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Personalization: An emerging direction for tackling the web searching barriers faced by teachers when searching for educational resources

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Received November 27, 2011; Accepted December 26, 2011

Abstract

This paper reviews the efficiency of web searching by teachers in the 21st century. The aim of this paper is to highlight web personalization as a perceived solution to the many barriers faced by web users and in particular the teachers in their educational web searching. Hence, research on searching requirements and problems of web users as well as the practical use of some educational search engines will be discussed. To make web searching easier for all teachers and in particular those in the UK, researchers are recommended to explore future information requirements and the search behaviors of teachers. This should enable individual teachers to personalize their search for finding online teaching resources and also the researchers, to design and develop a model of a relevant educational software design.

Keywords

Internet; Personalization; Search Engines; Teachers; Web Searching

Introduction

In this paper, web 'personalization' will be discussed as one of the emerging themes in the literature for tackling web searching barriers. It will discuss how 'personalization' is flagged by both the Government and technologists as the way forward in tackling many of the barriers faced by web users in general, and teachers (educational web users) in particular, in their web searching. Hence, this paper will begin by briefly discussing the design and development of search engines in the last twenty years in order to understand how they have been developed and are still continuing to develop.

The development of Search engines as an ICT activity

According to [Halavais](#) (2009, p. 5), a search engine,

"[...] is usually a system that indexes web pages, [...] to include a range of information environments and media forms, including multimedia and other content found on restricted intranets and individual computers."

The first search engine was called "Archie", short for "archives." It was created in 1990 by Alan Emtage, a student at McGill University in Montreal and was designed to retrieve online files by matching users' search queries with the database ([Wall](#), 2007, p. 1). Generally search engines have three main parts; 'Spider', 'Index' and 'Search Interface and Relevancy Software'.

The spiders are designed to collect, store and update information about web pages onto the search engine's index (catalogue) by looking at the contents, links and changes made to the individual web pages. The search engine software is then responsible for matching search queries with the index (resources in the catalogue) and the ranking of the returned results by placing the most relevant search results at the top of the list ([Taylor](#), 2003; [Wall](#), 2007). The system was further described by [Kaushik](#) (2007, p. 3):

"The search engines have a computer program called spider that indexes the list of words found in different web sites. This program further travels through the links connected with different sites and index another set of words. Only those sites that are being harvested by the search engine are opened. The spider searches a copy of the site, and when the user clicks on links, the actual site opens. The spiders are programmed to omit articles that appear in a page and detect terms that appear in titles, subtitles and meta tags."

Thus, as stated by [Wall](#) (2007, p. 3), processing a single search query would typically require the search engine to perform most or all of the following tasks:

- Accepting the user's inputted query, checking to match any advanced syntax and checking to see if the query is misspelled to recommend more popular or correct spelling variations.
- Checking to see if the query is relevant to other vertical search databases (such as news search or product search) and place relevant links to a few items from that type of search result.
- Gathering a list of relevant pages for the organic (unrefined or personalized) search results. These results are ranked based on page content, usage data, and link citation data.
- Requesting a list of relevant ads to place near the search results.

Following the success of "Archie" search engine more than twenty-five other search engines were created aimed at improving search results and relevancies. For example "Veronica" and "Jughead" were created in 1991; Veronica was developed at the 'University of Nevada System Computing Services group', aimed at serving the same purpose as Archie with the difference that it worked on plain text files. Jughead was created next and offered the same purpose as Veronica. Veronica and Jughead were both used to send files via the Gopher (created by Mark McCahill at the University of Minnesota in 1991), which was created as an Archie alternative ([Wall](#), 2007, p. 2).

Examples of other search engines include "Yahoo!" (released in April 1994 as a directory of web sites), "AltaVista" (released in 1995 as part of the Digital Equipment's web site), "Google" (released in September 1998); and "Microsoft Live Search" (released in 1998) ([Wall](#), 2007). In 2010, the major search engines 'by unique audience' were identified as Google, Yahoo! Search and Microsoft MSN/WindowsLive/Bing Search ([Schofield](#), 2009b) with Google holding 65% of the total search market ([Nielsenwire](#), 2010).

- The meta and specialized search engines

Advancements in search engine technology have enabled search engine developers to design and develop alternative search engines for web users to search the Internet. These search engines include the 'meta' and 'specialized' search engines. With '*meta search engines*' users can send their queries via multiple search engines simultaneously for example, 'Dogpile', 'IxQuick', 'Metacrawler' and 'Vivisimo'. Thus, in comparison to crawler-based search engines like Google and AltaVista, meta search engines "[...] use the indexes built by others, aggregating and often post-processing results in unique ways", rather than building and maintaining their own web indexes ([Sherman](#), 2002, p. 1).

The main advantage of using meta search engines is that users can retrieve and view their search results from different search engines (repositories) with one search rather than visiting each search engine separately, thus, increasing the variety of their search results. However, with these meta search engines, advanced search syntax/options are omitted and search results can be repeated or duplicated ([Sherman, 2002](#)), in addition to users experiencing "[...] time outs" and receiving fewer search results, since meta-search engines:

"[...] only retrieve the top 10-50 hits from each search engine, the total number of hits retrieved may be considerably less than found by doing a direct search on one of the search engines." ([Notess, 2006](#))

In contrast to 'meta search engines', '*specialized search engines*' is such that search results are restricted to one particular group of users or databases. For example, 'Become.com' focuses on shopping queries; 'Answers.com' is for queries on referencing information that is word definitions, technology explanations; 'MSN's Near Me' is for users with local information queries; Yahoo's 'FareChase' deals with travel queries; 'Google Video' is for video searching and 'Google Maps' is for geographical searching ([McLaughlin, 2005](#)).

Examples of recent specialized search engines include the 'FindAnyFilm' and 'Kosher'. The 'FindAnyFilm' search engine was developed by the UK Film Council to advice its users on buying ([Schofield, 2009a](#)), renting or downloading films and the 'Kosher' search engine was launched in Israel designed to find Jewish dishes and to filter 'forbidden materials' ([Butt, 2009](#)). The main motivation behind this specialized search engine was the following:

"[...] to meet the needs of the country's religious communities and to discourage them from using internet cafes [...] [For example] The search engine also has a facility that blocks online shopping during the Jewish Sabbath, which begins at sundown on Friday and ends at sunset on Saturday." ([Butt, 2009, p. 1](#))

Specialized search engines also include *academic and educational search engines* like the 'Economics Search Engine' ([Baker, 2005](#)), 'Educational World', 'EDinformatics.com', 'SearchEdu.com', 'Education Planet', 'Study Web', 'ERIC', 'National Education Association' (NEA), '4Education', 'The Library in the Sky' and most recently 'Google Scholar'. Specialized search engines tend to index pages for a particular topic or category on the web only, which are often not found in generic search engines. Hence, specialized search engines,

"[...] will have smaller and more manageable indexes and have a powerful domain-specific search interface." ([Steele, 2001, p. 1](#))

With this background information in mind, the following section of this review will discuss studies on individual users' web searching needs and their problems.

Research on the efficiency of web searching by the users

Further to rapid developments in search engine developments and indeed web users' demand and usage of online resources, there has been growing research interest in investigating users' web searching behavior. This involves looking at "[...] *what* users are searching for and *how* their information seeking process works" ([Rose & Levinson, 2004, p. 14](#)).

Much of this research is rooted in earlier work on information literacy skills such as [Bates's](#) (1979) concept of the "search tactic [...] a move made to further a search." in which twenty nine search tactics for users are described to improve their search practices, for example, the 'Reduce' tactic where 'ANDed elements' are reduced/removed from queries or the 'Block' tactic where 'AND NOT' is added to a query ([Bates, 1979](#)).

