web resources primarily because access to these is perceived as being much easier and quicker than the library provided resources.

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[3] Accessible at:

http://www.jisc.ac.uk/whatwedo/programmes/resourcediscovery/libraryMS
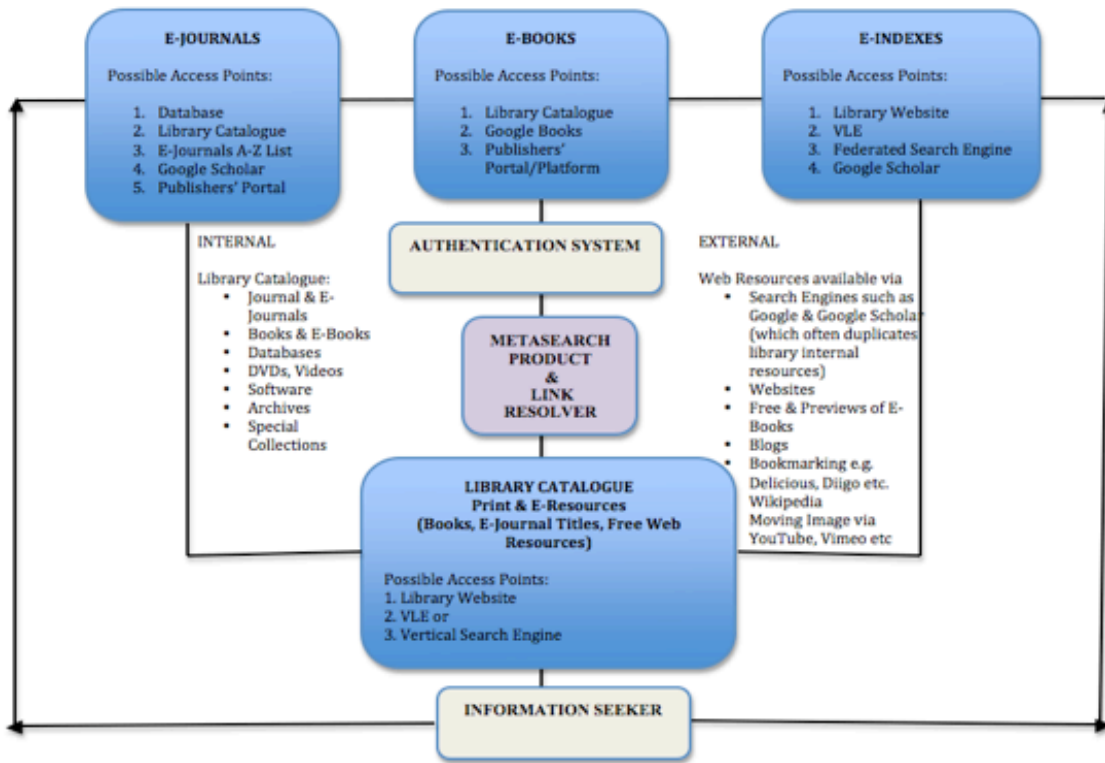
Figure 1: The many ways in which users can access quality resources in a typical HE resource discovery environment

The results of this study will be two-fold: (1) to provide an insight into information-seeking behaviours of undergraduate and post-graduate students and researches and (2) to propose to publishers design enhancements in the technologies that are used to access information.

1.3 Background: Information seeking models

Over the years, a number of studies have been conducted to investigate people's information searching behaviours. These studies have led to the development of a number of models, capturing and emphasising different stages of information seeking activities, (e.g. see Bates, 1990; Ellis, 1989; Ellis, Cox, & Hall, 1993; Ellis & Haugan, 1997; Kuhlthau, 1988; Marchionini, 1995; Sutcliffe & Ennis, 1998; and Wilson, 1999). A brief review of key information seeking models is presented next.

Kuhlthau (1988) describes a six–stage cycle of initiation, selection, exploration, formulation, collection and presentation, based on her observations of students working on an assignment in a physical library. The original model of information seeking behaviours suggested by Ellis (1989) based on studies of information seeking activities of social scientists, generated six characteristics of information seeking patterns including: starting, chaining, browsing, differentiating, monitoring, and extracting. Ellis noted that, 'the detailed interrelation or interaction of the features in any individual information seeking pattern will depend on the unique circumstances of the information seeking activities of the person concerned at that particular point in time' (Ellis, 1989, p. 178). This work was then extended by two more stages: verifying and ending, as a result of astudy on the information seeking activities of research physicists and chemists (Ellis, 1993, 1997).

Marchionini (1995) proposed a similar model perhaps better for electronic environments. The model identifies a sequence of eight action-oriented tasks developed in parallel: recognition of a problem, definition of the problem, selection of information resources, query formulation, search execution, results examination, information extraction and information search reflection, iteration and completion. Unlike Ellis (1989), this model presents different processes occurring during information seeing rather than behaviour of individual information seekers.

Bates (1990) has described the information seeking process more from a strategic point of view whereas Wilson (1999) viewed it as task processes. The latter model emphasis is on stages in the problem solving process, which occur in a linear manner. These stages constitute: problem identification, problem definition, problem resolution, and solution statement. The model proposed by Sutcliffe and Ennis (1998) supports the development of a cognitive model of information retrieval which consists of four activities: problem identification, need articulation, query formulation, and results evaluation.

These models are usually not intended to fully model user behaviour, but instead to model the more frequent and predictable user behaviour. It should be noted that applications that require huge efforts from their users risk becoming ineffective and useless (Langley, 1999).

A different approach to information seeking is presented by Pirolli and Card (1999). They describe information retrieval (seeking) behaviour in terms of 'information foraging', which was adopted from a food foraging theory called optimal foraging theory that helps biologists understand the factors determining an animal's food preference and feeding strategies. Based on this theory Piroli & Card (1999) developed an ACT-IF ("adaptive control of thought in information foraging") process model that can be used to evaluate information retrieval technology and understand user behaviour. They argue that users perceive relevance of information based on some measures of information scent, which are usually derived based on statistical techniques that extract semantic relatedness of words from large text databases. The model offers a novel and useful perspective on designing systems for information retrieval. It encourages the designer to think about the structure of the interface, how to support different searching and browsing strategies appropriate for the context of work and how to effectively use metadata cues to enhance item selection and patch navigation.

Based on her observations of users in their natural settings, Spencer (2006) presents a practical view on people searching for information. She argues that people experience four different modes during their seeking information activity. These modes of information search are: (i) "known-item" search where people know what they want, what search terms to use and what resources will provide them with information; (ii) "exploratory" search where people have some idea of what they need but their search terms may not be the right ones and they may not know which resources to use. However, when they do find information, they will recognise it if it is the right information; (iii) "don't know what you need to know" search where people may or may not know how to articulate what they need, i.e. may not have the right vocabulary but will recognize when

they have found the right answer even if they may not know whether they have found enough information; and (iv) "re-finding" where people look for things they have seen before, i.e. hunting down information they have previously seen.

Many of the participants in the UBiRD study appear to follow Spencer's modes of discovery – with an additional mode "storage" which Jones, Dumais & Bruce (2002) refer to as 'gathering' or 'keeping' information'. One other element that is implied but not explicit in the above models is the prior knowledge and experience a user comes with when beginning a search. This study will outline the stages in the information seeking process in relation to the above models.

Chapter 2 Methodology

2.1 Introduction

The study adopted a qualitative research approach to investigating user behaviour as they search for quality scholarly materials in resource discovery systems. The study sought to gather detailed information about how HE users interact with different resources, the search strategies they applied, and how these strategies differed across different levels of information and digital literacy. Qualitative research data is very rich and descriptive but is, unfortunately, voluminous. For example, the transcript of a one-hour interview can often be in excess of 15 pages. While possible, it is not the purpose of qualitative research to generate numbers that could be used to carry out inferential statistics. That sort of study would draw on the tradition of quantitative research, and their application in the context of this research has already been carried out by the complementary work of the CIBER research group and their findings reported elsewhere (Appendix 6, 2008[4]). Instead, some of key purposes of qualitative research are to provide descriptions from which we can (i) un-ravel and explain behaviours, and (ii) infer from them the variety of circumstances and situations that people will encounter and how they deal with them.

Given the time frame, and partly to complement the CIBER report (see Appendix 6), we focused on studying business and economics students and researches at a sample of three universities, representing the Russell Group, the 94 Group, and the Million+ groups of universities in the UK. These universities are the London School of Economics, Cranfield University, and Middlesex University.

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[4] Available at:

https://www.ucl.ac.uk/infostudies/research/ciber/downloads/ggexecutive.pdf

2.2 Participants

Using a stratified sampling strategy, we recruited a total of 34 volunteers from across different levels of information literacy: undergraduate, postgraduate and expert researches. There were 16 male and 18 female volunteers in the study, aged between 22–55 years. Following CIBER's work such as the E-Books Observatory Deep Log Analysis[5], the participants in our study were selected based on a similar sampling frame.

The study was conducted in two stages (to be described in detail in the next section) and the number of participants was distributed across the study conditions as shown in Table 1. Stage 1 was an exploratory study and was conducted first. It involved two sets of focus groups involving a total of 9 participants at Middlesex University. In Stage 2 we carried out a combined user observation and in-depth interview study involving a total of 34 participants distributed across the three universities. Table 1 shows how the participants are distributed across the different information literacy categories. Detailed demographic information about participants is presented in Appendix 1.

		Under-graduates	Post-graduates	Researchers	Total
Stage 1: Focus Groups (2)		6	3	0	**9**
Stage 2: Observations+ In-depth interviews	London School of Economics	5	4	3	12
	Middlesex University	5	3	4	12
	Cranfield University	0	6	4	10
	Total (Observations & In-depth interviews)	10	13	11	**34**

Table 1.   Number of Participants in study across universities

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[5] Available at: http://www.ucl.ac.uk/infostudies/research/ciber/observatory/

2.3 The study design

We designed the study to be conducted in two stages: (i) a focus group stage, (ii) and in-depth interview stage. We intended using this study design to compare information search and retrieval behaviours, difficulties and issues between the different types of institutions, and across the different levels of experience from undergraduate to post-graduate and to experienced researchers.

The methods used in both stages are elaborated next.

(i) *Stage 1 Focus Group interviews*. We used a focus group interview technique to identify the vocabulary that users understand and use in the context of resource discovery systems, the vocabulary used during information search and query formulation, and to identify which electronic resource discovery systems are used by the different user groups. From this information, we developed three sets of task of increasing levels of difficulty and ambiguity. These tasks were used in the later observation ('think aloud') sessions. These focus groups were audio recorded and then transcribed for subsequent analysis. The detailed information about participants together with the focus group transcripts is documented in Appendix 2.

(ii) *Stage 2 User observation and in-depth interviews*. In Stage 2, the study was carried out in two parts: Part A involved a user observation study that was combined with a 'think aloud' method and lasted about one hour each, where each participant was asked to carry out each of the three tasks of increasing difficulty and ambiguity; and in Part B we combined an in-depth interview with a cue recall technique based on their immediate experience of the three sets of tasks. Briefly, these tasks are outlined below, and they were defined based on an increasing level of ambiguity, making Task 3 more challenging than Task 1, requiring a higher level of ability to find the necessary information.

> *Task 1:* Find a range of examples from film and television programs, which illustrate product placement 'in action'.

> *Task 2:* Find evidence of film tourism from a range of different film industries to illustrate the impact this may have had on tourism.

Task 3: Imagine that you are the brand manager for a new range of mobile phones for Nokia; you required to produce evidence to demonstrate how you might use the film/television medium as a way of reaching your target audience.

Introducing a higher level of ambiguity for each task allowed us to observe how the ambiguity (as a way of assessing difficulty) could affect participants' searching behaviour and their choice of resources. This ambiguity is reflective of the real information search task for scholarly resources where the topics might vary in their level of difficulty. Through this, we investigated how users' level of information literacy influences their use of the various resource discovery tools, the navigation strategies that users apply when searching for information, and problems encountered when interacting with these resources.

2.4 The in-depth interview method

Critical Decision Method (CDM) was employed as a method for the interview part of the study. It is an open-ended, semi-structured retrospective interview method that is used for learning about a user's expertise and strategies invoked during a specific incident; in the case of this study it is: investigating the nature of information seeking, strategies used, decisions made and problems occurred when searching for information. More formally, it comes under a category of investigative techniques known as Cognitive Task Analysis.

