

Ascertaining the information seeking behavior of Computer Science students

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ABSTRACT

Postgraduate students of computer science have received little empirical attention from researchers in the field of Library Information Science; their information seeking behaviors often resembles those of either other faculties or undergraduates. With higher level of education and information technology background, postgraduate students of computer science ought to have a different information seeking behavior. Therefore it is interesting to explore their information seeking behaviors and to investigate to what extent they might constitute a unique user group. The objective of this research is to explore and analyze computer science postgraduate student's information seeking behaviors. A Survey was conducted at Faculty of Science Computer and Information Technology, University of Malaya. The sample consists of 140 postgraduate students. The quantitative data were analyzed using the statistical program SPSS. The results provide an insight into how computer sciences postgraduate students seek for information. With their IT skills and experience in seeking information, they can find a lot of information but they have problem with information overload and how to evaluate the information that they find.

Keywords: Information Seeking Behavior; Survey; Postgraduate

INTRODUCTION

Students face a lot of problem in seeking information. Students may seek information for various reasons such as to understand a specific subject or to conduct research. Information seeking is one of the most important activities in the learning process. According to Wilson (1999), information seeking is the purposive seeking for information as a consequence of a need to satisfy some goals. There are a lot of research have been carried out to identify students information seeking skill or behavior in different environments. There are research in various level like in high school children (Julien and Barker 2009), undergraduate students (Brown & Nahl 2001; Kakai et al. 2004; Urquhart et al. 2005; Eskola 2005) and postgraduate students (Barrett 2005; Saiti and Prokopiadou 2008). There are also research of information seeking skill in various field such as social science (Urquhart et al. 2005) and natural sciences like medicine and biology (Brown and Nahl 2001; Eskola 2005; Julien and Barker 2009) but little is known about how postgraduate students of computer science seek for information. The reason is because most researchers are more interested in studying novice users (Marchionini 1998) compare to users that have a background in IT or have more experience in seeking information like computer science postgraduate students.

Since postgraduate students of computer science have received little empirical attention from researchers, their information seeking behaviors often resembles those of either other faculty or undergraduates. With their higher level of education and a background of information technology (IT), postgraduate students of computer science should have a different information seeking behavior. Computer science postgraduate students have more skills such as IT skills, research skills and information seeking skills due to their disciplinary background and experience in doing a research. This apparent gap suggests that a need to explore computer science postgraduate students information seeking behaviors and to investigate to what extent they might constitute a unique user group.

The main purpose of this research is to explore and analyze computer science postgraduate student's information seeking behaviors. This study was conducted among postgraduate students of Faculty Science Computer and Information Technology at University of Malaya, Malaysia. The individual postgraduate students are the unit of analysis for this study. The paper is organized into six parts. First, this paper discusses the literature of information seeking behavior and the related research that has been done. This is followed by research objectives. Next, the description of the research method is discussed. Then, the results and the discussion of the data analysis are presented and summarized. After that, implications of the result for digital libraries are discussed. Finally, the paper concludes with research contributions, limitations and future research are stated.

INFORMATION SEEKING BEHAVIOR IN ELECTRONIC ENVIRONMENT

The role of information seeking in education has increased dramatically over the last decades. This is because of the powerful development of new information and communication technology and an increasingly student-centered and problem based pedagogical orientation. Students need to seek information for course work and assignments, preparation for examinations and tests, seminars or preparation for workshops, tutorial presentations and dissertation research (Kakai et al. 2004). Wilson (1999) defined information seeking behavior as a purposive seeking for information as a consequence of a need to satisfy some goals while Marchionini (1995) defined information seeking behavior as a process in which human purposely engage to change their state of knowledge. Wilson's definition is more into fulfilling information need while Marchionini discuss it in learning and problem solving concept. Based on that, information seeking behavior can be defined as a process of finding information with the specific information need in order to improve the level of understanding or knowledge related to a problem.

