Exploring Emerging Trends in Information Seeking Strategies for Discovery Learning

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Abstract
The ubiquitous information and communication technologies and internet are a worldwide phenomenon that has revolutionised people's lives and has reshaped a way which students access and obtain information to assist their learning in the twenty-first century. One significant facet of transformation is the internet has been gradually becoming an only information resource in learning. For locating required information, students in all levels of education generally utilise web search engine services as the primary gateway to information landscape. This research study developed the Virtual Environment for Internet Searching (VEIS), an online usage capturing technique to investigate the strategies used by Master degree students during their information seeking tasks. The results in this study suggest the information searching on the internet is not effortless and search strategies developed by the students are essentially arbitrary. It appears that in the end, it all decides to the students themselves and the uses they make of the technologies. They evidently do searching on the internet in ways that web search engine designers and information seeking researchers have not contemplated or imagined, as yet.

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Introduction

The ubiquitous information and communication technologies and internet are a worldwide phenomenon that has revolutionised people's lives and has reshaped a way which students access and obtain information to assist their learning in the twenty-first century. Communities in today century are made up of global information societies and the internet is an integral part of this. One significant facet of transformation is the internet has been gradually becoming an only information resource in learning. For locating required information, students in all levels of education generally utilise web search engine services as the primary gateway to information landscape.

It is clear that research cultures are rapidly changing and students now perform much of their learning time online seeking for information and will increasingly rely on the internet when searching for information in the future. Online searching is a learning process with unique seeking characteristics specific to particular learning levels (Jansen, Booth, & Smith, 2009; Marchionini, 2006). There is much academic discussion about the form of this new approach and scholars have various ideas about results of these changes. On the pessimistic side:

> In a fast food, fast data environment, the web transforms into an information drive-through. It encourages a 'type in-download-cut-paste-submit' educational culture (Brabazon, 2007 p. 22).

A number of studies have been undertaken exploring student online searching. Students are reported to regularly use electronic information technology (Barrett, 2005) and rely heavily on popular search engines, such as Google Search to find what they desire. Brophy et al. (2004) undertook a user testing study where University students were set 15 online information seeking tasks, but given no guidance on how to go about finding answers. They reported that the majority of students went first to a search engine to help them find the information they needed. In fact, over 70 percent of their student samples regularly turned to search engines first to help them find information. The Online Computer Library Centre (2002) reported that 79 percent of students use search engines for all or most assignments, 50 percent use web portals and 40 percent use course specific websites. Griffith (2002) reports that the majority of his student sample used a search engine (Google) as their "first port of call" when locating information. An extensive review of the relevant literature by Rowley and Urquhart (2007) indicated that there are gaps in the evidence concerning the browsing and selection strategies of students and the interaction of some of the mediating influences on information seeking behaviour.

Although the previous work can be helpful in understanding the overall direction of students' online information seeking, there is limited and uneven work in articulating various life aspects of this phenomenon. To my knowledge, no prior work exists that provides insights into the specific searching practices underlying the culture of online searching and students' lives. Further, much of the prior work on online searching has focused on searchings behaviour, such as the searching process and decision making. Although this can shed light on important aspects of internet research, these approaches focused only on the explicit elements and missed the knowledge embedded in these fields, those that are not mentioned explicitly. As such, open questions remain.

This research study, therefore, aims to explore what are the students' information seeking strategies that exist alongside and affect the more specific processes of the students' educational lives. The research questions, data collection methods and focus mean that this study will be able to present new knowledge providing a greater attention to detail and so enable us to move beyond the broad pictures set out in earlier works.

Literature Review

A number of theoretical models that describe information seeking behaviour have been developed by researchers in various disciplines. Saracevic's (1996) stratified interaction model posits a three level structure: surface, cognitive and situational. At the surface level, a user interacts with a system through an interface by issuing commands or queries that represent, in some way, a problem statement. At the same level, the system responds either with meta-information, or texts (including images, etc.) or with queries of its own designed to elicit from the user further information on the nature of the problem. At the cognitive level, the user interacts with the output of the system, or with texts obtained subsequent to system interaction, in ways that enable the user to assess the utility of the text in relation to the initial problem. At the situational level, users interact with the given situation or problem-at-hand which produced the information need and resulting question. The results of the search may be applied to the resolution or partial resolution of the problem.