CDM was designed for conducting critical incident-based interviews. It was intended to be open-ended and exploratory. In our study, we re-designed the probes so that we could focus on specific 'information seeking process' that the participant experienced during the earlier observation and 'think aloud' session. Participants are asked to think back to it and discuss what they experienced during the session. They were then systematically probed about the decisions they made during the information seeking session and to elaborate on their considerations, assessments and actions.

The CDM interviewer employed a small set of probes, or questions to elaborate the story and help to identify goals, cues, activities, evaluation of results and the criteria for choosing particular resources.

In the case of our study, the observations were utilized as a primer for in-depth interview. They were used as a recall to cue participants' recall of their decision processes during post –session in-depth interview to provide additional insights into their decision-making processes. Using this method the probability that 'think aloud' memory degradation would occur was reduced.

Each interview lasted between 40 and 80 minutes; was audio recorded and transcribed for subsequent analysis (see Appendix 4).

2.5 Procedure

In this section, we describe the procedure we adopted for Stage 2 of the study. Although the tasks were identical for the three groups, the instructions given to the undergraduate and postgraduate student groups were different from those give to the researcher groups. The different instructions provided different contexts for the tasks. In the case of the undergraduate and postgraduate students, the context was looking for information for an assignment that had been given to them as a part of their academic course work, whereas in the case of the researchers, it was for preparing an academic piece of work. The complete instructions and task scenarios are presented in Appendix 5. Stage 2 was conducted in two parts:

At the start of the study, each participant was given a brief introduction to the study, then explained their rights as a research participant, and were asked to sign the Informed Consent form. As not all users were familiar with the Apple Macintosh computer on which the study was carried out, a brief introduction of how to use some of its features (e.g. how to open and close a window, how to open a new tab, where to find a Word application) was given prior to the beginning of the session.

Part A: User observation and think-aloud. For Part A of the investigation, the participants were asked to think-aloud, i.e. to report what they were thinking as they carried out their tasks, and were observed as they carried out the three assigned tasks. They were given three tasks in sequential order: Task 1, 2 and 3. For each consecutive task the level of ambiguity increased, with Task 1 being the least ambiguous asking that the participants searched for specific information, and progressively becoming increasingly more ambiguous through Task 2 and 3. The participants' actions on the computer were recorded using a real-time screen capture software called iShowU HD (http://www.shinywhitebox.com). The software is also capable of audio recording voice at the same time, providing a real-time record of what was done when interacting with various resources discovery systems, and a think-aloud description of what the participant did, and why they did them. However, as people do not naturally articulate everything they do, we supplemented this part of the study with the in-depth interview, described next.

Part B: In-depth interviews and cued recall. We adapted the Critical Decision Method (Klein et al, 1989; Hoffman et 1998; Wong, 2006) and then combined it with another cognitive task analysis technique called Cued Recall (Puff, 1982; Omodei et al, 2005). The Cued Recall technique was useful in helping us further probe aspects of their interaction that we were uncertain of or did not understand. The interviews focused on:

a) identifying the expertise and underlying rationale for the search behaviours demonstrated in the earlier study,

b) how they used their expertise to overcome difficulties and ambiguity in the information search tasks, and where applicable, across different resources,

c) identifying the likely mistakes and omissions that the lack of experience can cause when searching for scholarly information,

d) the differences between services and attributes of physical and virtual libraries.

The in-depth interviews were audio recorded, and also transcribed.

2.6 Data analysis

For the analysis part of the study, we used approaches such as Emergent Themes Analysis (ETA), a technique for rapid yet systematic and rigorous extraction of key themes from both the observation and interview data sets of individual participants.

The ETA approach is a technique for qualitative data analysis that is based on Grounded Theory but takes advantage of the exploratory and efficient CDM data collection method. It uses a concept distillation process to rapidly and systematically identify broad themes that are similar ideas and concepts reported across interviews or observations. The data can then be identified, indexed and collated. The themes emerge from the data strengthening the validity of the findings. Using the same procedure, the sub-themes or specific themes within the data are identified and further categorized. These categories are the basis for analysis.

Following the ETA approach, the themes were collated and analyzed across the different study groups across all three studied institutions.

2.7 Constraints of the study

The UBiRD study is based on a qualitative research paradigm. In terms of quantitative research the 34 participants involved in the study may appear small and not very generalisable. We recognize this. However, it is the purpose of qualitative research is to provide richer descriptions of not just what people do, but also to seek to find insight as to why they do what they do. This approach complements the information from CIBER's work on deep log analysis (see Appendix 6) and provides insight into the reasons for people's behaviours which deep log analysis on its own cannot. In this study, we hope to have provided such an insight and a coverage of the variety of user behaviours that are invoked in their interactions with electronic resource discovery systems. Having the time allocated for the data collection scheduled over the summer holidays was not ideal, and did lead to a lower response rate.

Chapter 3 Results

In this section we report on our findings. In the first part of our findings we will briefly describe the *information environment* and how we have referred to the different resources, and what the participants in the study have found to be useful. Within that context, we will then describe the *information search and retrieval process* in resource discovery systems, the various *user information search behaviours and strategies* in resource discovery systems, and a number of *general observations*.

3.1 The Information Environment

We refer to the information environment as the collection of electronic resources that are available to students and researches through their computer systems, as they search for scholarly materials. These resources include various computer databases, search engines, and catalogues. For the purpose of our study, we have classified them as being either 'internal' resources, or 'external' resources.

Internal resources refer to those electronic resources that the students' or researchers' institution has developed, owns or has subscription access to, and these include resources such as the library catalogue, the EBSCO databases, Emerald or ISI Web of Science bibliographic and full-text databases, and the federated search engines. *External* resources refer to those electronic resources that are 'outside' of the library's provision and are often freely available on the Internet. These include Google, Google Scholar, Wikipedia and YouTube. Outside these resources, users also use their social networks such as friends and colleagues, to learn about a topic and search terms.

3.1.1 Electronic Resources: Popularity of use

Through an analysis of the most popular electronic resources amongst the participants, we discovered that there appears to be an inverse relationship between experience or

seniority (UG-PG-EX) in the use of 'internal' resources such as the EBSCO databases, Library catalogue, and 'external' resources such as Google, YouTube, Yahoo! As research experience increases, their reliance on 'internal' resources appears to increase, whereas their reliance on 'external' resources decreases (see Table 2 and 3).

	Middlesex UG	Cranfield UG	LSE UG	Middlesex PG	Cranfield PG	LSE PG	Middlesex EX	Cranfield EX	LSE EX
Number of participants	5	0	5	3	6	4	4	4	3
Resources used									
Course reading list			1						
EBSCO	1		1	3	5		2	2	1
Emerald				1	1		1		
Factiva					2			1	
Free web resources			2						
JISTOR				1					1
Beta catalogue			1						1
Library catalogue	1		3		1	1	1	1	1
Library Cross search					1	1		1	
Library electronic resources A-Z					1		1		
Library subject resources									1
E-journals	1		3		1		1		2
Mintel							1	1	
Library Multisearch	1			1			1		
ProQuest					2			2	
Science Direct									1
Business Insights							1		
Business Source Premier			1		1				1
Library Quick Search									1
Archive Catalog			1						
Amadeus					1				
Info M25			1						
Sage Journals Online				1					
Financial Time				1					
Academic Lib. E-Book			2						
Number of resources used =	4		10	6	10	2	8	6	9

Table 2. Most commonly resources used: Internal

	Middlesex UG	Cranfield UG	LSE UG	Middlesex PG	Cranfield PG	LSE PG	Middlesex EX	Cranfield EX	LSE EX
Number of participants	5	0	5	3	6	4	4	4	3
Resources used									
Google	4		5	3	5	4	3	4	3
Google Books					1				
Google Scholar	1		1	3	3	3	2	3	1
Google Image	1				1				
Wikipedia	1		1		2	1	1	1	2
Yahoo				1					
YouTube			1	2	2	2	1	1	1
British Library			1						
BBC News			1						
NY Times						1			
Lonely Planet					1				
www.Bhaya.Fry					1				
www.Askjeeves.com	1								
19th Century BL Newspapers	1								
cbc.com				1					
Number of resources used =	6		6	5	8	5	4	4	4

Table 3. Most commonly resources used: External

At Middlesex University the general preference was for users to authenticate to Athens, allowing participants to access all material subscribed to by the university from the Electronic Resources page. The most popular link was to the library's federated search engine 'MultiSearch'. This was most commonly used by the undergraduate (UG) user group rather than following the links to the Databases, E-journals or Newspapers. More

experienced users (PG and EX) preferred to use EBSCO's Business Source Complete to find information.

The UG group at the London School of Economics preferred to search on the Library or Beta Catalogue, whereas within the Expert user group EBSCO's Business Source Complete was the most popular resource. When it comes to using academic resources at Cranfield both user groups (Postgraduate and Experts) used ProQuest's ABI/Inform Global and the EBSCO databases. However, ProQuest was more common within the Experts group whereas EBSCO was more common within the Experienced group. The Experts group also used other internally provided resources such as Emerald and Factiva.

3.1.2 Electronic Resources: User Perceptions and Preferences

The following describes the user perceptions and preferences about the different electronic resources available to them.

(a) A liking for the federated search engine

The most frequently mentioned resource was EBSCO's Business Source Complete and ProQuest's Global Inform. Other frequently used sources of information include institutional federated search engines such as 'MultiSearch' at Middlesex, 'CrossSearch' at Cranfield and 'QuickSearch' at the LSE. The benefits of using federated search engines were often appreciated by participants. Referring to MultiSearch, "… it brings to you all the related searches together" (MP2, p.3). One key reason participants used these 'internal' library resources lays in the quality of information they provide: The academic databases are thought to be more reliable than Google (CP5, p.7).

However, most participants were unaware of where their resources were coming from, i.e. they did not understand how the federated search engines worked or what the differences were between the different sources of information, i.e. the different databases – which is perhaps as it should be. Participants also reported not paying attention to the names of the journals that they found the information from but rather on the relevance of the information. Students would only want access to particular journal titles if they had

been recommended by tutors or included in their reading lists in the module handbook. This was particularly common with LSE students.

(b) Prior knowledge and experience and the selection of resources

<u>Knowledge of the subject</u>. The assumption that you need to know more about a subject before using library resources seemed to come up a number of times: "In the marketing databases . . . they have different categories: business, consumer goods so I have to know what to check" CP5 (p.8). The lack of prior knowledge was evidenced when MP10 selected only EBSCO's Film & TV Literature Index with Full Text to search for 'product placement' rather than doing a simultaneous search on both the Business Source Complete and the Film & TV Index. Further, LP4 states that it was not possible to find anything relevant for the tasks at the LSE as the library was a social sciences library and film was not a social science subject.

<u>Knowledge of strengths and limitations of the resource</u>. Researches were more aware than UG and PG, of the strengths and limitations of different resources. For example, CP5 says with reference to SSRN, "I know that this site will not give me the full papers but will give me the names [i.e. references]", (p.3), and they tend to rely more on library subscribed resources than the internet. LP7 explains how she beings the search process: "Again a topic that I don't know anything about. I'll go to the library catalogue. My reaction is that I'll find this [empirical evidence] in journals but first I'll look up the catalogue in general in case books have been written about this . . . I don't see anything relevant here. Next, I'll have to go to the journal resources …".   This same user also bears in mind what information is being asked for in the task, i.e., "empirical evidence".

<u>Knowledge that it has links for exploring</u>. Prior experience also influences their choice of resources to use: LP7 (p.8) stated: "Let me try the beta catalogue. I remember that this was useful for wide searches". CP7, a researcher goes to Wikipedia as the first port of call: "I am going to Wikipedia . . . [as it will refer me to] other sources". LP7 uses this for the same reasons, "I look at Wikipedia because often there are examples there and

links that might be useful" (p.3). This is an example of where Wikipedia is used to find references to other, maybe more reliable sources of information.

Usability. Users' decision to use one resource over another is also influenced by usability issues. Some found using 'external' resources easier to use than the 'internal' library resources. LP1(p.8) states, "This is much more difficult to use [referring to Library Resources]. . . Google in that sense is much easier to use".

(c) Perception of trust

There appears to be a sense of trust and belief that external resources provided by Google and Google Books are reliable and relevant, and have quality materials. LP2 (p.2) tells us that after having found a reference to a book on Google Books, "It came from Google Books so it'll be ok". While CP9 said, "I prefer to use Google because . . . the top five will be the most relevant, and sometimes will give you Scholar articles" (p. 2). There is also a further sense of trust that these external resources will help them regain their 'bearings'. For example, one user who seemed to be 'lost' in university-subscribed resources turned back to Google stating, "I will go back to Google to help me get my bearings … ." (LP7, p.3).   An 'expert' user at Middlesex (MP10) states that she often looks in Google Scholar first before she uses the library resources as it provides a wider range of resources and if she needs to then request items through inter-library loans, she will do this.