Rapid developments of computers and Internet have brought significant changes in how students seek for information. Nowadays, students tend to seek information in electronic environments because it is more convenient and effective. By seeking information in electronic environments, students do not have to go to library or some other information agencies. They can seek for information from their research laboratory or their personal computers at home. There are a lots of search engine systems in the electronic environment. Students need to use the right search engine systems in order to retrieve the desired information (Singh 2008). Examples of search engine systems that have been using by postgraduate students are online public access catalogues (OPAC), Internet search engine, online database, and digital library. OPAC is a computerized catalogue containing bibliographic records of the items in a library (Ariyapala 2002). Students usually use OPACs to find books from the library's collection.

However, students in digital age rely heavily on the Internet (Julien and Barker 2009). They usually use Internet search engines. The information in search engine may consist of a web page, images and other types of files. Unlike others, search engine use web crawler or spider to automatically retrieve information from millions of web pages on the web and then stores the information in the index. This makes search engine have the most comprehensive coverage of the web. Examples of Internet search engines are AltaVista, AOL Search, and Google.

Despite the popularity of Internet search engines, students usually turn to online database and digital libraries to find scholarly and scientific information. Online database provided access to remote database through a database vendor or service provider. Examples of online databases are Elsevier, IEEE and ACM. Arms (2000) defined digital library as a managed collection of information, with associated services, where the information is stored in digital formats and accessible over a network. It provides a high quality resource that has been filtered by library professionals and subject experts and added manually. Example of digital library is Dspace@UM. There are number of studies that investigated information resources used by students (Kakai et al. 2004).

The Model of Information Seeking Behavior

Research on information seeking behavior has applied models from various perspectives such sense-making theory (Dervin 1983), behavioral model of information strategies (Ellis 1989), information search process (Kuhlthau 1991), seeking information in electronic environments (Marchionini 1995) and problem solving (Wilson 1999). However, information seeking model from Marchionini (1995) is used as the fundamental concept in preparing survey questionnaire. This is mainly because it represents information seeking in electronic environments which is closely relevant to the purpose of this study.

Marchionini (1998) noted that information seeking is a special case of problem solving and it consist a few steps starting from recognition of the problem until evaluating the results. It also can involve iterating through all over the process if necessary. The model consists of eight sub processes as shown in Figure 1. The first step is recognized and accepts an information problem. Information seeker must identify and assess that there is problem to start the process of information seeking (Kumar et al. 2005). Then the information seeker must define the problem. After that, a search engine system is chosen. Search engine system can be chosen based on experience with particular systems and information problem. Next, information seeker has to formulate a query based on problem recognized and execute the search. After executing the search and get the information, information seeker has to examine the findings. This is done through reading, scanning, listening, understanding, copying and storing information to manipulate and integrate them into the information seeker's knowledge of domain. Finally, information seeker can reflect, iterate or stop the search.

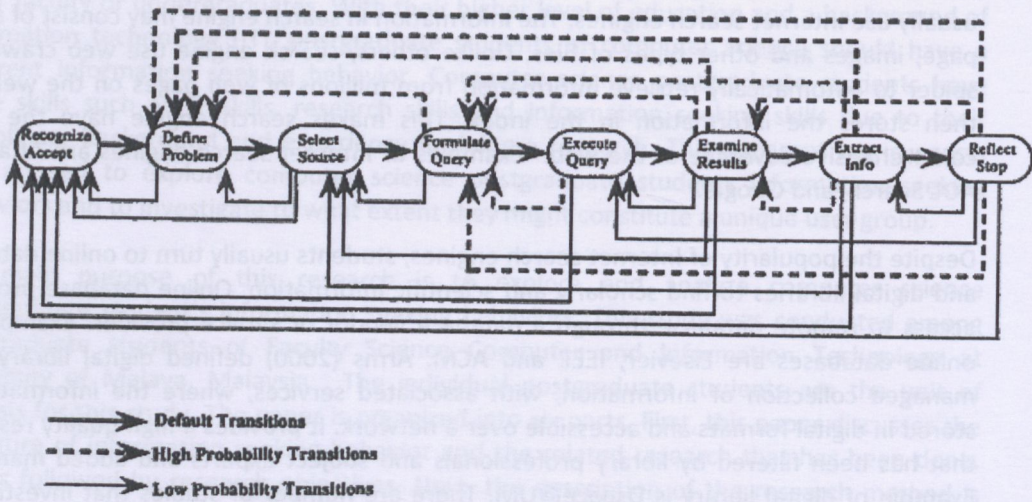


Figure 1: Information Seeking Model (Marchionini 1995)