Kuhlthau (2004) takes a more holistic approach to explaining information seeking and includes affective considerations in the information search process model. Influenced by Kelly's (1963) theory of personality, she views searching as a constructive process that works on three levels: the affective, cognitive and physical. From her research, Kuhlthau observed a "dip" in user confidence after a search has begun. This contradicts the assumption made by other researchers that confidence steadily increases from the beginning of a search to its end. A seeker "in the dip" can "experience uncertainty", "confusion", and "anxiety" until a focus is formed or a search is broken off (p. 166).

Kuhlthau's model is important because it addresses the information seeker as an active participant in the information search process. She identifies the complex cognitive processes, such as brain storming, contemplating, predicting, consulting, reading, choosing, identifying, defining, and confirming, that are involved in information seeking behaviours. Kuhlthau's (2004) information search model includes six stages: (1) task initiation; (2) topic selection; (3) pre-focus exploration; (4) focus formulation; (5) information collection; and (6) search closure. As an example, the Initiation phase of the process is said to be characterised by feelings of uncertainty, vague and general thoughts about the problem area, and is associated with seeking background information. The appropriate task at this point is simply to recognise a need for information. The remaining appropriate tasks are: to Identify, that is, to fix the general topic of the search; to Investigate, or search for information on that general topic; to Formulate, or to focus on a more specific area within the topic; Collection, that is, to gather relevant information on the specific topic; and to Complete, end the information search. Her model encapsulates the reiterative nature of information seeking and identifies how students explore the various avenues open to them on their information seeking journey. Her findings suggest that searchers experience all six stages as they complete a search for information.

The series of studies by Amanda Spink provide a model accounting for the nature and role of feedback during the searching processes. Derived from empirical research, her model identifies user judgements, search tactics or moves, interactive feedback loops, and cycles as all constituting the search process of a person in interaction with an information retrieval system. Her model provides a useful framework for describing interaction between students and their online searching process. Spink's model of web searching suggests the iteration of the online searching behaviour from an initial search strategy up to the extraction of a relevant document set. Each step consists of a particular online searching strategy followed by extraction and verification of the document set. After each step, the searcher has three choices: the first choice is to complete the searching process with the set of retrieved relevant document collection from the internet, the second choice is to initiate the next cycle with the same search strategy applied, and the third choice is to initiate the next cycle with a different search strategy. Both the second and third choices are determined by the online searcher verification and the relevance of the feedback (Jansena, Spink, & Saracevic, 2000; Spink, 1997; Spink, 2002; Spink & Jansen, 2004; Spink & Saracevic, 1997; Spink, Wolfram, Jansen, & Saracevic, 2001).

Methodology

This research study examined the learning practices of Thai workers/postgraduate students over a 12-week period situating their discovery of knowledge in the context of their information seeking on the internet. Employing this study, the researcher first did the face-to-face focus group interviews. The purpose of the focus group interviews employed in this study was to collect basic information on the students' methods of gathering materials to complete their academic assignments. Topics discussed included students' strategies for finding information, common methods used to locate and select online materials, as well as their internet searching skills. In addition, the interview sessions were used to introduce the website for data collection and to establish a connection with the students before the online collection process of this research began.

Further, the researcher developed a Virtual Environment for Internet Searching (VEIS), an online usage capturing technique to collect data by mixing quantitative and qualitative approaches. The VEIS was a technique of combining a modified Hypertext Transfer Protocol (HTTP) proxy with screen capturing, automated online monitor with a live-support system as well as live chatting and self-reporting modules to supplement the traditional web-logging data.

Twenty-one participants were drawn from a cohort of Masters Degree students enrolled in the Interior Design Management Program at Bangkok University, Thailand. The students ranged in age from 24 to 38 years old, with an average age of 30 years old. Twenty worked as a full-time employee; six of those were running their own businesses. There was a degree of homogeneity in the sense that they shared similarly high grades in their previous degrees. They had done relatively well in their bachelor degrees, with a 3.56 grade point average (GPA) for the group. All the participants used the internet on a daily basis. They claimed that they were experienced internet users who had access to the internet either from their offices or homes.