On the other hand, many of the students at the LSE made blanket judgments on the library collection at the LSE Library without verifying their assumptions. LP2 states categorically that the library is, "… not likely to have the journal 'New Cinemas: Journal of Contemporary Film …", without verifying this, "… the LSE has many film journals but not this one." (p.6).

3.1.3 Access point of resources

Some participants reported accessing the university electronic resources remotely, mainly from home. The reason they gave was that they preferred to work in the comfort of their homes without having to travel into campus to access the electronic resources. Since

many participants work as well as study, accessing university electronic resources from home or other off-campus locations is popular and provides them with the freedom of using the resources any time, anywhere. MP1: "Yeah, all depends on time … you know, I live in flat halls so I can access 'em from flat halls, sometimes I work, … in a friends house" (Interview scripts, p.14.)

However, other participants (students and researchers) suggested that they preferred to access the library resources while on campus. For some, the convenience of closeness to the library where they can view a printed version of the material where an electronic version is not available is of high importance.

Students reported preferring to use library resources on campus, especially when working on an assignment; being at home creates too many distractions whereas the library is a quiet place ideal for study or work. MP2: "I mean today I was like sitting and downloading some articles which I wanted to, you know, have to, look for the dissertation which is coming up, so I was sitting in the journal room today and [unclear word]. It's like, erm, ambience is also important like uni is, if you have to really concentrate on something, come to the uni, sit there and do it, then your work will be really fast, at home distractions are too much" (Interview script, p.10).
MP8: "… usually, when I need to get work done, I'd come in, get the work done, or sometimes if it was group work and stuff like this" (Interview script, p.6).

Those who preferred to access the resources from their offices wanted to keep their work separate from their private life. LP9: "…In the office, I usually work long days at the Uni and try not to work at home" (Interview script, p.11).

3.2 The information search and retrieval process in resource discovery systems

From our investigations, we believe the process of information search and retrieval in resource discovery systems may be represented as illustrated in Figure 2. It will provide a

basic framework to discuss how the various search tools are used or combined into user search strategies. The processes are described next.
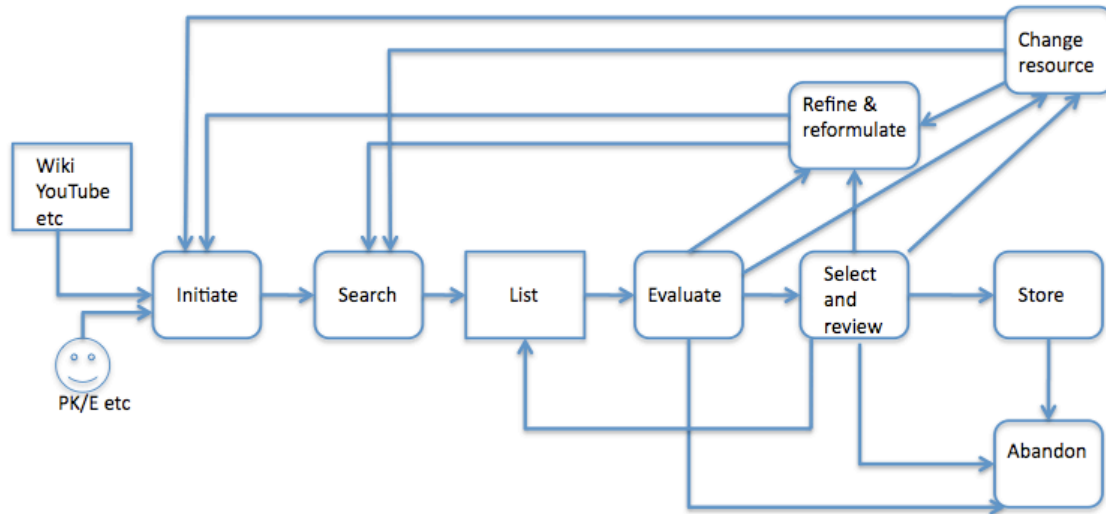
Figure 2. User information search and retrieval process in resource discovery systems.

3.2.1 Initiate

Initiate is the process of starting the search activity. This often involves defining the subject, understanding the concepts, and finding the keywords. This also involves deciding which databases to select, or actually using the Internet to understand the concepts of the domain, which can then help them determine appropriate keywords. Other activities here include using personal networks to help the user identify relevant concepts from which to generate appropriate search terms or phrases.

3.2.2 Search

Search is the process of activating the various search functions such as: known-item search, exploratory search, unknown search, and re-finding. These functions can be supported by a variety of tools such as single keyword, advance multi-word and Boolean search, links, and others.

3.2.3 List and Evaluate

This is the process of viewing the returns from the search specified earlier. In all current systems, this is a long list, perhaps, organized by significance. This is the Google-like list that the user often scans, visually searching down the list for candidate articles looking for the appearance of the search terms within the tile and text displayed, checking the source of material for its credibility as well as the type of publication and its currency. In so doing, the user also evaluates the results for relevance.

3.2.4 Refine or re-formulate

Refine or re-formulate. If after viewing the list, and it is determined that that search has not been successful, the user will refine the search terms used; re-formulate the query by perhaps using a multi-field search and starting the search again; or change the search terms in response to a change in his or her understanding and then generate new search terms.

3.2.5 Select and review

In this process, the user selects an item from the list returned by the search process, and instructs the system to retrieve the details associated with it. This could be the abstract or a summary in the first instance followed by the full text of the paper or article or even a book that can be viewed through Google Books. At this point, the user also assesses the relevance and usefulness that is presented. The outcome of this assessment is one of a number of decisions: discard, not sure, maybe later, and keep.

3.2.6 Store

Store detail. In this process, the user stores different parts of the material retrieved such as the details of the document, its abstract to read or study later, the URL address or notes about the book that they would like to inquire about at the later stage. This is currently done by 'tabbing', using 'copy & paste' and putting details into a Word document, saving material into folders, printing it, bookmarking, or using systems features such as 'My Research', 'Mark up', 'Ref Works' or 'End notes'. Some users prefer to use conventional pen & paper for noting down important information for future use.

3.2.7 Abandon

This process means that the user decides to terminate his or her search or change the resource discovery system. This could be because he or she has given up, has found what they were looking for, was not able to access either a resource or an individual document or a paper they found had to be purchased in order to be viewed and participants were not prepared to do so.

3.2.8 Change resource

Change resource occurs when the user decides or believes that the resource they have been using is no longer appropriate. A search may lead to a dead end where repeated searches do not reveal any useful leads, as if coming up against a brick wall. This is often when a 'phase shift' occurs, where the user switches resources and search behaviours. For example, when they 'hit the wall' and find no suitable leads, they may return to the initiate stage and switch from using a bibliographic database to searching the internet, in order to, say, learn more about the subject area or to discover more appropriate search terms. Following this, a 'phase shift' possibly occurs again, leading the user to return to bibliographic databases to search for the journal article.

3.3 User information search behaviour and strategies in resource discovery systems

In this section, we describe the various information search behaviours and strategies we have observed the various users invoke as they use the resource discovery systems during the study.

3.3.1 Initiating Behaviours and Strategies

Often the first thing that participants do when initiating a search is to make a choice of which resources to use. This choice depended on the understanding of the topic, prior experience and understanding of the scope of specific resources, and recommendations given. There were two types of resources: 'Internal' and 'External' (see section 3.1). The most common search engine used to find resources on the Internet is Google. We

observed a number of user behaviours about how searches are initiated, and they are described next.

(a) Users define subject, understand the concepts, find keywords and choose resources

Users usually initiate their searches by trying to identify the keywords for their topic or task, and when unfamiliar, by learning more about their subject by searching out various definitions and explanations. This process mainly involves the user going to Google, Wikipedia or an online dictionary to find definitions. Wikipedia was a very frequent and commonly used resource for this purpose although several participants began with a Google search. LP7 (p.19) "I am browsing, looking for keywords …".

In the UBiRD study, many of the users began by defining 'product placement' on Wikipedia.   The reason they chose this as resource as their first port of call was to do with trust and reliability having had a positive previous experience in using this source. One participant put it quite bluntly, "Wikipedia is my friend"(CP5, p.1) and another gives her reasons: "I'll go to Wikipedia and read everything about product placement, what it is about and try and understand it" CP8 (p. 2).

(b) Google & Wikipedia as first port of call

Some participants used Google as their first port of call. CP8, (p. 2) says, ". . . first I'll go to Google and try to find because Google is the first thing that comes to my mind". This was both out of habit and often to gauge how the search hits on Google can help with an understanding of the subject. It is also a way in which to gather keywords. For example, one of the students expressed concerns about the keywords and suggested his way of solving this problem: "If the keywords are not clear, I go to Google or electronic dictionaries to clarify [them]". (CP9, p. 2).

(c) YouTube - an unlikely first port of call?

A few users started with YouTube as their first port of call – immediately looking for examples for Task 1. This may have been because they had prior knowledge of the subject or because they were more familiar with YouTube, which is becoming used as a

reference tool just as much as Wikipedia. For instance, CP6 makes it clear that the search requires video clips rather than articles so YouTube is a better source.

(d) Google auto-suggestion to help develop search terms

Some users found Google helpful as a starting point as it corrects the spelling as well as suggests alternatives to the search terms used. CP5 (p.1) states, "You know in Google when you make a mistake it corrects it" referring to the auto-suggestion feature for incorrect input on Google. They are also aware of the pitfalls of searching on the Internet, and CP5 cautions, "You have to be careful because people put a lot of stupid stuff but it will give you a general idea" (p.1).

(e) From Google Books and back to the Library

Another resource used was Google books, where participants find relevant material and then checked its availability in the library. Participants thought that it was good that material could be viewed instantaneously and the search feature allowed participants to find required information without investing too much time in the process. In addition, search terms were highlighted within the text making much easier and faster to scan the book and view the relevant parts. Being able to see the content of a book was another aspect that participants highly valued. This is very often missing where internal resources are concerned.

(f) Library catalogues for an overview

Some use the library catalogue to gain an overview of the subject by first getting a sense of what books have been written about the subject, and perhaps to use those books to gain some familiarity with the subject. Researcher LP7 explains: "Again, a topic that I don't know anything about ... I'll go to the library catalogue. My reaction is that I'll find this [empirical evidence] in journals but first I'll look up the catalogue in general in case books have been written about this … I don't see anything relevant here. Next, I'll have to go to the journal resources. In this case shall I look at e-journals?" (p.2).

(g) e-Books not a popular initiating point

It was observed that only two participants attempted to use e-books subscribed by the library. On both occasions, they failed to access the e-book and decided to abandon the search. They did not know what to do with information displayed on the screen and how to access the E-books collection (see Figure 3). The comments from one of the participants support this view: "… and again, I don't know what to open" (LP5, p.6). After exploring the page for a while the same participant commented: "I'm closing the E-books because I have no idea what to look at" (LP, p.7).
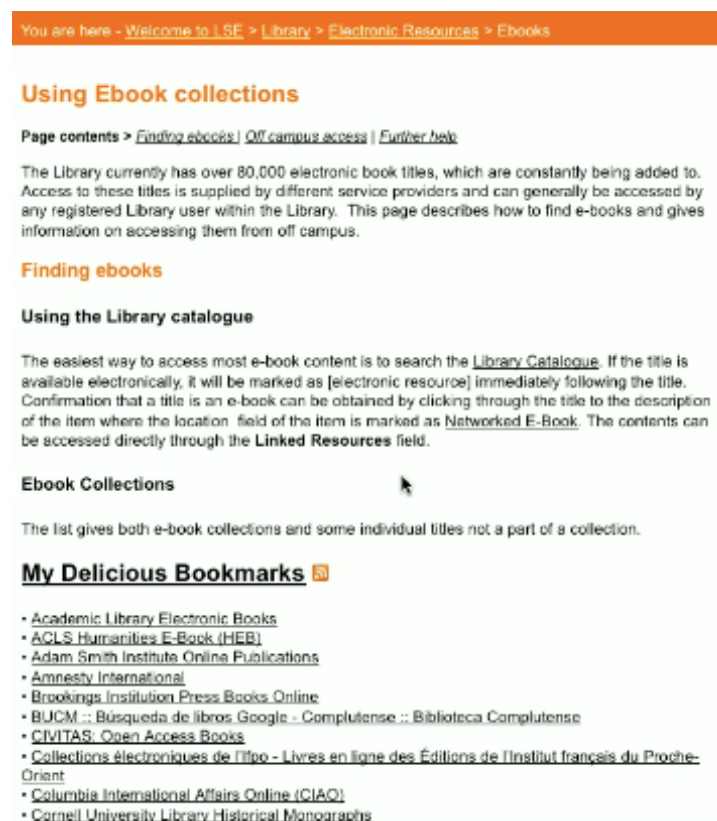
Figure 3. Screen shot of the e-Books access interface.