Bates later proposed a new model of searching called "berrypicking" ([Bates, 1989](#)). In this model typical search queries were described to 'evolve' and users were considered to

commonly gather information in bits and pieces and not by one set of returned search results/documents using a variety of search techniques and sources for example, 'Author searching' and 'Journal run', identifying a main journal in an area and searching through relevant volume years. That is, information found at one point in a search may lead in a new unanticipated direction (search moves) and indeed to the development of new goals; the searcher can give higher priority to his/her new goal, thus, user query is said to be modified and/ or changed as relevant information is found along the way.

Berrypicking was used to propose design features for creating databases and interfaces. For example, it was recommended that databases should contain large amounts of text and resources; databases should provide users with simple and easy access that is searchers should "[...] not have to follow a complicated routine to withdraw from one database and enter another" (Bates, 1989, p. 11), and the interface design should enable users (searchers) to bookmark their required information by simply highlighting, storing and printing their selected information and or references (Bates, 1989). In addition, understanding searchers needs and practices was also highlighted:

"As the sizes and variety of databases grow and the power of search interfaces increases, users will more and more expect to be able to search automated information stores in ways that are comfortable and familiar to them. We need first, to have a realistic model of how people go about looking for information now, and second, to find ways to devise databases and search interfaces that enable searchers to operate in ways that feel natural." (Bates, 1989, p. 13)

Other studies on the search behaviors of web users include that of Foster and Fords (2003) who looked at the information seeking behavior of interdisciplinary scholars concerning serendipity. Also in another study by Watson (2008) the searching behavior of experienced web searchers comprising of five faculty members of the School of Information and Library Science at the University of North Carolina, Chapel Hill and six public librarians was examined to provide searchers the opportunity for serendipitous discoveries.

Furthermore, researchers have also been investigating the perceptions, reactions and feelings of users when searching the Internet for information. For example, the perception and reaction of web searchers in missing potentially important information while searching the Internet was studied by Mansourian and Ford (2007) and their different types of interactions when searching and retrieving online information was investigated by Ellis et al. (2002).

Indeed, findings from the above studies on the web searching behavior of users underline the importance of understanding the searching needs of web users, which will be discussed in the following section of this review.

- Research on the web searching needs of the users

Studies on the searching needs of web users include that of Broder investigation on the cause or reasons behind web searching. In Broder's *Taxonomy of Web Searches*, the intention of users is classified into three classes, 'Navigational', 'Informational' and 'Transactional'. The *navigational goal* corresponded to users who wanted to access some known web sites like the BBC and the *informational goal* represented those users who intended to obtain information assumed to be available on the Web for reading only. Finally, the *transactional goal* described those users who wanted to carry out some web-mediated activity such as downloading files, pictures, videos and searching databases (Broder, 2002).

Following Broder's *Taxonomy of Web Search*, Rose and Levinson argued that the goal of users would fall into a hierarchical structure. After analyzing a selection of queries from the AltaVista search engine, the goals for the three levels of hierarchical structure were classified. These levels were entitled as '*Navigational*' (top level), '*Informational*' (middle level) and '*Resource*' (bottom level) queries. According to this hierarchical structure, navigational queries

are very much similar to the Broder's taxonomy as the goal of the user is to access web pages of known organizations or institutions. On the other hand, informational queries are used to obtain information about the 'query topic' that involves finding answers to open and or closed questions. Under this level, the user may also search for 'undirected' requests such as getting advice on health related issues or further information about a particular subject area ([Rose & Levinson](#), 2004, p. 14-15).

Lastly, resource queries at the bottom level represented those users who wanted to find online materials or learning objects other than information in order to 'obtain', 'download', 'entertain' or to 'interact' with online resources dynamically ([Rose & Levinson](#), 2004, p. 15). A typical resource query for teachers would be to download a course handbook or to obtain lesson plan templates from an educational web site.

Moreover, as was explained by Broder, the navigational and informational needs of users were addressed during the first (1995-1997) and second generation (1998-1999) of the search engines. That was when more advanced technologies like anchor-text, link analysis and click-through data were introduced and widely used by major search engines while, transactional queries were addressed only indirectly. Currently, under the third generation of search engines efforts were said to be mainly focused on combining data from multiple sources in order to answer the need behind the users query. Consequently, it was argued that to answer the need behind the users query in the third generation, search engines should go beyond using a limited framework via semantic analysis, context determination and dynamic data base selection ([Broder](#), 2002). In addition, the following argument has been used ([Spink et al.](#) (2002):

"We need a new generation of Web searching tools based on a more thorough understanding of human information behaviours. Such tools would assist users with query construction and modification, spelling and analytical problems that limit their ability or willingness to persist in finding the information they need." ([Spink et al.](#), 2002, p. 109)

Other examples of search engine designs include the Anomalous States of Knowledge framework (ASK), which was an early attempt on designing and implementing a retrieval system, personalized for the informational need of users. Under this framework, the requirements of the user were matched to the following five different classes of information: (1) Well-defined topic and problem, (2) Specific topics, (3) Topics quite specific, (4) Topics fairly specific and (5) Topics and problems not well defined. However, the study was not very successful as a number of problems were identified by the researchers regarding the implementation of their system, especially in translating the need of the users into system codes. It was therefore concluded that an ASK-based IR system is at least feasible ([Belkin et al.](#), 1982, p. 161).

Considering this background information, a number of studies have also examined how web users adopt search tactics and strategies to locate and retrieve their required online resources. For example, [Hoelscher](#) (1998) analyzed 16 million queries processed by [Fireball](#) ([www.fireball.de](#)), a German Web IR (information retrieval system) during July 1998, using semi-structured interviews and observation techniques. The aim of this study was to investigate how experienced web users ('Internet experts') "[...] manage to use the Internet effectively for their information needs and, more specifically, what knowledge structures and strategies do they use?" ([Hoelscher](#), 1998, p. 1212). In this study 'Internet experts' were described as those web users who have the knowledge and skills to use the Web and other Internet resources successfully in order to answer their search query; solve their information problems ([Hoelscher](#), 1998, p. 1212).

However, as was explained by [Jansen and Pooch](#) (2001, p. 237), the findings from this study lacked detailed information and in-depth analysis of such that:

"[...] no information was provided concerning user sessions, and there was limited discussion of query terms [...] Also the Fireball search engine provided the summary statistics, not the raw data, to the researcher, making the particulars of how the transactions were logged and analyzed unknown [thus] [...] is a serious shortcoming given the rapidly changing environment of the Web." ([Jansen & Pooch](#), 2001, p. 237)

In addition, [Silverstein et al.](#) (1999) have analyzed around one billion queries from the AltaVista search engine and in support of previous findings they concluded that "[...] web users' web queries differ significantly from that assumed in the standard information retrieval literature"; there is an increasing use of short queries in web searching, explaining that traditional techniques are no longer adequate for retrieving web search queries ([Silverstein et al.](#), 1999, p. 6).

Moreover, [Spink and colleagues](#) (2002) conducted an extensive research on the Excite search engine looking at users' search behavior, analyzing more than one million queries over a period of four years. The study concluded that users were increasingly viewing only the first couple of pages of their search results and that their general searching habits did not change considerably over the period four years. Indeed, it has been reported that query lengths were simple in structure with few users incorporating advanced search features to their queries ([Spink et al.](#), 2002, p. 109).

Similarly, [Eastman and Jansen](#) (2003) examined one hundred advanced queries from the transaction log of a web search service that contained query operators such as AND, OR, MUST APPEAR (+), or PHRASE (" "). In their study, advanced operators were removed from queries and sent to Google, AOL and MSN search engines; a total of 600 queries were submitted and 5,748 documents were evaluated, in order to compare the coverage (total number of documents found), relative precision (relevant documents found), and ranking (relevant items found at the top of the list) of relevant documents ([Eastman & Jansen](#), 2003, p. 383).