Results and Discussions

Both searching and browsing are two common methods of exploring the internet. While both methods are used regularly, because of the expanse of the internet both can be awkward and time consuming. In this section, I argue online searching is not effortless. In fact, it is costly in terms of time required. The investment of significant amounts of time and the overwhelming choice of sites – leading to information overload – were mentioned by the students as issues they usually face before selecting the content. The students feel drained of energy after investing their time to do the online search carefully and then trying to make a decision about what to select from the large number of websites.

Even if students invest time before selecting the websites and the content, they inevitably encounter many irrelevant websites. Some student spend time carefully looking through the websites Google shows, yet many of the selected websites do not match what they needs.

Click, Wait and See

Sometime the process of online searching is complicated and this investment of time in reading seems to be linked to issues of slow connection. This combination of slow connections and careful sorting through websites creates the online searching model of "Click, Wait and See".

In this study, 59 percent of search sessions (49 out of 83 sessions) lasted between 10 to 50 minutes. There are 13 search sessions (16%) where the students spend more than one and a half hours for their search (see Figure 1).

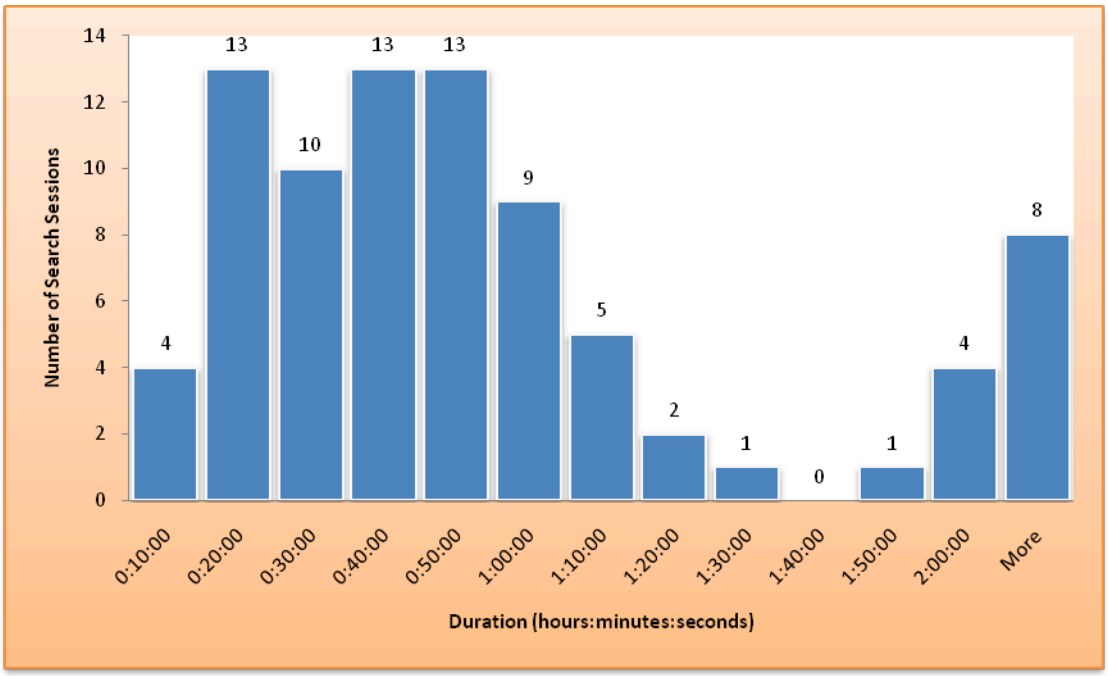

Figure 1: Number of search sessions and amount of time that the students spent on the sessions.

A Low Hanging Fruit

Judgements made by students must be based upon prior the experience they have gained in the overall activity of online searching and tactics may well be derived from a strategy that has proved to be useful. Given the limits on how much time they can invest, some students use a strategy of bookmarking the websites they consider might be useful so that they can explore the contents later. This approach leads to what is

sometimes referred to a "low hanging fruit" approach (Carlson, 2004 p. 33) – choosing those parts of the results which can be accessed or viewed immediately and without difficulty. In this case, students make bookmarks regardless of whether they have explored the content of those websites in great detail. Subsequently, this approach could lead to a phenomenon as "getting lost"; a feeling that the internet is a maze in which you can get lost if you stray too far.