(h) Social networks as initiating points

Another way of finding information discussed by participants was personal/social network. CP2 suggests, (p.13) "I would go outside the academic [world] …". Using peers to help them to remember or to suggest films with product placement examples came up many times – both by UG/PG students and researches. CP1 (p.8) "I might ask someone

to help me"; LP2 (p.8) "I will ask Mark Kecko [author of the article] for some information" and "I want to find film locations so I will go to the chat room or something to see what people are saying as it's easier to find …" CP5 (p.1).

3.3.2 Search Behaviours and Strategies: Basic or 'atomic' components of search activities

It was observed that participants applied different searching strategies depending on their experience in information literacy, their background, domain knowledge and their understanding of task requirements they were asked to perform. Participants applied different strategies to obtain information for each of the three tasks.   Each of these strategies could be described as a combination of a set of different basic or 'atomic' components of search activities. These basic 'atomic' components of search activities were identified through our analysis. We have classified them as 'atomic' because they are basic activities and can no longer be meaningfully broken down any further. Each atomic component is defined next, and then how these components are combined is elaborated in the following section:

i.   *Simple Search* (SS) – terms were taken from the given task and were used as a part of the search sentence into the single search field (e.g. 'product placement in films'; or 'product placement in films and movies for the purpose of brand awareness')

ii.   *Boolean Search* (BS) – a number of search terms used together with different Boolean operators (e.g. AND, OR, AND NOT (e.g. 'television OR movie OR film AND product placement AN Times AND NOT Irish')

iii. *Simple and Boolean* (SS&BS) – a combination of the two described above.

iv.   *Personal Knowledge and Experience Search* (PK/E) – terms are developed based on personal knowledge/experience such as name of movie participants have watched: 'yaaden full movie and coca cola', 'transformers 2 and Egypt' ' matrix and nokia' etc.

v. *Re-formulated Search* (RFS) – terms were taken / combined from document keywords found in earlier searches and used to refine/re-formulate the search (e.g. 'galician mary-lou "product placement" lse')

vi. *Link Search* (LS) – follow the hyper-links within documents to find relevant information (e.g. 'product placement in television' => 'list of results' => 'wikipedia article' =>'TV programmes')

vii. *Multi-Field Search* (MFS) – a number of search terms specified for different fields (e.g. 'film' in 'Citations and document text'; 'product placement' in 'title' AND 'tourism' in 'title') and carried out within the same search

viii. *Phrase Search* (PHS) – terms were put in quotation marks to find information containing an exact phrase (e.g. "product placement")

ix. *Database Search* (DBS) – specific databases were selected in order to narrow a search (e.g. EBSCO's Film and Television Literature Index)

x. *System Suggestions* – follow system's suggestion to narrow the search by using 'Suggested Topics', 'Results by Source', 'Source Type', Clustered Results, Cited by and specific resources (e.g. Scholarly journals, peer review) and/or correct spelling or take on suggested keyword, e.g. "Do you mean . . . ?"

xi. *Full Text/PDF Search* (FT/PDF) – select Full Text or PDF file options to narrow the results

xii. *Date Limit Search* (DL) – refine results by date range e.g. 2006-current year.

3.3.3 Search Groupings

In our analysis, we observed that searches are often carried out in combination. For example, a link search is often combined with a re-formulated search, where terms or concepts discovered during the visits to hyper-links are used to refine search terms or reformulate the way new queries are generated, such as to input the search terms in multiple fields. We refer to such combinations of search 'atoms' as search groupings.

Five most frequently occurring search groupings have been identified and they are:

i. The Link Search – Re-formulated Search – Multi-Field Search – Personal Knowledge and Experience Grouping

ii. The Re-formulated Search – System Suggestion – Multi-Field Search – Link Search Grouping

iii. The Multi-Field Search – Re-formulated Search – Link Search – System Suggestions Grouping

iv. The System Suggestion – Re-formulated Search – Multi-Field Search Grouping

v. The Database Selection – Boolean Search Grouping

It should be noted that all these groupings have the Simple Search atom as common, i.e. the Simple Search is the fundamental building block on which the other searches build. In addition, what is important within these groupings is that users used them during their information seeking activities. The sequence in which the search activities appear in our report is not as relevant as the fact that these activities are likely to be used as a suite of actions; in this case the future resource discovery systems needs to support such combinations of searches.

(a) 'Link Search' grouping

The 'Link Search' grouping incorporates the 'Re-formulated Search', 'Multi-Field Search' and 'Personal Knowledge/Experience' atomic search components.

Link Search *(23/26)*		
	Re-formulated Search	*(9/26)*
	Multi-Field	*(8/26)*
	Personal Knowledge/Experience	*(7/26)*

Participants who during their search activities applied 'Link Search' (i.e. clicking on a link to investigate further the potential value of a reference) during their information seeking activities also pursued 'Re-formulated Search' (using keywords obtained from the retrieved documents to do a new search) as well as 'Multi-Field Search' where a 'publication' or 'citation in a document text' were used in selective fields (e.g. 'mobile phone' in 'Document title', 'advertising' in 'Citation and document text', 'marketing' in

'Citation and document text'). The same participants also invoked their personal knowledge and experience (PK/E) in the subject area to provide new leads in the search. This was mostly observed in the context of task 1 and 2, where participants were ask to provide examples of 'product placement and evidence of 'film tourism'. Their queries included the name of products, the title of movies or names of places of which they were aware.

(b) 'Re-formulated' Search grouping

The most popular components of this grouping were: 'System Suggestions', 'Multi-Field Search' and 'Link Search'.

Re-formulated Search (21/26)		
	System Suggestions	(10/26)
	Multi-Field Search	(9/26)
	Link Search	(9/26)

Participants who extracted search terms from retrieved documents and used them in their consecutive searches were also more inclined to combine their 'RFS' with 'System Suggestions' where they used system help such as 'Suggested Topics, 'Results by Source', Source Type' or selected specific resources (e.g. Scholarly journals, peer review) to narrow the search. Participants in this grouping also followed links in resulting documents (LS), which helped them expanding their search terms as well as suggesting and combining multiple fields in which to search (MFS).

From the study observations, it seems that Experts used this combination of components mostly. It may be suggested that their higher level of information literacy as well as knowledge of a subject domain allowed them to be more 'adventurous' with their choice of search components.

(c) 'Multi-Field' Search grouping

When searching for information the 'Multi-Field Search' component was most frequently used in conjunction with 'Re-formulated Search', 'Link Search' and 'System Suggestions' components.

Multi-Field Search (19/26)	
Re-formulated Search	(9/26)
System Suggestions	(8/26)
Link Search	(8/26)

Users who in their search activities selected a number of search terms specified in different fields (MFS), are said to be users of the 'Multi-Field Search' action. These MFS users are also more likely to use this component in conjunction with 'Re-formulated Search', 'System Suggestions' as well as 'Link Search'. It appears that MFS by narrowing down the results provides 'System Suggestions' that are more relevant to the search, which consequently delivers more focused, topic driven results. In addition, users in this grouping also used their skills to extract new terms from the search documents (RFS), which opened new possibilities for them in terms of searches but also Link Search that expanded their original searches.

Experts used this grouping more frequently than other groups with the exception of 'Link Search', which was more popular amongst PG and UG groups. Once again, this may suggest that the higher level of information literacy and confidence in following up 'System Suggestions' gives participants a sense of making progress and going in the right directions.

(d) 'System Suggestions' grouping

This 'atomic search component' was applied by participants most frequently together with: 'Re-formulated Search' and 'Multi-Field Search'.

System Suggestions (17/26)		
	Re-formulated Search	(10/26)
	Multi-Field Search	(8/26)

Participants who were advanced in their information literacy skills followed the help provided by a system ('System Suggestions') in a form of 'Groupinged Results', 'Results by Source' or 'Suggested Topic' which allowed them to narrow their searches to the areas selected by a resource discovery system. It seems that the new results obtained from the system suggestions provided new terms helping the users to re-formulate their queries (RFS). In addition, users in this grouping took advantage of different field options (MFS), which provided ways to narrow the search results further.

This searching behaviour was popular amongst Experts who are more advanced in query formulation using other sources than those given in the tasks as well as following system suggestions and using advanced features of resources discovery systems (MFS).

(e) Database Selection grouping

In the case of 'Database Selection', participants preferred to use it in conjunction with 'Boolean Search' more than any other components.

Database Selection (16/26)		
	Boolean Search	(6/26)

Users who selected specific databases in order to narrow a search (e.g. EBSCO's Film and Television Literature Index) also took advantage of a Boolean operator AND, OR, or AND NOT to limit not only the scope of their search but also to bring together the results for a number of searches within one action (e.g. 'television' OR 'movie' OR 'film' AND 'product placement' AND 'Times'). It seems that combining these two components saved time but more so provided fewer but more relevant results.

From the user observations and their comments it can be suggested that participants within a higher literacy level preferred using this combination of 'atomic search components' because they were aware of the existing databases within the library collection and they knew what subject areas they covered. Participants who used this grouping were familiar with the resources they used, often ProQuest, CrossSearch and EBSCO offered an 'Boolean Search' facility and a selection of databases to choose from.

It appears that the researchers (EX) from Cranfield University were more inclined to use these combinations of search components. The participants seemed to be more aware of the different databases available from the library resources as well as taking advantage of Boolean Search provided by the resources they used during the information seeking activities.

Another group of users who appeared to have knowledge about the databases subscribed to by the library and used Boolean Search options supported by EBSCO was PG group from Middlesex.

3.3.4 Search groupings and user groups

It was observed that participants applied different combinations of basic 'atomic' searches, when searching for information and the choices they made related to the level of information literacy. Some components occurred more frequently in some of the user groups than others. For instance, undergraduate students (UG) used the 'Multi-Field Search' marginally more than postgraduate students (M=0.33 and M=0.13 accordingly) whereas the 'Link Search' component had a greater use by postgraduate students (PG) than by UG (M=0.54 and M=0.27). The section below gives a detailed description of what searching mechanisms are associated with the different user groups.

(a) Use of 'Re-formulated Search' vs. Personal Knowledge/Experience

All participants applied the 'Re-formulated Search' and 'Personal Knowledge Experience' atomic search components to a greater or lesser degree when seeking information. However, it was observed that this was a component that appeared more frequently in the Experts group than in any other group (M=0.6). This group of users was able to extract keywords and collect new search terms from the initial set of search results with a greater level of confidence and re-formulate their search. UG students appeared significantly more reserved in applying this 'Re-formulated Search' (RFS) component (M=0.16) and used keywords that were extracted from the given tasks thus choosing the safer option and remaining within a self-imposed boundary. This may be a reflection of either a lack of experience or a lower level of literacy (or a nervousness at being observed?).

Similar results were observed with the 'Personal Knowledge/Experience' Search component. UG used this search less often (M=0.11) than the Expert group (M=0.2). It appears that UG do not have the same level of confidence in experimenting creatively with search terms in order to take them outside their comfort zone. They felt more comfortable using terminology provided within the task descriptions.

(b) Use of Link Search

This search was used most frequently by the PG group (M=0.54) and less frequently by Experts (M=0.3) and by the UG (M=0.27) group. Participants followed links in order to find more information, to confirm previous findings or simply to explore other possibly related material (e.g. follow references). Following links were perceived to be time consuming and Experts preferred to be more focused on their task and performed searches that resulted in immediate outcomes. UG on the other hand, spent more time evaluating already retrieved results. This may be because they were less familiar with the topic and/or because they did not want to experiment with keywords. Again, the UG group was less experimental and less willing to take risks in 'chasing' the unknown. PG students were observed to apply this component more frequently than others. It seems possible that their level of information literacy and the domain knowledge were not high

enough to let them peruse with more focused searches and not low enough to be concerned with the possibility of 'going off track'.