The study concluded that the use of most query operators had no significant effect on coverage, relative precision, or ranking of the search results. Moreover, in this study the choice of search engine and use of operators did not have an impact on the relevancy of research results. This has been reported by the authors as following:

"It appears that there is little advantage to using OR in a query, but there may be an advantage, at least in some cases, in using the PHRASE operator. A difference in ranking might be expected to make some difference to the user since it is more convenient to have relevant items at the top of the list. However, this study found only spotty improvements to ranking with no general improvement using any operator." ([Eastman & Jansen](#), 2003, p. 400)

Additionally, the searching behavior of the European web users using a European search engine called AlltheWeb.com was examined by [Jansen and Spink](#) (2005). Furthermore the searching characteristics, the number of documents viewed, the length of time spent viewing documents and the topical relevancy or usefulness of the searched documents were also studied and two datasets were collected from the AlltheWeb.com.

The first set of data was collected on the 6th of February 2001 and the second set was on the 28th of May 2002. Each dataset contained an approximately one million queries, submitted by over 200,000 users, during a 24 hour period. Results from this longitudinal study showed that the query lengths and sessions of the users are short with little or no use of Boolean operators. Moreover, half of the web documents viewed (documents selected by the web user) were found to be topically relevant. Based on this finding, it was concluded that further research on the web searching strategy of the users is required. This included the comparison between the US and European users of the web search engines ([Jansen & Spink](#), 2005, p. 378).

Datasets from nine major web studies were also compared from 1997 to 2002 in order to check their external validity amongst web and search engine users in general ([Jansen & Spink, 2006](#)). Four of these studies were on European search engines called 'Fireball' (German), 'BWIE' (Spanish) and 'AlltheWeb.com' (Norwegian), while the other five were US-based search engines including 'Excite' and 'AltaVista'. In this study four research questions were addressed: (1) What are the trends and differences in the number of one-query sessions? (2) What are the trends and differences in the number of one-term queries? (3) What are the trends and differences in the number of result pages viewed? and (4) What are the trends and differences in search topics? ([Jansen & Spink, 2006](#), p. 252).

Findings from their study showed that session lengths and query lengths are not increasing ([Jansen and Spink, 2006](#), p. 259).

"The percentage of one-term sessions is remaining stable over time and across web search engines [...] The percentage of single-term queries is holding steady, and the use of query operators is also remaining stable."

However, the use of query operators by web users varied significantly among different search engines and therefore these findings could not be considered for the external validity in predicting behaviors of other search engines. Moreover, viewing of only the first page of search results was increased over time and web searching topics were found to have changed; people were using the Web as a tool for variety of information tasks ([Jansen & Spink, 2006](#), p. 260).

Finally, [Madden \(2007\)](#) investigated search behaviors of 'general public', in Sheffield; observing 39 searches performed by 9 volunteers aged 28 to 77 years old. In this study, volunteers were asked to perform self-selected tasks and pre-defined search tasks, set by researchers. Moreover, volunteers' search sessions were captured and recorded using software called 'My Screen Recorder'. Findings from this study showed that searchers who entered few search keywords and reviewed their returned search results were more successful at finding relevant and or useful information than those who tried to narrow down their search result by entering long series of terms, which also highlighted the importance of understanding users' web searching practices:

"[...] it is clear from the findings of this study to date that, while search engines have an important role to play in information seeking on the Internet, often, the major part of a search takes place elsewhere." ([Madden et al., 2007](#), p. 11)

The online searching behaviors of users were further investigated by [Madden and colleagues](#) (unpublished work), who compared observational data from more than 100 people composed of the 'general public' in Sheffield against transaction logs that had been described in other studies like [Spink et al. \(2002\)](#). They argued that investigating users' web searching behaviors should go beyond student samples in Universities (search practices of undergraduate or graduate students), which are convenient to the researcher ([Madden et al.](#), unpublished work).

In the observation made by [Madden et al.](#) (unpublished work), volunteers were asked to carry out 'self-selected tasks' by recalling and repeating one of their previous unsuccessful online searches as well as performing two or more pre-prepared search exercises. Search exercises were distributed to users based on their individual web and search engine experiences. This information was initially obtained from participants using a university monitoring form. The completion or duration of each exercise for each individual participant was determined by the identification of their useful online information or by their search termination decision. Therefore, a completed task was either when a volunteer felt that a satisfactory answer was obtained, or when the subject wished to stop searching ([Madden et al.](#)).

From this study, the reasons for selecting a particular search engine by the users were identified ([Madden et al.](#), unpublished work):

1. "Size.
2. Aesthetics (e.g., users like the search engine's look).
3. Error (e.g., users use a search box that is specific to a particular web site thinking that they are searching the Web).
4. Familiarity.
5. Functionality (e.g., users feel that the search engine allows them to enter search terms in a way that suits them, or it presents the results of a search in a way that they find more manageable).
6. Recommendation by friend, relative, colleague or teacher."

As part of this study, users 'Query length', 'Session length', 'Boolean use and misuse', 'Number of pages studied', 'Link position' (i.e., first page), 'Success rates' and 'Semantic changes' were also analyzed. Hence, results from this study showed that constructing search queries using Boolean operators mainly quotation marks were appeared to be a difficult task to perform and that finding relevant online resources should not necessary involve using long query terms or Boolean operators ([Madden et al.](#), unpublished work).

Therefore given the above information, findings from related studies on the searching problems of the web users will be discussed in the next section.

- Research on the web searching problems of the users

A number of other studies have also examined common problems faced by users when searching the Web. For example, research suggests that most users are not prepared to spend time learning about extra functionalities. It has been found that only less than one percent of the public use any of the advanced features offered by many search engines ([Steinberg](#), 2004). However, the increasing use of the advanced search features would predominantly depend on their benefits offered to the web user with reference to their individual needs and preferences. Additionally, when faced with unsuccessful searches, 49% of users would often switch search query and or search engine after reviewing the first page of their search results ([iProspect](#), 2008, p. 16).

Furthermore, the frequent interaction of users with search engines have resulted in experiencing many problems with their online searching such as *ambiguity* in their query terms and finding *irrelevant* search results. Ambiguity of query terms arises as generic search engines such as Google and Yahoo require its online users to express their searching needs (query) using search keywords ([Ayers](#), 2005; [Speretta & Gauch](#), 2004). And as [Kaushik](#) (2007, p. 4) described:

"At present, most of the search engines work on the basis of the exact matches of the keywords entered for search. This can be confusing as a single word can have different meanings. In future, search engines will be developed on the basis of concept-based searching and natural language queries, and this phase of evolution in search engines has been keenly awaited by users around the world." ([Kaushik](#), 2007, p. 4)

The filtering difficulties of web users in their search results also occur as the relevancy of search results or links are often determined by the number of times it has been visited and referred to by other web sites ([Nunberg](#), 2003). Therefore such results are not necessarily determined by the individual needs and preferences of the users; results are ordered by web site popularity rather than web users interests ([Speretta & Gauch](#), 2004).

Therefore, given the above findings, it can be said that search engine developers are required to re-focus their time and effort on the 'query construction' of the users and the 'quality' of search results that they receive, in order to tackle the individual/human issues of users and their web searching barriers ([Jansen & Spink](#), 2005; [McLaughlin](#), 2005; [Spink et al.](#), 2002). The success of achieving this level of user satisfaction is also dependent on the management

and organization of the web page ([Asadi & Jamali](#), 2004; [Jansen & Spink](#), 2005). This requirement is further highlighted by [Olsen](#) (2005, p. 2) as following:

"With books, scholarly papers and television programs being digitized and put online, the technology necessary to search through the material needs to be that much better. People need a way to trust the information they find and to ask more-complex questions with search tools so they can extract knowledge or ideas."

Since, currently the existing retrieval systems are not fully adaptable to the individual searching needs and preferences of web users, search engine developers need to understand the goals and practices of online searchers ([Nunberg](#), 2003; [Sugiyama, Hatano & Yoshikawa](#), 2004; [Teevan, Dumais & Horvitz](#), 2005).

Finally, developments in search engine technology have resulted in a number of studies on the searching needs of the web users as well as their problems and usage of educational search engines. These related studies on educational search engines will be discussed in the following section of this review.