A Side Tracking

Finding the unexpected interesting topic also tells us about what I call the "getting sidetracked" phenomenon. It is interesting that in the context of study this "side tracking" is a problem for the students, whereas in terms of expanding one's knowledge it is exciting. I argue, this situation comes about because the students are constrained in what they can follow or get to know by time limits imposed by needing to finish set assignments.

Information Foraging

The result of this research also reveals the whole phenomenon of too much information. Students collect (too) much information, and then never read it all. This could be explained by Pirolli's (2007) information foraging theory. According to this searching theory, like animals foraging for food with time and energy constraints, humans forage for information or look for answers. Given the abundance of information and the increasing growth rate of new information on the internet, information foraging states that the students adopt adaptive strategies that optimise the intake of useful information per unit cost. The information foraging theory also illustrates the application of the Principle of Least Effort (Zipf, 1949), as the students take actions that get the information they want or think they need with the expenditure of the least cost.

Collecting, Not Reading Thoroughly

Many students say they are just saving, downloading or printing the materials they find. This indicates that sometimes when the information is interesting the students actively engage as they undertake their searches. Yet, most of the time they are just collecting, not reading thoroughly. The data on the accumulated time for all search sessions shows that the students spent 65 percent of this time visiting websites (collecting information) and 35 percent of it searching on Google (see Figure 2)

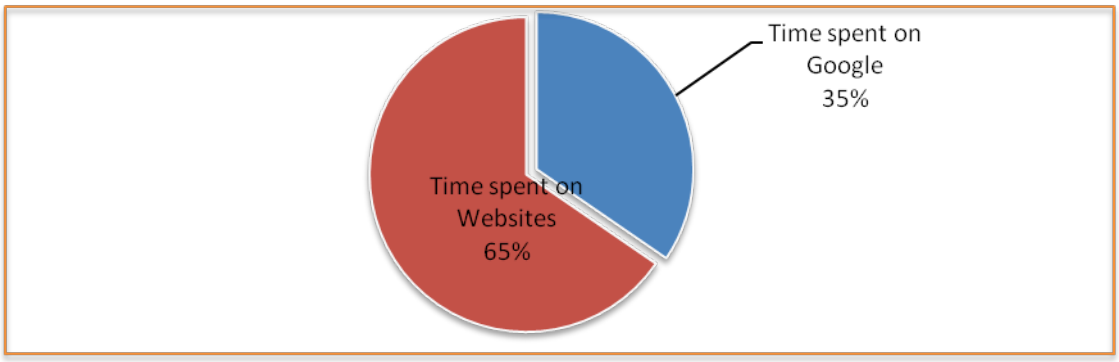

Figure 2: Breakdown of time spent on different activities in all search sessions (%).

However, there is a danger in this method of collecting to do with a lack of close reading. As some students point out sometimes these collected materials are not read

in more detail, as the student is not interested anymore. This case demonstrates that searching is a distinct process different from reading/analysing which requires concentration. Thus, what does this mean for how students are learning. On the internet, they rely upon their own knowledge, which is limited because they are students, so the questions is what does this means for how much and how comprehensively students can expand their knowledge?.

Get to Know Website Styles and Contents

Despite information overload and irrelevant information, decisions about the level of investment of time and the choice of sites are also related to the issue of the style and content of the websites. As different websites have different styles and contents, students have to invest their time in getting to know and learn the characteristics of the particular websites they wish to explore. This is because of the differences among the websites – they are designed inconsistently, and each organised the content differently.

Conclusion

The web search engine is a marvellous new technology. The fact that this study found is an indication of how the students do online research for discovery learning. Students have always been unpredictable in how they will do their research. The argument in this study is that information searching on the internet is not effortless and seeking strategies developed by the students are essentially arbitrary. It appears that in the end, it all decides to the students themselves and the uses they make of the technologies. They evidently do searching on the internet in ways that web search engine designers and information seeking researchers have not contemplated or imagined, as yet.

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