(c) Use of Multi-Field Search

The 'Multi-Field Search' (MFS) is one of the advanced 'atomic search components' which require the use of sophisticated searching capabilities such as searching within different fields (e.g. 'Publication title', 'Citations and document text' or 'Person'). In the UBiRD study, the group that used it most frequently was Experts (M=0.5), followed by the UG (M=0.3) and it was the least frequently used by PG (M=0.1). Experts were better aware of the advanced search capabilities in the various resource discovery systems and used this component to narrow the search, which consequently resulted in fewer but more relevant results. Interestingly, the UG group consistently applied the MFS component in two library resources: EBSCO's Business Source Complete and the Emerald E-Journals portal (which also allows searching within a journal) in an experimental way suggesting a willingness to come out of their comfort zone in library-provided resources.

(d) Use of advanced 'atomic' searches

From the 'atomic search components' that were used by the UBiRD study participants, using some of the components required an advanced level of information and digital literacy as well as domain knowledge in order to use them effectively but more so to use the advanced features that they encompass with the intention to obtain more 'powerful' results. These components are: 'Boolean Search', 'Multi-Field Search', 'Database Selection' and 'System Suggestions, which we referred to as 'advanced'. Although the advanced components were used by participants from all studied groups the Expert group used them more frequently than others. Table 4 presents the mean value for each of the discussed components for each user group.

Group	Atomic Search Component			
	BS	MFS	DB	SYS
UG	16%	33%	11%	10%
PG	9%	13%	30%	20%
EX	25%	50%	35%	45%

Table 4. Distribution of the use of more advanced 'atomic search components' by User Group (NOTE: The percentages do not add up as the table only shows a partial set).

It appears that even though UG participants used the 'Boolean Search', they were rather conservative with using other components such as the 'Database Selections' and 'System Suggestions'. The reason for not using 'Database Selections' could be two fold: a lack of information about the databases available from the library; and a lack of knowledge about the scope and type of material available on the databases. Even when a resource discovery system made suggestions, the 'System Suggestions' search component was ignored and was not used by the UG group. This could be because it was not clearly shown on the screen or because they did not understand what the suggestions meant. This behaviour often resulted in users undergoing a 'phase shift' and beginning a new search either on the same system or another one. Again the best example of this is the use of GreenFile to search "product placement television programmes" (CP3) or searching just the 'Film & TV Literature Index' rather than combining the search with EBSCO's Business Source Complete (MP10).

3.3.5 Results evaluation behaviour and strategy

Evaluation occurs at two different levels: (i) evaluation at the level of results; and (ii) evaluation at the level of individual documents. Although the second level of evaluation, evaluation of individual documents, was very much the same for documents retrieved from the library or free Internet-based resources, the first level, evaluation of results, changed depending on the resources used.

Once the results were obtained, participants went through the evaluation process deciding which material was relevant and which was not. During this process the decisions were made based on: (a) the appearance of the search terms within the title and text displayed, (b) source and authority of information, (c) credibility of the source, (d) type of publication, and (e) currency of material.

(a) The appearance of the search terms within the title and text.

The process was initiated by viewing the title, searching for keywords related to the topic or other indicators of what an article was about.   CP9 (p.24) "From the titles you can see that they don't have the specific keywords related to [the topic] … so that means there will be some relationship but there is no direct link …".

(b) Source and authority of information.

When working with Google's search results, participants evaluated the relevance of the results by processing the information included within the web address link displayed and examined the source of individual results by looking for known facts and information rather than just reading the titles of returned results. The first few lines of the text displayed within each of the results are examined for the keywords that imply its relevance.

(c) Credibility.

Another important issue lay in the *credibility* of the source. Participants examined the source's URL address looking for information that would identify its origin (e.g. a forum, university, or journal) and based on that they pursued with exploring results. For instant, if the name of the site consisted of the word 'forum', this was an indication that this site was dedicated to people's discussion and was consequently of a lower value. Here are just a few examples to support this view: CP10 (p.16) "'Birmingham Mail' – I've never heard of it. I'm not sure if this is a very good source or not. I'd probably go to their website and check out what they do, [i.e.] what kind of leadership do they have etc." CP2 (p.16) "Oh, the 'Journal of Advertising Research' – it sounds like a reasonable journal . . . it has a good title but I've never heard of it so I'm going to find out about that journal". Although often in the academic world Wikipedia is a 'no go zone' resource: LP4 (p.16)

"[Wikipedia] may not be a perfectly reliable source", participants often used it as a basic source helping them in understanding the topic and providing information worth following (e.g. examples of product placements in movies). Moreover, the general view was not to use Wikipedia material for referencing but rather follow up the sources checking out their credibility.

(d) Type of publication.

Participants also paid attention to the type of publication. This related to the second task where the participants were asked to provide evidence of film tourism. In this context CP4 decided to ignore local publications as by her understanding of the topic she wanted to find examples from well-known publications: "… like we have the Grimsby Times – it's obviously a local publication so I'll completely ignore that." (p.17). CP4 (p.16) "There are hundreds of journals are coming up but I'm not happy with them. Some of them look okay but some of them look like they are not really the type of journal you want to be basing your work on apart from 'Management Science' and 'Marketing Science'…" CP10 (p.17) "This is from 'Businessline', which I know is a very good Indian newspaper . . . so that's a good one". LP2 (p.17) "It came out from Google Books so it'll be okay".

(e) Currency of material

This was yet another relevant issue when evaluating information at the level of results. Participants wanted to obtain the most recent information believing that it was one of the task requirements. Different approaches were identified in relation to the currency of material: (i) 'Date Limit Search', (ii) date was included as a part of a search terms (e.g. 'film tourism 2008 2009'), (iii) choice/selection of information sources (e.g. journal articles (current information) vs. books (older information)). LP2 (p.11) "If it was a book it would be easier … But it's probably going to be too old. It's already one year old. I need an article … first of all I will look for journals and not for books – for the simple reason that journals come out frequently …"

3.3.6 Refine or re-formulate behaviour and strategy

If the participants were not satisfied with their search results, i.e. too many or too few results, or the resources are inaccessible or irrelevant, or they 'hit a brick wall' they most often refined or re-formulated their search. This generally requires additional information i.e. more relevant results or use a better set of keywords to get a more focused or specific results. When this occurs often enough participants changed where they were searching.

(a) Refining the search.

Searches tended to be refined when additional keywords were found. For example, CP1 expresses delight at having found a useful keyword for his/her search, "Yeah, I found another word that I can put together 'Destination Marketing'" (p. 18). LP7 (p.19) "If I was familiar with the topic, I'd be searching for authors as well. . . to find the most relevant authors. This would be the second stage – a search for key authors on the subject"

(b) Expanding the search.

This user has become confident and starts to use his search terms to broaden the search. CP4 (p.19) ". . . because I know that my search terms work, I'm going to check television as well – if I can do film, television and movies in one go, . . . a lot of things may come up"

(c) Narrowing the search.

At times the user needs to narrow the search results due to the sheer number. Some users expressed their irritation at the great number of results. . For example, CP4 (p.20) "So I have masses of results. . . . which is irritating . . . so they need to be narrowed down".

(d) Logical expansion of search.

This is described by CP7 (p.23) when s/he begins with TV as a means of communication, then TV as advertising, TV as effective advertising and then the mobile industry as an effective means of advertising. This may not be logical to us but it made sense to the user carrying out the search based on the evaluation of the search results that were thrown up.

(e) Noting down their searches and re-using their search on other resources.

Users generally tended to keep their searches and re-use them on different resources when they worked. CP4 (p.20) "I'll keep that search now that I've got something that works and I can repeat that on Guardian and FT . . . I'll then do a similar search on Google and I'll make a note so I won't forget".

(f) Additional keywords were often used to redefine the search.

CP8 (p.21) "I have more keywords (referring to the keywords listed in an article] so I can go to the library databases and look at EBSCO and ProQuest."

3.3.7 Change resource

(a) 'Hit the wall'.

Users tended to express emotions when they 'hit the wall'. The use of the words, 'annoying', 'irritating' 'stuck' ' frustrated' are evident in the language that was used in the talk aloud comments. Users also expressed embarrassment when search results were not as expected: "I'm very surprised that . . . my search terms have brought up things to do with porn and sex [laughing] . . . so I am going to have to think of something else as it's [keywords] obviously wrong" (CP4 (p.17).

(b) Phase shifting.

If they were using internal resources such as one of the bibliographic databases, they may leave it and go to the internet and use tools such as Google to find their bearing, learn more about the search topic in order to find better search terms, or to re-do their search. CP4 (p.20) "I'm feeling annoyed by the search I have done - and this is all I have found . . . I am going to go to Google". We call this change in resources from internal to external and vice versa, *phase shifting.*

3.3.8 Abandon behaviour and strategy

On some occasions, instead of applying a 'Re-formulated Search' participants abandoned their search and started new ones, or abandoned a resource and selected a new one.

This happened when they were either not able to find any information, not able to access the resource (e.g. required to 'Sign/Log in' or purchase of a document), information was not available (e.g. no full text or PDF only an abstract) or when they could not authenticate to Athens to access a database.

As stated earlier, this occurred when participants 'hit a wall'; that is they reached the point when after performing a number of searches which returned unsatisfactory results and exhausted a number of resources that they believed were appropriate for finding information on a given topic no progress towards finding relevant information was made: '… that's what I call it a dead end. I don't know what to do.' (LP2,p.2).

Users also expressed embarrassment when search results were not as expected:
CP4 (p.17) "I'm very surprised that . . . my search terms have brought up things to do with porn and sex [laughing] . . . so I am going to have to think of something else as it's [keywords] obviously wrong".

Users would get 'massively irritated' if search engines/interfaces did not work in the way they expected. CP4 (p.25) "I don't know why you can't . . . they might have changed the functionality. You used to be able to . . . I am abandoning this as this is too frustrating" (p.26).

When users feel frustrated using library resources, they go back to Google to find their bearing or to re-do their search. CP4 (p.20) "I'm feeling annoyed by the search I have done - and this is all I have found . . . I am going to go to Google".

Sometimes, participants would come across the option to purchase the full-text article and they would seek alternative ways to obtain the resource such as checking availability in the library or asking friends or others if they have access to specific resources.

3.3.9 View details behaviour and strategy

Working with an individual document was the second level of evaluation. Participants read the abstract or a summary in the first instance to gain an idea of the article's content and validate the level of its relevancy. During this process, they noted down new keywords/phrases that they believed were relevant and could be used in the next query. If the document appeared to be promising, the next step was to obtain the 'full text' or PDF file and evaluate the relevance of the material further.

When working with documents the 'full text or PDF' option appeared to be of high importance. Participants did not want to waste time on material that did not have the full information (see section 'time issues' for more details). Having a full version of a document they scanned its other parts including the 'Table of contents', 'Introduction', 'Finding', 'Conclusions', 'References' searching for relevant information. CP9 (p.24) "Usually I'll look at the first paragraph and then the first sentence of each paragraph and see if it's interesting – if it is, I'll read it all". Often they used 'search within' facilities to speed up the process of looking for specific information within a document, website or a book.

When the material was relevant but not available (e.g. no access, restrictions, required 'Log/Sing in') participants noted the details of it and stored it in the Word document for further investigation. In such situations participants suggested using alternative ways to obtain required material; that is personal or social network. The same method was reported to be used at the Initial stage of information seeking process.

The study shows that in cases when required information was not available or not accessible participants considered using personal or social network to obtain it. They suggested contacting friends from different universities, which subscribe to more/or different databases asking for help in downloading a specific article.

This way of acquiring information is rather novel; nevertheless is becoming more and more popular. Again, the important issues here is time; people will try to obtain information in the fastest way and personal/social network seems to support this.

There were situations where the relevant documents found using Google could be bought online. In such cases, the common practice was to note all the details about the article and consult a lecturer or a tutor to validate its relevance. Participants were reluctant to pay for material online and they only would do it if particular material was of a high importance to their work.

Users tend to look for keywords in the title for relevancy. CP9 (p.24) "From the titles you can see that they don't have the specific keywords related to [the topic] . . . so that means there will be some relationship but there is no direct link . . . "

3.3.10 Store behaviour and strategy

The study shows that storage of information is an important part of the information search and retrieval process. It takes place at the different stages of information seeking: (i) at the initial stage of evaluating results where participants scan through the list and select potentially relevant results for further evaluation. Information is either stored on separate tabs or files are downloaded and kept on the desktop, and (ii) at the level of evaluation when participants work with individual document/material. All relevant material was stored.