Research on the practical use of educational search engines

The purpose of this section is to review empirical evidence about search engines in Education. However, *when searching the literature only a handful of studies* were found in this area. Hence, four examples of previous educational search engines including (1) 'Gateway to online Educational Materials', (2) 'Curriculum online', (3) 'Toolbox Digital Repository' and (4) 'SchoolNet' will be reviewed in this section to show the range of issues facing teachers when searching online.

In the US, there is an educational search engine called the Gateway to online Educational Materials (GEM). The aim of this web site is to improve the ability of the educators to access online information such as lesson plans and curriculum units for their classroom teaching ([Fitzgerald](#), 2003, p. 2). This search engine is defined as the one-step, any-step access to high quality lesson plans, curriculum units and other education resources on the Internet ([Fitzgerald](#), 2003, p. 5). Therefore this search engine supports the assumption that teachers have inadequate time to plan and integrate technology into their teaching, while high-quality and poor-quality educational materials can both be found on the Internet, and these can be sifted out through the application of quality criteria ([Fitzgerald](#), 2003).

With this web site, teachers can search for teaching materials such as 'lesson plans', 'educational web pages', 'books for sale' and also resources available via the national museums. Teachers could use keywords such as 'subject' or 'grade level' to refine their search results. Educational materials entered into the Gateway are described using metadata 'title', 'description', 'grade level', 'GEM subject headings', 'date', 'language', 'publisher', 'creator', and 'cataloguing agency'. Furthermore, the quality or usefulness of a material is determined by the following six criteria ([Fitzgerald](#), 2003, p. 3-4):

1. Accuracy: information presented is reliable, valid, and authoritative, impartially presented, and current. Biased resources should be avoided.
2. Appropriateness: vocabulary and concepts should be appropriate for the intended learners' level. Information and procedures should be relevant to the topic. Extraneous [irrelevant] data, overly advanced vocabulary and concepts, and irrelevant activities are not appropriate.
3. Clarity of objectives, methods, procedures, and assessments: there should be a clear tie between the purpose (goals and objectives) and the content and procedures suggested. This correlation should be comprehensive and obvious. Redundancy is usually unwelcomed and isolated activities without a relationship to objectives are superfluous.
4. Completeness: resources should provide full coverage of essential, current information, as well as include such components as self-contained activities, lists of materials

- required, prerequisites, information for obtaining related resources, assessment criteria, links to quality indicators, and standards. Logical concept development should be evident and content should be comprehensively covered.
5. Motivation: activities should encourage active engagement of the learner. Desirable activities are challenging, interesting and appealing. They build on prior knowledge and skills, and emphasize and promote relevant action on the part of the learner. Activities with potential for developing confidence and satisfaction as a result of learner effort are desirable.
 6. Organization: the resources should reflect logical development and clear actions to be taken by both teacher and learner. It should be easy to use and logically sequenced, with each segment of the resource related to other segments. It should flow in an orderly manner, using organizing tools, such as headings, and avoid use of unrelated elements that are potentially ineffective or overpowering.

Accordingly, the GEM web site (system) was evaluated over a four year period using online questionnaire surveys, focus groups and expert reviews among teachers (end users), content designers and/developers. However, despite four years of continues assessment and improvement of the GEM search engine, problems such as teachers' lack of experience/skills and indeed their individual preferences for online searching, were all reported to be unresolved. Moreover, in the Gateways' final evaluation report (year 4) it was stated that teachers' failure to limit their search results to lesson plans only was a cataloguing and search interface issue, which was a great disappointment to teachers (Fitzgerald, 2003, p. 22). Teachers in the GEM study found it difficult to search the Gateway repository using Boolean operators and indeed to understand the controlled vocabularies (Metadata) adopted by the GEM search engine that is vocabularies commonly used by experienced searchers such as the librarians and computer programmers:

"We observed firsthand that they [teachers] did not understand Boolean logic functioning and phrases commonly used by librarians such as 'full text', 'full record', or 'browse'." (Fitzgerald, 2003, p. 23)

Moreover, when compared to generic search engines like Google, the Gateway search engine was said to lack preferred level of search interface simplicity by the teachers:

"While it seems unlikely that the limited resources behind *The Gateway* can ever imitate the Google phenomenon, we must acknowledge and accept that users are increasingly expecting the power and simplicity of *Google* in many searching situations. Where choices are to be made between increasing complexity versus clean simplicity, it would seem that users continue to prefer the simple route. Both focus groups expressed a desire for simplicity, which is perhaps the real meaning for their liking for *Google*." (Fitzgerald, 2003, p. 23)

Thus, a number of recommendations were made by Fitzgerald (2006, p. 27) in order to further improve the GEM search engine. For example, it was recommended to simplify the interface design/layout of the GEM search engine, to include a 'starter' page to the web site and to evaluate the cataloguing vocabularies currently used to describe resources.

Other search engines that processes users' search queries; provides learner's and or educator's with learning resources, using metadata includes the '[ARIADNE Knowledge Pool System](http://www.ariadne-eu.org)' (www.ariadne-eu.org), the '[National Science, Mathematics, Engineering, and Technology Education Digital Library](http://www.smete.org)' (www.smete.org), '[Multimedia Educational Resources for Learning and Online Teaching](http://www.merlot.org)' (www.merlot.org), the '[Health Education Assets Library](http://www.healcentral.org)' (www.healcentral.org), the '[Education Network Australia](http://www.edna.edu.au)' (www.edna.edu.au), the '[iLumina](http://www.ilumina-dlib.org)' (www.ilumina-dlib.org), the '[LearnAlberta Online Curriculum Repository](http://www.learnalberta.ca)' (www.learnalberta.ca), '[CAREO: Campus Alberta Repository of Educational Objects](http://www.ucalgary.ca/commons/careo)' (www.ucalgary.ca/commons/careo) and the '[LydiaLearn](http://www.lydialearn.com)' (www.lydialearn.com), (Neven et al., 2003; Roy, Sarkar & Ghose, 2010; Sampson & Karampiperis, 2006, p. 131).

The summary of the different available learning object repositories together with their searching and browsing facilities in different subject domains like Science, Mathematics, Language and Music is given by [Roy, Sarkar & Ghose](#) (2010, p. 111-112), in the e-book series entitled "Advances in Semantic Computing".

Finally, issues relating to the design of content models, content reusability, context-aware recommendation and or personalization have been discussed by authors such as Xavier Ochoa, Erik Duval, Gonzalo Para, Joris Klerkx and Katrien Verbert.

In the UK the *Curriculum online web site* was launched in January 2003, as part of the government's initiations to improve standards in schools. Hence, the aim of this web site was to provide "[...] access to a wide range of digital materials to support teaching and learning across the curriculum" ([Kitchen et al.](#), 2006, p. 7). With this new portal, teachers across the UK were able to search accredited suppliers for their required/preferred online teaching resources (digital resources). Using this new portal, selected teachers were able to purchase their required resource/s using their schools' 'eLearning Credits' (eLCs), funded by the government:

"The first tranche of funding was released in the autumn of 2002, and £100 million was provided in each of the academic years between 2003 and 2006." ([Kitchen et al.](#), 2006, p. 7)

This web site was evaluated each year through a series of school questionnaire and interview surveys amongst primary and secondary teachers in England. Initially, the evaluation of the portal showed that teachers do support this new development but was unsatisfied with their search features. Teachers found their search (results) to be 'irrelevant', 'unsorted' and 'time consuming'. Moreover, the search results were not adequately improved by the advanced search options ('refine search') and were considered to be too complex for some teachers to use. Suppliers were also reported to have concerns about the way in which their product was marketed to teachers and were said to find registration and tagging of products difficult to perform:

"Fewer than half of suppliers stated that they found the mechanism for metatagging or uploading metadata, or the conditions and mechanisms to get products accredited, easy to understand. Nearly half (47%) of suppliers were concerned about equality of exposure of products on the web site." ([Kitchen et al.](#), 2006, p. 12)

Consequently, the curriculum online web site was re-launched in December 2003, which led to improving the web site appearance and clarity together with developing a standard system for promoting the products of the suppliers. As a result, findings from this study showed that in 2005, the use of digital materials by teachers for their lesson planning were increased in comparison to 2002 ([Kitchen et al.](#), 2006).