In the case of information being relevant, the material is stored using different medium such as: (i) a Word document for further references (i.e. details of documents/web sites were copy & paste), (ii) systems' features such as 'My Research', 'Mark up', RefWorks or EndNote (iii) bookmark, (iv) save in folders, or (v) print.

The data shows that students as well as researchers often preferred to print out their material for future referencing and reading. Printed material helped them to organise their thoughts and concepts as well as giving the flexibility of reading anytime anywhere. CP9

commented: "If it is more than 5 pages I will save and print it so I can read when travelling" (Interview script, p.2).

However, some students preferred reading on line. The reason for that was twofold: one related to the economical situation of international students; printing is expensive and they have to economize, another was participants' concern for the environment. CP6 commented: "I don't' like to print because of concern for the environment" (Interview script, p.3) or CP10: "I do not print any more. It's bad for the environment and difficult to organize printed copies" (Interview script, p.2) whereas MP12 commented: "I try not to print too much because it is a waste of paper" (Interview script, p.6). Others commented that reading on line is something that they are used to doing: MP2: "I'm used to reading on the screen ... it's better to read online" (Interview script, p.11).

As stated earlier tabs were used as a form of storing material. This was observed to be a common practice across all user groups. In addition, the specific reasons for using tabs are: (i) to run multiple searches using different resources, and therefore have the ease of speedily returning to an earlier search; (ii) to keep track of already viewed resources and material that could be used for future references; and (iii) to store information temporarily so they could go back and review it before storing it in an allocated place such as a folder, bookmark, print out or a Word document.

This is consistent with the work of Jones, Dumais & Bruce (2002). Their study shows that people use different ways to gather or 'keep' their information send emails to oneself, send emails to others, print, save documents as files, pass URL's into documents, put documents into personal website, create bookmarks, write paper notes, create toolbar links, and use the note facility in Microsoft Outlook. It was apparent that there are new means of storing information, which are supported by different systems, however they are not always user friendly and required further improvements in order to support this process more efficiently.

Chapter 4 Discussion

The previous chapter presented the results that described the process of information search and retrieval in electronic resource discovery systems. In this chapter we present a discussion of those results and in particular the issues that they raise.

4.1 Information literacy and Information Technology literacy

Information literacy is an often used but often mis-understood term. For the purposes of our report, we have chosen to adopt the definition provided by the Presidential Committee on Information Literacy (1989), which defines information literacy as the set of abilities that enable individuals to "recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information." According to the Information Literacy Competency Standards for Higher Education (2000), these abilities may be described as being able to:

- Determine the extent of information needed
- Access the needed information effectively and efficiently
- Evaluate information and its sources critically
- Incorporate selected information into one's knowledge base
- Use information effectively to accomplish a specific purpose
- Understand the economic, legal, and social issues surrounding the use of information, and access and use information ethically and legally

Information literacy overlaps somewhat with information technology (or what some refer to as digital) literacy because much of today's information is contained with information technology systems. Searching and retrieving of information is so closely intertwined with the process of making sense of the information found, often because the ways by which people formulate their queries today is highly dependent upon the functionality provided by information technology.

Information literacy emphasises the sense-making aspect: how does one know that the information they have found is relevant to or will satisfy their task, or how do they use the results they have found to re-formulate or re-structure their search terms in order to yield better results? This requires some understanding of how knowledge is stored and organised within the systems, methods for assessing relevance and quality, and how to integrate that new information into his or her knowledge and value system.

Information technology literacy, on the other hand, is described by their ability to operate the user interface, their understanding of how the technology is designed to enable the search (e.g. what terms have been used in the built-in indexing systems), and therefore how best to exploit them. Thus, being "fluent" in using information technology will help user focus on the content, analysis, searching and evaluation of the quality and usefulness of the information found.

In the UBiRD study, we have found this overlap between information literacy and information technology literacy. We have also found that the poor usability, high complexity, and lack of integration of many electronic resource discovery systems, have raised the threshold of information technology literacy, and this acts as a barrier to information search and retrieval. This increase in the level of difficulty distracts users from focusing on the content, analysis and evaluation that would help them learn and make sense of what they have discovered. In addition, we have also found evidence to suggest that information literacy skills are lacking. For example, at a simplistic level, many of the participants do not understand how to assess the quality of materials they find. Google or Google Scholar have lower thresholds of information technology literacy, and are considered their "… friends" because of the apparent higher yield or success rate.

In this report, we will try to distinguish between them. While we acknowledge that information literacy may not be a new or recent problem, the evidence suggests that it continues to be a problem. Being able to operate a search engine, does not mean that one

is able to find the good quality information necessary to help us learn and to advance our society.

4.2 Information literacy problems

The levels of competence in information retrieval and evaluation varied enormously among participants, but not by any recognisable standard – such as a first year undergraduate as compared with a postgraduate. This suggests that the gaining of information literacy may be more a case of chance than design. Many participants were unclear about what resources were available and/or which resources were appropriate for their immediate needs: "I don't always know which is the most appropriate [database]", (Researcher, CP2, p. 10), how to access these resources, how to collect keywords, create a search strategy and search effectively and efficiently. Additionally, many did not have an understanding of the difference between library-provided resources and those freely available on the Internet. Their only gauge was the ease of use and the perceived efficiencies of using Google to search on the Internet. Further, users were unaware of the scope of their own institutions' library collections ("cinema would not be at the LSE for sure" Undergraduate students, LP2, p.23).

Based on the interview responses, all three institutions provide basic information skills training and library support to students and staff. For students, training sessions in library use predominantly take place during *Induction Week* when students are familiarizing themselves with their new institution. However, many students voiced the opinion that this is not always the best time as they are overloaded with information and the skills being taught by library staff are not of immediate relevance to their needs.

For the rest of their time at university it seems hit or miss as to whether they receive any training at all, piecemeal, let alone systematic. For example, it is clear from many of the undergraduate participants that they and their peers are not aware of library electronic resources for the entirety of their first year as in the majority of cases, their coursework does not require them to go beyond the Internet as the main source of information for online resources. This in itself may not be bad news if it is part of a deliberate strategy by

academics working closely with librarians to develop a gradualist approach to information literacy with a clear intent to introduce more advanced skills and awareness in the second year. However, it rarely is.

The development of advanced information literacy skills is too often dependent on the native wit of the student, the chance encounter with an enlightened academic who has foregrounded skills development in a particular module or a cost-ineffective but very valuable one-to-one session with a librarian.

Participants communicated mixed messages about the use of the library and the use of the librarian. Participants at Cranfield reported a higher volume of interaction with the librarian than at the other institutions, users usually began seeking help at the preliminary stage of their research when both their research topics and the library was new to them. Cranfield users reported that they liked to work in the library, on their laptops as the library provided a good environment for both individual study and group work. However, participants at the other institutions were much more vague about what was available to them. MP1 did not even now that there were librarians to help them although she had been to a library induction given by a librarian The most common enquiry related to finding a book that was not on the shelf as specified in the catalogue. There were also other instances when participants would request librarians' assistance that related to various technical and administration issues such as: problems with a computer/network login, proceeding with an inter-library loan request and/or making reservations for books.

Indeed the single most common basis for skills development often appears to be peer-based. It was reported that often during group work participants exchanged information about resources with their peers. It was not common practice to seek help from a librarian when searching for information. Many had never met their subject librarian nor were they aware that the library provides subject support in finding information. MP12 states emphatically with respect to his recent discovery of Middlesex's federated search engine 'MultiSearch' which he likens to Google Scholar, ". . . you know, in our research office where we all sit - PhD students- . . . we do share information that will help each

other, but I think most of us are not aware of this and [it has been] quite a revelation for me."

4.3 The system fails to provide immediate and unproblematic access to integrated resources

This study shows repeatedly that participants want quick, easy and unproblematic access to and download of resources. One of the key problems is that often in order to locate desired articles, the user often has to search across several different databases that have different operating procedures. In addition, database searches can often be unproductive because, for example, the full text is not available as anticipated or has been embargoed. There is a gulf between what the user expects the system to be capable of, and what the electronic resource discovery system is capable of supporting.

Looking at the library catalogue and browsing books was often seen as too time consuming. Users got easily exasperated if the results took them down the wrong path: CP10 who is an 'expert' researcher became annoyed when an article that should have been on the topic turns out to have only a few words that relate to his keywords. He uses the expressions, "irritates me", "it wasted my time" and "I don't like it". In a number of cases, participants expressed annoyance, frustration and surprise when there were no results retrieved after a search on a subscribed database.

Additionally, users were annoyed when a promise of a link to a full-text article (as in those references found via federated search engines and Google Scholar) did not result in the article(s) being available and required a further step in the process of accessing materials.

"I don't know if this is going to be a relevant article or not. It's not relevant. This is something which irritates me. I was looking for something that might be of relevance to me. I wasn't sure but I still opened it. Because it looked like … I had to go in find a link, click on that link and it asks me a couple of things. I didn't click the link properly, my mistake. It wasted my time.' (CP10, p.6).

Students reported that often they do not have enough time when working on academic assignments - hence their choice of resources. The perception of participants was that finding information on Google is quick – and speed appears to be a greater priority than quality of result. MP1 states that he finds material on Google Scholar because it's quicker and more efficient than the information databases and then he logs into the databases to download the articles he has found on Scholar. The searching capabilities on Google are much more efficient, in the words of another participant, "Google has come along and revolutionalised the whole search concept . . . Google is more dependable . . . than anyone else" (MP12, Interview script, p.2).

In reviewing the user behaviour of participants, the "instant gratification syndrome" described in the CIBER (2008) report comes to mind.

4.4 Confusion when dealing with multiple paradigms and interfaces across systems

Users found it confusing as the electronic resources are accessed through a multitude of different systems that in some cases appear similar, but actually operate differently. Also, sometimes a particular resource (e.g. a journal) can be accessed through multiple access points (with and without Athens authentication) and therefore have different access rights, different access structures, different user interfaces, and are based on different assumptions.

Although library resources provide specialized material of a high quality they are often found to be too difficult and complex to use; they are not user friendly and they require specialist knowledge. MP12 describes the academic resources provided by the library as being 'professional' for 'professionals' whereas freely available web resources are for everyone to use including the novice user.

Confusion and disorientation with the unfamiliar was common. The user can quickly become baffled as in this example: a page of Delicious bookmarks on the LSE library site 'Free Web Resources' (Figure 4) confused one user who came across it: "There are too many words. Normally I'd prefer a search box . . . not sure what to click on . . . 'business' maybe?" (LP5, p. 7).

Figure 4 'Free Web Resources' at London School of Economic library (LP5)

At times the participant is puzzled when database functionalities are either real or perceived:

 "I don't know why you can't … they might have changed the functionality. You used to be able to just put in Times in 'Publication Title', which was really good because it would bring up the normal Times, The Financial Times and the Times on Sunday but now something seems to happen in ProQuest where … you can't do that and so … which I don't understand. Because now I have to pick each publication but this makes the amount of searching that I have to do more. Because now I have to do an increased amount of searches because I got to put 'The Daily Telegraph' separately from 'The Sunday

Telegraph' where ordinarily I would just put Telegraph and it would bring up both for me. Because I haven't got as many rows to add as I would like, because I normally do everything at once in one job … so I don't know why it's done that. But this is really irritating. I'm abandoning this because it's too frustrating." (CP4, p.5).

Sometimes this could arise from a confusion as to which data structures that were being searched: the built-in thesauri or the records themselves.

Participants were also dissapointed that university electronic resources (such as EBSCO and ProQuest) do not have a spelling correction feature. Again, having the experience of using Google, where the system provides users with alternative spellings with a 'Do you mean . . . ?", participants expected the same from the database search. Users did not understand how EBSCO's Business Source Complete could come up with results which matched none of their keywords. They did not understand the 'smart search' facility and usually abandoned the search at this stage instead of evaluating the system-generated results.

A time-out problem. When the database timed-out, all the searches performed were lost and there was no record of them after the user re-logged into the system. This was especially irritating when participants had been working on the system for a while and had created many searches that were lost. This was evidenced at Cranfield.

From the above, it is obvious that in order to use library-provided resources, one requires not only the knowledge of how they can be accessed, how the search mechanisms work but also a subject/domain knowledge that allows the creation of 'correct' keywords which are recognised by the system.

Participants commented on various limitations of the systems. One of these relates to the availability of requested documents. Surprisingly, even when a document was not available, the systems suggested otherwise on many occasions.