"Some teachers recognised that the use of digital sources for lesson planning could lead to savings in time, commenting that over time it would be possible to build up a bank of easily adaptable ICT-based resources and this would eventually free up time for teaching. Teachers also described how some ICT tools could shortcut activities such as searching the internet for information and pictures or creating exercises." ([Kitchen et al.](#), 2006, p. 18)

Thus, teachers were seen to have developed a more positive attitude towards using digital resources in their lesson plans:

"Digital sources were used on average for 15% of primary subject leaders' lesson planning in 2002, and this increased to 32% in 2005. Among secondary subject leaders, the average proportion of planning using digital sources rose from 15% to 25%." ([Kitchen et al.](#), 2006, p. 18)

However, despite the re-launch of the curriculum online web site, teachers were still faced with a number of technical problems. In their final evaluation of the curriculum online, mismatches were observed between individual teachers' search queries (search criteria) and their returned search results. Equally, concerns were raised about the lack of granularity and abuse of meta-tagging by some suppliers ([Kitchen et al.](#), 2006, p. 14).

In Australia, there is the '[Toolbox Digital Repository](#)' project (<http://toolboxes.flexiblelearning.net.au>) that was undertaken in 2002 as part of the Flexible Learning Toolbox project which involved the design and development of a digital library to support the retrieval, access and reuse of online teaching materials (learning objects).

In this project, content developers were required to define their resources using fifteen descriptors adopted from the EdNA (Education Network Australia) metadata set; a metadata version that was consistent with the Australian Government Locator Service (AGLS). The toolbox was further described by [Crisp et al.](#) (2003, p. 77-78) in the following quotation:

"When keywords are entered into the search engine, a page (or series of pages) is produced with links to the various resources that match the keyword search. [...] Selected items are added to a *collection* with the user able to add (and remove) items until all required items have been sourced. [...] on command from the user the system creates a zip file comprising the pages selected and the resources (e.g., images, graphics) displayed on each page, and allows the user to download this file to the user to facilitate reuse of the items in the user's setting."

Finally, the design and usefulness of the toolbox was evaluated through series of 'test and trials' from which a number of recommendations were made. This included supporting the reusability of digital resources by encouraging content developers to use accurate and reliable metadata ([Crisp et al.](#), 2003).

In Canada, an educational portal called 'SchoolNet' was initially developed in 1993 to support teachers' online searching needs. An evaluation of the educational portal was conducted by KPMG ([KPMG Consulting LP](#), 2000) through email questionnaires, interviews and six case studies to learn about teachers' online searching practices and needs; emails were sent to 3,000 web users from which only 216 replied.

In this study issues relating to SchoolNet's users' lack of ICT training was raised ([KPMG](#), 2000, p. 76). Moreover, in their final evaluation (report) of the portal, four conclusions ('Key Lessons Learned') and eight recommendations were made, amongst which constant monitoring and adaptation of new/improved computers and Internet technologies was called for and the need for the SchoolNet (an educational portal) to identify and tackle other related ICT barriers was highlighted:

"[...] there is a wide variety of barriers to effective ICT use that will be important in the near future, including technical issues related to high-speed access to the Internet, lack of ICT technical support, and so on. SchoolNet is considered to have a moderately important future role in addressing virtually all of them." ([KPMG](#), 2000, p. 76-77)

Other examples of academic institutions or educational search engines include 'UREKA' and 'DigLib-CI'. UREKA is a learning object taxonomy and repository architecture (ULTRA) that aimed at personalizing the creation (storage and retrieval) of learning objects as well as increasing the usability of learning objects among teachers, departments or universities by means of dividing the learning object into (1) a Semantically Meaningful Unit (SMU) metadata based on the IEEE LOM standards stored in XML file with "[...] using Profiling that plays a vital role by storing Basic and Domain Profile of the user" and, (2) a Common Media Framework (CMF); integrating relevant SMU's using Synchronized Multimedia Integration Language (SMIL) ([Ihsan et al.](#), 2006, p. 231).

Furthermore, DigLib-CI, an on-going project (smaller scale but equally relevant study), is a digital library with research and learning materials such as articles, lecture notes, textbooks, quizzes and manuals created at the department of Computer Informatics, Faculty of Mathematics and Informatics (FMI), Sofia University. In this project a set of subject ontologies is investigated in order to provide 'flexible, semantics-oriented access' to the library resources according to their users' profile and language skills ([Nisheva-Pavlova & Pavlov, 2010](#)).

"The complete implementation of the project will help to enhance the research activities and the exchange of teaching innovation and thus will improve the overall scholarly and teaching quality in Computer Science and Information Systems at FMI. It will also contribute to the methodology of development of innovative software systems maintaining the entire lifecycle of academic digital content." ([Nisheva-Pavlova & Pavlov, 2010](#), p. 55)

However, despite the availability of quality learning objects and their organization, that is the continues tagging and sharing of online learning resources around the world ([GLOBE, 2011](#)) by 'publishers', 'consumers' and manipulators; third parties who use metadata to provide 'information services' to online users (i.e., search engines or web portals), reusing and tagging of learning objects is said to be time consuming and thus a difficult task to achieve ([Ahmed et al., 2007](#); [Neven et al., 2003](#); [Nisheva-Pavlova & Pavlov, 2010](#)).

Furthermore, articles from business and IT experts like Hoover, the senior editor of the weekly printed magazine 'Information Week', reported that major search engines like Google, Microsoft and Yahoo are all racing to develop the next generation of search engine technologies in order to better assist web users with their search ([Hoover, 2007](#), p. 1):

"With emerging tools, people will no longer have to dumb down their queries with the pidgin language understood by first-generation search engines. They'll be able to ask questions in English and other languages-- or pose no question at all and automatically receive results based on their earlier queries or the applications they're using." ([Hoover, 2007](#), p. 1)

Indeed issues relating to metadata (tagging of leaning objects either manually or automatically), retrieval and re-usability of learning objects (including web personalization) have been investigated by many researchers and or authors in the field of information science and technology. For example, in Ford's (2008) annual review of Information Science and Technology research studies and issues related to interoperability and sharing of online resources, use of metadata and adaptive systems for personalizing users' resource discovery were discussed.

Additionally, [Roy, Sarkar and Ghose](#) (2010), described social and cultural barriers and challenges of developing sharable learning objects by way of surveying academic staff members (fifteen staff at the School of the Built Environment, University of Salford) from which a conceptual framework for improving the technology was designed and developed; [Liu and Belkin](#) (2011) proposed a model for personalizing users' search results according to their search goal and search behavior in order to improve web users' returned search results by means of predicting relevant and or useful documents; and [Rekha et al.](#) (2011) proposed a model for personalizing online search engines (improving information retrieval systems) using a combination of 'usage mining' and 'content mining' technique to offer its users with potentially useful online learning objects or information.

With this background information in mind, the following section of this paper will discuss web 'personalization' within the context of the UK educational setting in order to tackle ICT barriers when searching online for teaching resources.

Personalization of ICT–use and its outcome in education

One of the themes that are emerging from the literature is the concept of web 'personalization'. Today, the government and technologists, flag web personalization as the way forward in enhancing search engine performances and indeed achieving web users' satisfaction. This has been reported by Heppell (2008) and Wirken (2011):

"In the 21st century technology empowers and democratises [...] [and] As a world of one size fits all gives way to a world of personalisation, education will need to follow to survive." (Heppell, 2008, p. 29)

"The concept of personalisation is one of the next big frontiers in the story of search, primarily because this is the one thing that might provide the most significant step towards quest for the perfect search engine - one that gives us exactly what the users are looking for." (Wirken, 2011)

This means that since new techniques and search algorithms have emerged, web users can receive different sets of search results reflecting on their individual preferences and interests. Currently there is no standard definition on what the term 'personalization' means (Fuller, 2002). For example, Wu et al. (2003, p. 2) defines web personalization:

"[...] to be the adjustment and modification of all aspects of a website that are displayed to a user in order to match that users needs and wants. This includes modifications to the content that is displayed to the user, adaptations of the display itself and of the user's passage through the display, that is the set of links the user might take. What we do not perceive as personalization is the update or modification of a web site that occurs to all users, e.g., the presentation of a travel flyer announcing a special cruise deal. In addition, if a user indicates in a check box that they do not wish to receive email advertisements from a website, we do not perceive this as personalization. Thus, although our definition is broad-based, it clearly focuses on adaptations that are exclusively for the individual user." (Wu et al., 2003)

And according to (DfES, 2004, p. 4) personalization is:

"[...] about putting citizens at the heart of public services and enabling them to have a say in the design and improvement of the organisations that serve them. In education this can be understood as personalised learning – the drive to tailor education to individual need, interest and aptitude so as to fulfil every young person's potential."

However, despite having no common definition, in the DfES's (2006), *Teaching and Learning 2020 Review*, 'personalization' was identified as a key educational priority for UK's schools. In this review it was explained that the education system (schools) needs to respond to the challenges of the 21st century, for example by having:

"[...] far greater access to, and reliance on, technology as a means of conducting daily interactions and transactions [and indeed] [...] a knowledge-based economy where it will be possible to compete with developing and global markets only by offering products and services of high quality, matched closely to customers' [users i.e., teachers'] needs." (DfES, 2006, p. 8)

Additionally, Sunikka and Bragge (2008, p. 4) reviewed 1200 articles that contained the word "personalization" from two scientific journals called "ISI Web of Science" (WOS) and "ABI Inform ProQuest Direct" (ProQuest), during 1986 to 2006. Findings from this review showed that personalization is on the rise and that it is being carried out in various disciplines particularly information systems (IS), computer science and marketing. Moreover, the terms used for defining personalization was said to be unclear however it is anticipated that a common understanding of personalization will emerge in the future. Accordingly, the authors called for further studies on personalization from the perspective of users (Sunikka & Bragge, 2008, p. 9):

"Further studies on personalization are needed; especially in the areas of consumers' views on benefits and drawbacks of personalization, as well as the true effectiveness and efficiency of personalization."

In this review the term personalization is defined as "[...] the process of presenting the right information to the right user at the right moment" ([Speretta & Gauch](#), 2004). Therefore, with personalization we are moving away from 'consensus relevancy' or generalization to 'personal relevancy' or specification. This means that the computed relevancy for the entire population is replaced with the needs and preferences of individuals within the context of their interactions ([Pitkow et al.](#), 2002, p. 50).

Furthermore, research on the personalization of education search engines include that reported by [Wishart and Oades](#) (2003), who performed a four month research, investigating the needs and preferences of different web user groups when using educational web search engines. This study was conducted amongst 27 educators (25 teachers and 2 teaching assistants) and 24 non-educators that is librarians, adult learners and parents/governors, using online questionnaires, two computer based tasks and focus groups. Of the 51 participants, 38 were from the East Midlands and 13 were from other regions in the UK ([Wishart & Oades](#), 2003).

As part of this investigation, users' reaction to personalized features was also surveyed, which included bookmarks and personally tailored web sites together with personalized email alerts and newsletters. In their conclusion, the following users' needs and characteristics were listed by participants when using educational portals ([Wishart & Oades](#), 2003):

- They [participants] wish to be certain of the quality of information they find and use.
- They experience many demands on their time. They have a strong requirement to be able to find the information they need easily, quickly and without having to think too hard about how they might approach the task. They want to be able to use a website intuitively.
- They prefer web pages that fit onto a screen without requiring them to scroll to view the entire page.
- They like a simple, clear site design, with less textual information and more icons on the page. This was a particularly evident characteristic of educators.
- Their information needs are complex. They want to be kept up to date but fear information overload; they are anxious that they don't miss any new developments but want to receive information that is relevant to them. Additionally, they are aware that achieving a perfect match to their requirements would be difficult and are uncertain about whether personalisation can be achieved.
- Teachers have a clear requirement from the web for subject specific teaching resources.
- They require the benefits of personalization features to be clearly communicated on a website. Additionally, they want ready access to simple and comprehensive instructions. Without these, it is unlikely that they will register.
- They expect a personal page to make them feel welcome and valued. They would like to be recognised by a greeting that uses their first name and for this greeting to be prominently displayed on the page.
- Educators often teach low performing cohorts. They also teach cohorts of mixed ages. Others teach children with special needs. In each of these instances, they experience great difficulty in retrieving useful information.

Also, in a small scale but relevant study, the searching needs and practices of teachers were investigated by using the following three research questions: (1) How do teachers learn to access information on the Internet? (2) How do teachers conduct what they consider to be successful searches? and (3) What literacy skills do teachers believe are necessary to the process of conducting searches on the Internet? ([Henry](#), 2005).

This study was carried out in a rural school in North-eastern Connecticut (USA), amongst six middle school teachers using mainly interviews and observations from which the following six

1. '*Literacy skills*' – reading and writing on the web.
2. '*Other skills and strategies*' – critical thinking, Judgment and Common sense, and Logic and Problem Solving.
3. '*Learning technology*' – For example, all the teachers said they have learned how to search the Internet by using 'a trial and error approach', 'being self-taught' or 'a combination of attending workshops followed by self-exploration'.
4. '*Emotional reaction to technology*' – all teachers were reported to have an 'emotional reaction or connection' to using technology in general. In this study, only one teacher had a positive emotional connection with technology (considered herself as a "computer geek") while the other teachers reported to have negative emotional reactions that included 'fear', 'stupidity' and 'panic'.

Additionally, a number of teachers were also reported to have experienced frustration when using ICT tools in their classrooms. This included problems with accessing the Internet and the school's server equipment.

5. '*Issues of digital divide*' – that is students having different access levels at home and or school and levels of ICT skill which can make it difficult for teachers to incorporate technology into their classroom; and
6. '*Technology in the Classroom*' – that is perceiving technology as an important tool and or resource for teachers to meet their students' learning needs in the classroom.

Finally, the author concluded that apart from issues relating to 'literacy' and 'problem solving' skills, there are also other technological and access barriers that need to be further investigated:

"[...] searching and locating information on the Internet requires not only literacy skills but problem solving skills as well. Additionally, there are other issues to be considered such as levels of technology attainment, teachers' comfort with using technology, and equal access for students." ([Henry, 2005](#))

Conclusion

This paper discussed the idea that education needs to be personalized by teachers according to their individual students' learning requirements and preferences. Currently despite the advances in web (Web 2.0) and search engine technologies, teachers in particular, are still faced with a number of ICT barriers when searching online for teaching resources.

This paper also highlighted that there is not a great deal of work carried out on making the search engines, in particular web searching easier for teachers to use in their teaching. Finally, 'personalization' was outlined as a proposed solution to the many barriers faced by web users in general and educators in particular, when searching the World Wide Web. Therefore, to make web searching and finding online resources easier for UK teachers, researchers are recommended to explore further research problems in the area of teachers' information needs and search behaviors. The requirement for online resources has been outlined in the 'Harnessing Technology' strategy and 'ICT in Schools Policy'.

Furthermore, studying the web search practices by teachers would also aid researchers to design and develop a model of teachers' web information needs and search behavior relevant to educational software design. This can ultimately be used by search engine designers and or developers to better understand the web searching needs and preferences of teachers, when designing their search tools.

Acknowledgement

First and foremost, the author would like to thank the Almighty God, for giving me the ability, strength and determination to write this review. The author would also like to acknowledge Dr. N.F. Dolatshad for helping in the proofreading of this article and a very special thank to Dr. A. Seyedarabi, for her unconditional support and interest in my work.