The federated search engine promises to incorporate accurate information on where a title is available as full-text and where it is only a reference. However, users are expected to click to find a full-text only to be informed that the article is not available in the library and that they need to request it through inter-library loan. Users abandon searching on library-subscribed resources when this occurs too frequently and turn to freely available resources on the Internet. This kind of situations raised expectations and often upset and irritated participants as they wasted time without obtaining the required document.

A clear division of which resources are available as full-text and which ones are references to articles on the screen at the outset would increase user satisfaction immediately.

"Because we don't have the full text, I'd go to SFX and follow any link it'll give me. Although sometimes this is frustrating because even though you follow the links, we don't have access to it. So you get there and you still can't download it, which is just plain irritating" (CP4, p. 27).

Often search features appeared to be too complex and did not help inexperienced users to formulate their searches and select appropriate options in order to narrow the search results and obtain relavent documents. Very often, participants just put the search terms in the first box provided without specifing the field within which the search should be carried out. For example, MP7 types the following terms in the Google Scholar: "pepsi product placement in movies television".

Much of the confusion is due in part to the lack of transferability of learning between systems, and the apparent similarities between them that underlie significant differences. At the moment, users need to know when they are in a particular 'mode' so that they can apply those rules and assumptions that govern operation of the system under those mode conditions.

4.5 Users often revert to the familiar

Users were often observed to revert to resources or practices they are familiar with. For most of those users observed, having grown up with Google, and with it being considered a powerful search tool, many users resort to it when they come up against a wall. It may help them locate the actual article itself, or help them find better or alternative search terms or locations. Many participants felt at home searching Google. MP12 explains that he is inclined to search on Google first because it is more familiar than the library resources. Not only is Google more familiar but also safer to use (Interview script, p.1). Partly because of the ease of use of Google and Google Scholar, and in particular their reasonably high hit rate, many users have developed a naïve belief that Google is a reliable source, and that it has high quality articles.

Unfortunately, users do not like taking the time to become familiar with the resources nor about restrictions on how the databases work. They do not read what the different databases are about or what they can or cannot provide, embargoes that determine when articles become available, or why some have only partial availability.

Other participants used their peers to exchange information or develop their understanding of the topic. MP9, in her interview, emphatically states that she goes outside the University for help. She would rather ask her brothers and/or sisters than ask her tutor or the librarian for help (Interview script, p. 13).

As stated before, participants' choice of resources was determined/dictated by their domain knowledge, knowledge about available resources that would provide information on the specified topic, knowledge about the content, structure and experience of using specific resources.

Some overseas postgraduate participants used their previous university library resources (where they had studied previously) or accessed resources directly using the web address instead of the links from a library web site because they did not know the web address for the library website. They were familiar not only with the resources available at their

previous universities and what they offered, but also with access methods which they found confusing in the UK: "…erm, what I could do is go to my, and I'll probably do this from my Australian university 'cos I used their databases in the last few years" (CP12, p.5).

4.6 Structure vs. Semantics: Database structures hinder users finding information

For most users, their familiarity with search engines like Google, they have transferred their understanding of information search and retrieval to databases. While similar – both Google and databases allow you to find and retrieve information about articles – Google users do not need to have an understanding of how the data is stored on the internet, whereas, having some idea of the principles of relational databases, data tables and tuples (records in relational databases), i.e. the structures in which most bibliographic databases store their records, will help them in formulating their searches.

Another difference mentioned earlier is that the specific operating procedure for accessing records in different databases are different. Users have to learn the procedural knowledge for using a particular database, which obviously has limited transferability. Their familiarity with search engines which are more forgiving and have much fewer rules, allow them to find information at a semantic level. With databases, they need to know the procedure, as well as some basic idea of how the data table is organised, and to what subject matter does the built-in thesauri refer (e.g. a database on marine biology would probably not have an index term "marine biology"!).

One of the things that we did not observe much of during the study was the use and application of Web 2.0 tools to the resource discovery process. In fact, the assumptions that have made (by others) that present day users are Web 2.0 savvy, is probably not wholly accurate. While a number of users may be familiar with Facebook, Twitter, and so on, there is little evidence in our study to suggest that their knowledge in the use of such technologies is actually being applied to search and retrieval tasks in resource discovery. What we have noticed was that users use their social networks – be it through

Facebook or simply email – to seek advice from their friends or people they know who have the knowledge. The absence of evidence that users use Web 2.0 tools such as Zotero to help or integrate their resource discovery activities suggests that the design and purpose of these tools are so different that the users find it hard to apply these tools to resource discovery settings.

This presents an opportunity for many resource discovery databases to be re-designed, and to re-think how skills developed in Web 2.0 applications, can drive the re-design of database-oriented systems so that they focus on a semantic level of search (finding information), rather than at a data retrieval leval of search (accessing a database), and drive the design of better techniques such as user storage techniques, alerting features, storage on the 'cloud' and anywhere access.

4.7 Users' perception of the librarian: from technician to substitute course tutor

The above suggests a further emerging issue, namely the perception of the librarian and their perceived role within the participant's overall development towards full information literacy. This study provides some evidence to support the view that librarians are not perceived as having provided any aid in developing users' understanding of their own needs (in line with Theng, 2002). Rather, librarians were seen as guiding them on how to use specific resources they themselves had chosen. Participants reported being generally autonomous library users; they do not ask librarians for help in their queries but rather use the electronic resources to find material. The most common request made of a librarian related to finding a book that was not on the shelf as specified in the catalogue. There were also other instances when people would request librarians' assistance that related to various technical and administration issues such as: a problem with a computer, proceeding with an inter-library loan request and making reservations for books.

Reference has already been made to the user approaching the librarian to speed up a search that is stalling. The further implication of LP4's comments is that a perceived role

of the librarian is to help clarify and interpret tasks and briefs given them by their course lecturers. CP2 (p. 10), "I'd definitely go and ask the librarian because they are really good at [identifying] what resources are useful and they would be able to help me to find an answer." This suggests that the librarian is sometimes used as a substitute for that particularly scarce resource: the academic.

4.8 Need for storage and how it is used

This study shows that one of the important activities people do during a search and retrieval process is the storing of information. This happens at different stages of the information seeking and the first storage usually takes place when participants evaluate a list of results and store temporarily individual documents/material using tabs. These tabs are then re-visited for further evaluation and if information is relevant stored permanently using different means; from notes in a Word document, saving downloaded material into a folder, bookmarking to more sophisticated features provided by various resource discovery systems (e.g. RefWorks, Endnotes, My Research).

Storing relevant information allows users to keep track of material, organise their references, but importantly, also allows them to re-visit at anytime. The notion of tracing back to documents previously found or storing information in the systems' pre-defined storage area was not always an easy task for the UBiRD users. It was observed that users were un-aware of some of these features such as 'alerting' or 'save searches'. Only one participant from the study (CP9, p.7) saved his searches and then after failing to obtaining satisfactory results (he performed 10 searches in total) he went back to 'Search History' to select the search that returned the highest number of results.

It was also observed that participants often gathered information from various resources and put it together in an easily accessible place. This was either a folder, a bookmark in a browser or a number of tabs. Participants want to have access to the stored material at anytime and at a 'click away'. MP12: "… I think the concept of saving to the desktop is

getting more and more into the background I guess, because I tend, you're right, I tend to bookmark things more than save them because I am assuming it will be there when I click the bookmark again." (p. 6).

Although browser's bookmark features were applied by the UBiRD users, none of them demonstrated knowledge of Web 2.0 bookmarking facilities. Instead, they made reference to not having their locally stored bookmarks available during the study, which created problem finding or retrieving found information.

The already existing storage spaces within various resource discovery systems were used very rarely and one can only assume that users were not aware of they existence, or not sure about what they offered. It appears that the current systems lack good ways of storing and retrieving documents allowing the users to create repositories of information that can be accessed easily and be transferable across different resources.

4.9 Search components grouping

As stated previously, (see section 3.3.4) when users searched for information very rarely did their search consisted of just a single search component (e.g. Simple Search). Mostly they applied a different combination of search components, and these combinations varied across different user groups. It seems that those who are more advanced in information literacy and subject knowledge (Experts and Postgraduates) used components that often required the ability to extract keywords from documents and use them in new searches (such as Re-formulated Search users). The same groups were also more inclined to use their personal knowledge and experience to expand the search area and bring new leads to the query terms. Other less experience users followed different paths when looking for information. They specified different field options for the search terms in order to narrow the search scope and returned fewer but of higher relevance results.

The search components were used in different combinations and did not follow a specific sequence of actions. The important point is that existing resource discovery systems need

to facilitate for different users from a novice who is often unsure of the ways that the system supports searching activities, to an expert who requires a more advanced way of information seeking.

4.9 Publishers' business model getting in the way

The impression that many users gave was that many library-subscribed resources were unreliable; the certainty of whether one would find appropriate resources was 'hit and miss'. Users did not have the same level of trust with a resource as they had with conducting a Google search or finding relevant information to get them started on Wikipedia's list of references.

Often participants after tracking down a paper were faced with limited access to it; putting embargos on current journals and changing the embargo period without warning are practices that put unnecessary and unreasonable restraints on use. Outrage and a lack of understanding was expressed at an embargo where an article was not available for another four months on database was expressed by LP5 (p.9), "I get four months later? What does it mean?!" User expectations have increased so where databases have full-text, users expect the most current issue to be available. Having some articles available in their full-text format and others not immediately available is confusing.   From what was observed during the study it appears that general feelings amongst users were that there are many restrictions that prevent them from accessing quality articles. Since research is usually conducted by academic bodies and for the benefit of public it should be treated as a public good and therefore it should be freely available.

Perhaps publishers of e-resources need to be more transparent in their commercial practices. For example, the common practice of releasing materials "free of charge" for a period, only to gauge level of interest before withdrawing them and asking for a subscription is, at best misleading as it raises expectations that a particular library may not be able to meet. Putting embargoes on current journals, and changing the embargo period without warning, are practices that put unnecessary and unreasonable restraints on use. At the very least Publishers should provide clearer information on which journal

titles have what embargos, as this information is not always clear unless users come to the librarian to have this information verified.

While we recognise the need and complexity of the running a profitable business, we would like to suggest that an alternate business model is needed that would make access to quality scholarly materials easy and transparent. We note that the current ways of doing business is getting in the way of finding quality scholarly materials through the respective resource discovery systems.

Chapter 5 Conclusions and Recommendations

Overall, we are in a situation where electronic resources and the technologies by which they may be accessed, together with changes in the broad social behaviour of 'the millennium generation', have accelerated far beyond current practices in library user education. We have also seen how fluency with operating information technology can be misconstrued as being information literate. The blurring of the boundaries between the two concepts can present significant problems in the future. The ability to operate a search engine does not mean that one is able to assess the quality or usefulness of information found, refine their searches, and how to effectively integrate what they find into their knowledge and value systems. The building of knowledge on sound information is crucial for society to advance.

One of the challenges of the UBiRD study was to investigate how students and researchers from business and economics study use the electronic resources when searching for academic material. What emerged from the study is an identification of different users' searching behaviour when looking for information, ways of finding it, resources used and the reasons behind using them aw well as different problems and difficulties participants experienced during the search and retrieval process. This study has also suggested a set of recommendations for the publishers and librarians.

Participants of this study used both 'internal' and 'external' resources. However, it appears that when the level of literacy increased the use of the 'internal' resources increased as well. Hence, Postgraduates and Experts commonly used resources such as EBSCO, ProQuest, or Emerald whereas Undergraduate user group used library federated engines (at Middlesex: MultiSerach, LSE: QuickSearch) and a library catalogue.

Amongst the most common 'external' resources, Google was top of the list, then Google Scholar, Wikipedia and YouTube.

The main driving force for the choice of resources used was the prior knowledge and a positive experience with a resource and a perception of trust and belief that external resources provided by Google and Google Scholar are reliable and relevant, and always return a list of results. The most common reason for using 'internal' resources was the quality and credibility of material and broad subject coverage.

In addition, a novel way of finding information was identified; that was using personal and social network. The users from the study groups reported asking friends, family, associates or colleagues for help in identifying sources of information as well as obtaining required information.

When looking for information different ways of finding it were distinguish; some participants used Google & Wikipedia as a starting point whereas others began their searching with the library catalogue looking for books as a source for gathering background information. Undergraduate group was more inclined to use these resources. Another group used Google Books to find relevant material and then check its availability in the library. In should be noted that only two participants from the studied groups tended to use e-books but they abandon the source as they did not know what to do.