References

- Ahmed, V., Pathmeswaran, R., & Aouad, G. (2007). Learning to share, is sharing to learn. *Emirates Journal for Engineering Research*, 12(1), 27-36.
- Asadi, S., & Jamali, H.R. (2004). [Shifts in search engine development: A review of past, present and future trends in research on search engines](#). *Webology*, 1(2), Article 6. Retrieved September 25, 2011, from <http://www.webology.org/2004/v1n2/a6.html>
- Ayers, D. (2005). [Search personalization and attention](#). Retrieved September 25, 2011, from <http://dannyyayers.com/2005/12/11/search-personalization-and-attention/>
- Baker, L. (2005). [Search engine for economists - Nutch powered](#). *Search Engine Journal*, December 27, 2005. Retrieved September 25, 2011, from <http://www.searchenginejournal.com/search-engine-for-economists-nutch-powered/2701/>
- Bates, M.J. (1979). Information search tactics. *Journal of the American Society for Information Science*, 30(4), 205-214.
- Bates, M.J. (1989). The design of browsing and berrypicking techniques for the online search interface. *Online Review*, 13(5), 407-424.
- Belkin, N.J., Oddy, R.N., & Brooks, H.M. (1982). Ask for information retrieval: Part II. Results of a design study. *Journal of Documentation*, 38(3), 145-164.
- Broder, A. (2002). [A taxonomy of web search](#). *SIGIR Forum*, 36(2). Retrieved September 25, 2011, from <http://www.sigir.org/forum/F2002/broder.pdf>
- Butt, R. (2009). ['Kosher' search engine launched in Israel, Rabbi-approved Google filters out sexual images, TV and other orthodox Jewish taboos](#). *The Guardian*, Monday 15 June 2009. Retrieved September 25, 2011, from <http://www.guardian.co.uk/world/2009/jun/15/google-israel-search-engine>
- Crisp, G., Thiele, D., Scholten, I., Barker, S., & Baron, J. (2003). Interact, integrate, impact. *Proceedings of the 20th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE)*. Australasian Society for Computers in Learning in Tertiary Education, Adelaide, December 7-10, 2003.
- DfES. (2004). [A national conversation about personalised learning](#). Retrieved September 25, 2011, from <http://publications.teachernet.gov.uk/eOrderingDownload/DfES%200919%20200MIG186.pdf>
- DfES (2006). [2020 vision - report of the teaching and learning in 2020 review group](#). Retrieved September 25, 2011, from <http://www.educationengland.org.uk/documents/pdfs/2006-2020-vision.pdf>
- Eastman, C.M., & Jansen, B.J. (2003). Coverage, relevance, and ranking: The impact of query operators on web search engine results. *ACM Transactions on Information Systems*, 21(4), 383-411.
- Ellis, D., Wilson, T.D., Ford, N., Foster, A., Lam, H.M., Burton, R., & Spink, A. (2002). Information seeking and mediated searching. Part 5. User-intermediary interaction. *Journal of the American Society for Information Science and Technology*, 53(11), 883-893.
- Fitzgerald, M.A. (2003). *The gateway to educational materials: an evaluation study, year 4* (pp. 1-32). Technical report. Department of Instructional Technology, University of Georgia.
- Foster, A., & Ford, N. (2003). Serendipity and information seeking: An empirical study. *Journal of Documentation*, 59(3), 321-340.
- Fuller, B. (2002). [Website personalization strategy](#). Retrieved September 25, 2011, from <http://www.ceed.us/tools/articles/personalization-data-management.htm>
- GLOBE. (2011). [About global learning objects brokered exchange \(GLOBE\)](#). *Connecting the World and Unlocking the Deep Web*. Retrieved September 25, 2011,

from <http://www.globe-info.org/en/aboutglobe>

- Halavais, A. (2009). *Search engine society*. Cambridge: Polity.
- Henry, L.A. (2005). [Information search strategies on the internet: A critical component of new literacies](#). *Webology*, 2(1), Article 9. Retrieved September 25, 2011, from <http://www.webology.org/2005/v2n1/a9.html>
- Heppell, S. (2008). [Education 2020](#). *ESCalate Newsletter*. No. 10, Spring, February 28, 2008. Retrieved September 25, 2011, from <http://escalate.ac.uk/4454>
- Hoelscher, C. (1998). How internet experts search for information on the Web. In *World Conference of the World Wide Web, Internet, and Intranet*, Orlando, FL.
- Hoover, N. (2007). [The ultimate search engine](#). *InformationWeek*, August 4, 2007. Retrieved September 25, 2011, from <http://www.informationweek.com/news/201202986>
- Ihsan, I., Mohib-ur-Rehman, Ahmed, M.-U., & Qadir, M.A. (2006). UREKA learning-object taxonomy & repository architecture - ULTRA. *Multitopic Conference, 2006. INMIC '06. IEEE*, Islamabad, December 23-24, 2006, pp. 231-236.
- iProspect. (2008). [iProspect blended search results study](#). Retrieved September 25, 2011, from <http://www.herramientas-seo.com/pdf/estudio-buscadores-iprospect.pdf>
- Jansen, B.J., & Pooch, U. (2001). A review of web searching studies and a framework for future research. *Journal of the American Society of Information Science and Technology*, 52(3), 235-246.
- Jansen, B.J., & Spink, A. (2005). An analysis of web searching by European AlltheWeb.com users. *Information Processing and Management*, 41(2), 361-381.
- Jansen, B.J., & Spink, A. (2006). How are we searching the World Wide Web? A comparison of nine search engine transaction logs. *Information Processing and Management*, 42(1), 248-263.
- Kaushik, P. (2007). [History of search engines, search engine evolution - From Archie to Bing](#). Retrieved September 25, 2011, from http://seo-tools.suite101.com/article.cfm/history_of_search_engines
- Kitchen, S., Dixon, J., McFarlane, A., Roche, N., & Finch, S. (2006). *Curriculum online: Final report*. British Educational Communications and Technology Agency (BECTA).
- KPMG. (2000). *Evaluation of the SchoolNet1 initiative, final report*. In K. C. LP (Ed.): Industry Canada.
- Liu, C., & Belkin, N.J. (2011). Implicit acquisition of context for personalization of information retrieval systems. *Proceedings of the 2011 Workshop on Context-awareness in Retrieval and Recommendation*, CaRR 11, pp.10-13, February 13, 2011, Palo Alto, California, USA.
- Madden, A.D., Eaglestone, B., Ford, N.J., & Whittle, M. (2007). [Search engines: A first step to finding information: preliminary findings from a study of observed searches](#). *Information Research*, 11(2), Paper 294. Retrieved September 25, 2011, from <http://informationr.net/ir/12-2/paper294.html>
- Madden, A.D., Whittle, M., Ford, N., Eaglestone, B. (n.d.). [Internet searching by the general public. Part I. Verification of observations derived from search engine transaction logs](#). Retrieved September 25, 2011, from https://docs.google.com/document/d/1rnBC_adsCQCBTGDiO1z6hO-NK6hL_43kulTNKRtdJkg/edit?pli=1
- Madden, A.D., Whittle, M., Ford, N., Eaglestone, B. (n.d.). [Internet searching by the general public. Part II. Difficulties encountered - their nature, and the response of searchers](#). Retrieved September 25, 2011, from https://docs.google.com/document/d/1s_FexOdyuXzpfkNbgJQzC5prcoIEBqUXPIFdYIWlBz8/edit?pli=1
- Mansourian, Y., & Ford, N. (2007). Search persistence and failure on the web: A "bounded rationality" and "satisficing" analysis. *Journal of Documentation*, 63(5), 680-701.
- McLaughlin, L. (2005). [New Search Stars- What's the trend in web search? Newcomers and search giants cook up specialty services that get you information faster than ever](#).