The study also revealed that participants very rarely applied only one searching strategy when seeking information but their strategy changed in relation to the outcome of their search. This resulted in search refine or reformulation, abandon of search or resources or change of resources

We observed that most of the time searches were carried out in combination. For example, a link search is often combined with a re-formulated search, where terms or concepts discovered during the visits to hyper-links were used to refined search terms or reformulated the way new queries are generated, such as to input the search terms in multiple fields. The important message is that people used these different combinations of search components, which depends on their level of literacy and the domain knowledge. However, the current systems do not support these various ways of searching making the information seeking activities difficult and time consuming instead of being problem free.

5.1 Usability and effectiveness of the Publishers' electronic discovery systems

In general, we observed that most users were able to use the Internet and apply tools such as Google, Google Scholar, YouTube, to find relevant information. However, we observed that they had faced a lot of difficulty and frustration when trying to use the electronic resource discovery systems.

Recommendation 1A: Produce a standardised platform for all types of resources

Navigating from one system to another – all of which have different functionalities and different bells and whistles with respect to searching, limiting/refining, indexing, saving and storage or exportation - is confusing for all users. This has been evident in the 'talk aloud' comments made during the observations and in the interviews that followed. Users literally have to 're-frame' their minds when they move from one system to another and this requires patience, persistence and is time consuming. If this issue is not dealt with, it is likely to alienate present and future users from accessing academic e-resources. With dwindling budgets, libraries have to continually justify the purchase of electronic resources by usage statistics. It is unlikely that libraries will continue purchasing expensive databases if this issue of the need for a common platform, a standard, for electronic resources is not addressed urgently.

Recommendation 1B: Include spelling auto suggestions

Auto-suggestion ensures that users are prompted with the correct spelling when a keyword is typed incorrectly. This increases the user friendliness of a system and the perception that the system is helpful.

Recommendation 1C: Ensure in-built dictionary or encyclopaedia

Given that most uses begin by gaining an understanding of their subject by looking on Wikipedia, it would seem that concept/subject/keyword definitions would be a useful feature to have built into the database – and these must come from a quality, trusted source, preferably one that is subject specific.

Recommendation 1D: Ensure keywords are present in every article

Keyword identification undoubtedly helps the user interrogate the system successfully. Author-identified keywords were found to be useful by study participants. For example, CP8 states, "… at the bottom here I have more keywords so now I can go to" (p.10).

Related to this is the subject thesauri and a list of subjects which some databases also have - e.g. EBSCO's Business Source Complete. However, it is not clear or intuitive to the user what the difference is between these two options to refine a search and which will lead to keyword that may broaden or narrow the search.

Recommendation 1E: Use Simple Interfaces

Google's simple search makes it a user-friendly search engine (Figure 5). The interface is clean and attractive. It is not cluttered or filled with any other unrelated information (when initiating a search). Users tend to know what to do intuitively.
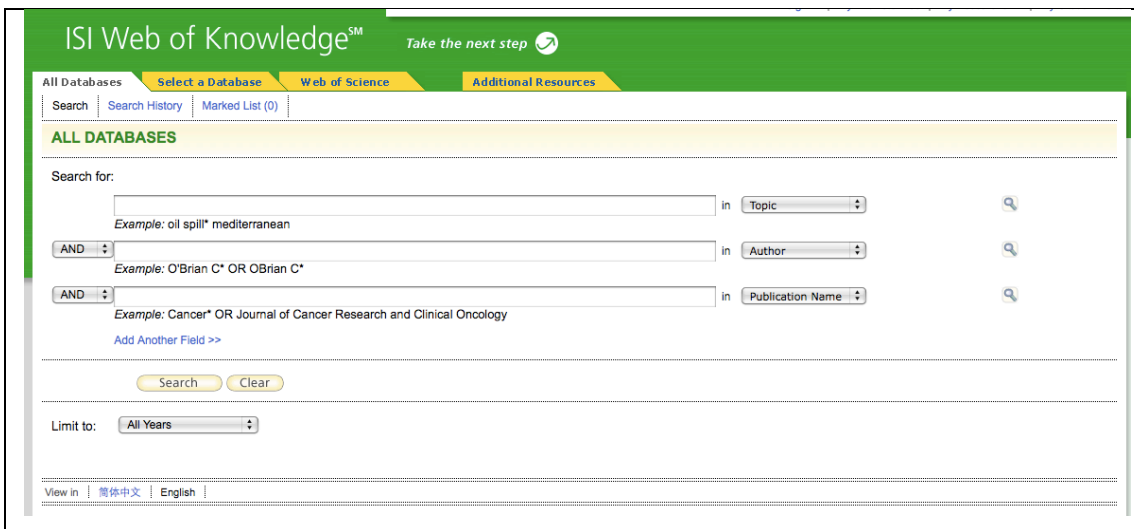
Figure 5. Google's search box

Figure 6. ISI Web of Knowledge

Too many options are putting users off and making searching appear overly complicated in the initial stages of a search process (Figure 6). This is confirmed by the interview comments made by MP12 and he advises "keep it simple" (Interview script, p. 3). CP10 (p.10), "Here is EBSCO. I used it in the past and don't like it very much. It's a little complicated to use. What is this 'EBSCO host Research Databases' and 'Business Searching Interface'? . . . give me a simple interface . . ."; and the same user makes the following comment again ". . . select all of these. Why do I have to select all of these.

And where do I search? It is in these instances, users turned to the librarian to ask for help.

CP2 (p.24) "[Journal Citation Index'] has the worst searching capability ever. It doesn't do the nearest match [i.e. smart text searching]. You need the exact title and it isn't easy to find that either . . .."

Recommendation 1F: Make users aware of changes to database functionality

Publishers need to make it clear that database functionalities have changed so that users are aware of these changes. Users who have not logged on for a while do not like unexpected changes and express irritation and surprise (CP4, p.25).

Recommendation 1G: Address the "time out" issue

Users became frustrated when searches were saved by the system and the system would 'time out' CP4 (p.26) "Another issue with ProQuest is 'Time Out'. It is irritating because all the searches are lost!"

Recommendation 1H: Improve facilities to support dynamic searches, retrieval and re-access process

We recommend that electronic resource discovery systems (i) need to be flexible to enable users to move in and out of these resources and to return to and continue a previous search. We call this continuity across different search modalities; (ii) accommodate the various combinations of search activities, rather than just static or rigid pathways, recognising that search activities occur in various combinations, rather than in pre-defined sequences; and (iii) enable easy transition between 'internal' sources (library catalogues, EBSCO, Science Direct), and 'external' sources (the internet, Google, Google Scholar, YouTube).

Recommendation 1I: Include facilities for annotation and analytical support
functions

We recommend that the future resource discovery systems should support such annotations and analytical functions that would enable them to compare, trace, correlate, and to find expected as well as un-expected associations between published works.

5.2 Usability of Library's electronic resource discovery systems

Recommendation 2A: Make it easier for users to the identify appropriate resources
for their study

Information on the value of using a resource is perhaps something that needs to be more readily available to the user. S/he may not know what the scope of a database is if they are faced with a list of electronic databases without much information on what the database covers and its' usefulness to different areas of study. This is particularly important for multidisciplinary research. Examples of how users are guessing, at best, which resource is appropriate abound in the study. Some are given below:

"I am going to use EBSCO because I believe they will have a reasonable selection (CP2 p.11); Emerald because it's probably not listed in EBSCO; and ProQuest as a kind of big database. I don't know what COPAC is (a resource that is listed on the library site); Ingenta Connect – I suppose I could include this as well for completeness. There are far too many" (LP2 (p.11).

"You know the less confident with using journals, the less you are going to use the journals. This is exactly so in my case. This is the painful thing that I have to try because I don't know what 'Subject Browse' means". "I am not sure what category to use" (LP5 (p.12). Uncertainty with access or resource meant many students just gave up (see: LP5, p.29) and "That's what I call a dead end" (LP2, p.29).

Recommendation 2B: Avoid confusion caused by multiple usernames and passwords

Many participants did not have a separate Athens username and password (LSE and Middlesex) and were confused when asked to type in their Athens username and password to access the resources (example, LP2, p. 27 and LP4, p. 28). Some participants abandoned the use of library e-resources altogether when prompted to authenticate as they did not have or remember their username and password.

Recommendation 2C: Integrate Free Web Resources as part of the Mix in Resource Discovery

Google is a reality and good enough for finding quality information. Librarians must teach students how to make best use of Google rather than deny its significance and value. Increasingly, users want instant access to full-text resources and many institutions are now linking their subscribed electronic resources and institutional repositories to Google Scholar. Researchers are also moving away from the established publisher print models to publishing in online open access journals. Many library catalogues have links to Google Books so that their users can preview the book. Users want this instant access and the time taken to physically go and retrieve a book off the shelves or to request and interlibrary loan and wait for it is too cumbersome for many. Many would rather go and see if the article they want is available 'freely' on Google Scholar [not realising, of course, that the reason it was freely available is because their institution has subscribed to the resource and they are already authenticated to Athens]. With reference to requesting material through the ILL service, CP4 states, "So I'd order through the interlibrary loan because it's not there. I suspect there will be a delay and I will have to wait for it for quite a while . . . I will just go to Google Scholar to see if I can get it another way" (p.7). Librarians need to acknowledge that Wikipedia is a source that student's go to as a matter of course. "Wikipedia has a lot of value if you know how to extract the value. Librarians appear technophobic if they don't acknowledge this is a potentially useful source" (Doctorow, 2009).

Recommendation 2D: Manage user expectations better

User expectations need to be better managed by providing them with the information they need to make informed decisions. Users do not appear to know what databases to use, what the scope of a particular database is nor are they aware of the limitations of the resources supplied by the library. The 'hit and miss' approach mentioned above does not help matters. Much of this needs to come from information skills sessions which must be provided as part of the curriculum in collaboration with academic staff and jargon-free information on the library's information portal. Working closely with academic colleagues so that information literacy is embedded into the curriculum is clearly a way forward.

5.3 Poor understanding of the concept, scope and the way the e-resources operate

It is not obvious to the user what information is available, contained, organised or stored in the electronic systems. They do not have a good or useful 'mental model' that they can use to explain to themselves how to search the disparate data sets. They simply cannot tell how big are the data sets, what do they cover, and how useful they are to their information search problem. As such it is difficult to find, to use, and to re-find, information.

In contrast, in physical libraries, there are areas that look different (e.g. journals collection, reference collection, daily newspapers, archived newspapers etc), and the paper catalogues with index cards, which provide clues as to the size of the collections. Such clues are important sign posts to help users find their way around the libraries. Similar equivalents are missing from current electronic libraries, making it harder to create a good mental model which can help inform and guide their information search and retrieval activities.

In addition, because of the lack of clear indicators, many users make assumptions about what the databases provide (e.g. the mistaken assumption that LSE does not have film and music in their collections).

Recommendation 3A: Make the underlying database structure visible

There were lots of problems trying to understand what is available in the various data sets (e-journals, e-books, e-indexes, library catalogues etc) because of a lack of system visibility, or where search terms do not correspond with the terms used by built-in thesauri. This will help users who are unfamiliar with the database structure to be better able at interrogating the database.

Recommendation 3B: Provide road-sign in virtual information spaces

We recommend that the current virtual information spaces need to be designed so that they cater for important but intangible attributes that help them make sense, find their way around, and find the information they need, by making the information spaces, meaningful places, so that routes or access pathways to these places so that users can 'see' and therefore navigate their way around the place. This is the notion of ecological interface design where the idea is to reveal the features of the environment so that users can perceive what pathways are available to them and therefore become more adept at their task of finding required information.

5.4 Information and Digital Literacy

Recommendation 4A: Develop a coordinated information and digital literacy strategy

There is a real need is for the development of a national strategy with an authoritative body defining information literacy standards and promoting pedagogic good practice, including the use of diagnostic testing of learners. At the present, the onus falls on individual university learning resource centres to develop and implement their own policies. There are many examples of good practice. For example, the University of Staffordshire   and   the   University   of   Cardiff

(http://www.cardiff.ac.uk/insrv/educationandtraining/infolit/hilt/) offer models of good practice. Individual university libraries can work in consortia (such as the M25 consortium bringing together universities in Greater London) with the support of both JISC and CILIP. However, a UK-wide policy that has the buy-in from the professional bodies as well as the QAA is the answer to dealing with the issue in the longer-term.

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