- PCWorld*, May 31, 2005. Retrieved September 25, 2011, from http://www.pcworld.com/article/120962/new_search_stars.html
- Neven, F., Duval, E., Ternier, S., Cardinaels, K., & Vandepitte, P. (2003). An open and flexible indexation- and query tool for Ariadne. In Lassner, D., & McNaught, C. (Eds.), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications (EDMEDIA)* Honolulu, Hawaii, USA, June 22-28, 2003 (pp. 107-114). Chesapeake, VA: AACE.
 - Nielsenwire. (2010). [Top U.S. search sites for June 2010](http://blog.nielsen.com/nielsenwire/online_mobile/top-u-s-search-sites-for-june-2010/). Retrieved September 25, 2011, from http://blog.nielsen.com/nielsenwire/online_mobile/top-u-s-search-sites-for-june-2010/
 - Nisheva-Pavlova, M., & Pavlov, P. (2010, 16-18 June). Search engine in a class of academic digital libraries. Paper presented at the Publishing in the Networked World: Transforming the Nature of Communication. *14th International Conference on Electronic Publishing*, Helsinki, Finland.
 - Notess, G.R. (2006). [Search engine showdown, the users' guide to web searching](http://www.searchengineshowdown.com/multi/). Retrieved September 25, 2011, from <http://www.searchengineshowdown.com/multi/>
 - Nunberg, G. (2003). [The nation: Search engine society; as Google goes, so goes the nation](http://www.nytimes.com/2003/05/18/weekinreview/18NUNB.html?ex=1368590400&en=e17a3b535b191691&ei=5007&partner=USERLAND). *The New York Times*, May 18, 2003. Retrieved September 25, 2011, from <http://www.nytimes.com/2003/05/18/weekinreview/18NUNB.html?ex=1368590400&en=e17a3b535b191691&ei=5007&partner=USERLAND>
 - Olsen, S. (2005). [Academia's quest for the ultimate search tool](http://news.com.com/Academias+quest+for+the+ultimate+search+tool/2100-1038-5831050.html). Retrieved September 25, 2011, from <http://news.com.com/Academias+quest+for+the+ultimate+search+tool/2100-1038-5831050.html>
 - Pitkow, J., et al. (2002). Personalized search: A contextual computing approach may prove a breakthrough in personalized search efficiency. *Communications of the ACM*, 45(9), 50-55.
 - Rekha, C., Nirase, F., & Iyakutti, K. (2011). An attempt to enhance the information retrieval system towards client side for web personalization by combining usage and content mining technique. *Proceedings of 2nd International Conference on Business and Economic Research (Proceedings - 2nd ICBER 2011)*, pp. 2695-2703.
 - Rose, D.E., & Levinson, D. (2004). Understanding user goals in web search. *WWW2004*, May 17-22, 2004, New York, USA.
 - Roy, D., Sarkar, S., & Ghose, S. (2010). [A comparative study of learning object metadata, learning material repositories, metadata annotation & an automatic metadata annotation tool](http://www.tmrfindia.org/eseries/ebookV2.html). Vol. 2. Joshi, M., Boley, H. & Akerkar, R. (Eds.), *Advances in Semantic Computing*. Retrieved September 25, 2011, from <http://www.tmrfindia.org/eseries/ebookV2.html>
 - Sampson, D.G., & Karampiperis, P. (2006). Towards next generation activity-based learning systems. *International Journal on E-Learning*, 5(1), 129-149.
 - Schofield, J. (2009a). [FindAnyFilm wants to help you find any film in the UK](http://www.guardian.co.uk/technology/2009/feb/02/netbytes-findanyfilm-uk-movies/page1). February 2, 2009. Retrieved September 25, 2011, from <http://www.guardian.co.uk/technology/2009/feb/02/netbytes-findanyfilm-uk-movies/page1>
 - Schofield, J. (2009b). [Microsoft launches Bing.com as its new search engine](http://www.guardian.co.uk/technology/blog/2009/may/28/microsoft-bing). Thursday 28 May 2009. Retrieved September 25, 2011, from <http://www.guardian.co.uk/technology/blog/2009/may/28/microsoft-bing>
 - Sherman, C. (2002). [Meta search engine week!](http://searchenginewatch.com/showPage.html?page=2160771) *Search Engine Watch*, September 16, 2002. Retrieved September 25, 2011, from <http://searchenginewatch.com/showPage.html?page=2160771>
 - Silverstein, C., Henzinger, M., Marais, H., & Moricz, M. (1999). [Analysis of a very large web search engine query log](http://www.sigir.org/forum/F99/Silverstein.pdf). *SIGIR Forum*, 33(1). Retrieved September 25, 2011, from <http://www.sigir.org/forum/F99/Silverstein.pdf>
 - Speretta, M., & Gauch, S. (2004). Personalizing search based on user search histories. *Proceedings of the 2004 CIKM conference on information and knowledge management*.

- Washington, DC: 2004.
- Spink, A., Jansen, B.J., Wolfram, D., & Saracevic, T. (2002). From e-sex to e-commerce: Web search changes. *IEEE Computer*, 35(3), 107-109.
 - Steele, R. (2001). [Techniques for specialized search engines](http://www-staff.it.uts.edu.au/~rsteele/SpecSearch3.pdf). Retrieved September 25, 2011, from <http://www-staff.it.uts.edu.au/~rsteele/SpecSearch3.pdf>
 - Steinberg, D.H. (2004). [Search: The current and next big thing](http://www.oreillynet.com/pub/a/network/2004/10/08/search.html). *Web 2.0 Conference Coverage*. Retrieved September 25, 2011, from <http://www.oreillynet.com/pub/a/network/2004/10/08/search.html>
 - Sugiyama, K., Hatano, K., & Yoshikawa, M. (2004). Adaptive web search based on user profile. Constructed without any effort from users. *WWW2004*, May 17-22, 2004, New York, USA.
 - Sunikka, A., & Bragge, J. (2008). What, who and where: insights into personalization. *Proceedings of the 41st Hawaii International Conference on System Sciences*, January 7-10, 2008, Waikoloa, HI.
 - Taylor, C. (2003). [An introduction to metadata](http://www.library.uq.edu.au/iad/ctmeta4.html). July 29, 2003. Retrieved September 25, 2011, from <http://www.library.uq.edu.au/iad/ctmeta4.html>
 - Teevan, J., Dumais, S.T., & Horvitz, E. (2005). [Beyond the commons: Investigating the value of personalizing web Search](http://research.microsoft.com/en-us/um/people/sdumais/PIA2005-final.pdf). Retrieved September 25, 2011, from <http://research.microsoft.com/en-us/um/people/sdumais/PIA2005-final.pdf>
 - Wall, A. (2007). [History of search engines: From 1945 to Google 2007](http://www.searchenginehistory.com). Retrieved September 25, 2011, from <http://www.searchenginehistory.com>
 - Watson, E.A. (2008). *Going fishing: Serendipity in library and information science*. Unpublished Master dissertation, University of North Carolina, Chapel Hill.
 - Wirken, D. (2011). [The issue of trust with search engines and the World Wide Web](http://www.leadgenerationcompanies.ca/the-issue-of-trust-with-search-engines-and-the-world-wide-web). Retrieved September 25, 2011, from <http://www.leadgenerationcompanies.ca/the-issue-of-trust-with-search-engines-and-the-world-wide-web>
 - Wishart, J., & Oades, C. (2003). What do teachers, learners and other education advisors want from a web based educational portal? *British Educational Research Association Annual Conference*, Heriot-Watt University, Edinburgh, September 11-13, 2003.
 - Wu, D., Im, I., Tremaine, M., Instone, K., & Turoff, M. (2003). [A framework for classifying personalization scheme used on e-commerce websites](http://www.hicss.hawaii.edu/HICSS36/HICSSpapers/INPMS02.pdf). *Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS 03)*, January 6-9, 2003. Big Island, Hawaii. Retrieved September 25, 2011, from <http://www.hicss.hawaii.edu/HICSS36/HICSSpapers/INPMS02.pdf>

Bibliographic information of this paper for citing:

Seyedarabi, Faezeh (2011). "Personalization: An emerging direction for tackling the web searching barriers faced by teachers when searching for educational resources." *Webology*, 8 (2), Article 90. Available at: <http://www.webology.org/2011/v8n2/a90.html>

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