Related Research

In education, research have been done among high school students (Limberg 1999; Julien and Barker 2009), among undergraduate students (Brown and Nahl 2001; Kakai et al. 2004; Eskola 2005; Urquhart et al. 2005; Mohd Sharif and Zainab 2007; 2009), among novice researchers (Ismail et al. 2009) and among postgraduate students (Barret 2005). Most studies have been conducted among undergraduate students because it is the easiest and most convenient method of information seeking (Valentine 1993). Barret (2005) had studied humanities postgraduate students' information seeking behaviors and compared it with existing models of undergraduate research behaviors. He found out that even though overlapping exists in certain area, postgraduate student information seeking behaviors are distinguishable from undergraduate students.

In terms of academic background, most of the studies focused on the social sciences, nature sciences (Eskola 1998; 2005; Kakai et al. 2004) and physical sciences. Foster and Gibson (2007) study inter disciplinary academic and postgraduate and their findings showed that sixty percent of the students had found articles and books for their papers but they still had problems such as not enough or poor-quality resources. Only few studies were conducted among Computer Sciences students such as the study conducted by Mohd Sharif and Zainab (2007; 2009). Mohd Sharif and Zainab (2009) have studied 14 final year Computer Sciences and Information Technology undergraduates and investigated their preference of information resources, the use of Internet, the search strategies adopted and their thoughts on intellectual property and ethical issues. They found that those Computer Sciences and Information Technology undergraduates were having the same problems despite having IT background and skills. They also discovered that Computer Science undergraduate students refer to Internet as their major information resources and used books as their major reverence.

In this study, Computer Science postgraduate students' information seeking behaviors was studied. They were chosen to represent a cluster of user group because of the difference of their background from others. Computer Science postgraduate students have more skills such as IT skill, research skill and information seeking skill due to their experience in doing a research.

RESEARCH OBJECTIVES

The main purpose of this research was to explore and describe computer science postgraduate student's information seeking behaviors. This involves investigating of:

- Postgraduate student's skills in recognizing and defining their problems
- Types of search system normally used by the students
- Ability to formulate a query that is related to their problem
- Duration they need to find information
- How they determine the reliability of information
- Satisfaction with the information found

RESEARCH METHODS

The study was conducted at Faculty of Science Computer and Information Technology (FSCIT), University of Malaya. Postgraduate students include those from Masters by Coursework, Masters by Coursework and Research, Master by Research and PhD from FSCIT that are currently active for academic year 2010/2011 were the target population of this study. In FSCIT, postgraduate students should have a Bachelor's degree with Honors or comparable degree for Masters and a Masters degree for PhD in the field of Computer Science or Information technology as a requirement for admission. They also have to do a research work that leads to the submission of a dissertation. With the skills and the background above, they are expected not to have a problem in seeking information in this digital age.

The population was selected because postgraduate students of computer science should represent a unique user group in information seeking studies based on their level of education and their background in using IT. These students are expected to be computer and Internet literate and expected to have an adequate knowledge and skill in seeking information. Weiss (1994) noted that the sample chosen should be able to provide information since they are expert and are privileged in witnessing the event. The unit of analysis was the individual postgraduate student. With a FSCIT postgraduate student's population of 498 students that currently active at FCSIT, representative study populations of 140 students were used, giving a satisfactory response rate of 28.1%. The respondents provided a reasonable representative profile of all postgraduate students. Replies were obtained from various age groups, gender, types of study, mode of study and nationality

Data Collection

The initial questionnaire was pre-tested with Cooper and Schindler (2006) pretesting method. First, the researcher pretesting was used. In this pretesting, the questionnaire is reviewed by other researchers in the same research area. This is to make sure the questions are valid and accurate. After the questionnaire is revised and modified, the questionnaire was tested using participant pretesting method. In this pretesting, the questionnaire was field-tested by sample of respondents that have a similar background with the desired respondents. A sample of 10 respondents of computer science postgraduate student from other university is tested.

Data were collected during November 2009 to January 2010 with an online questionnaire (see Appendix A). Quantitative method like questionnaire usually has been used in studies

of information seeking (Eskola 1995). Two weeks after the initial email, an email was sent to the remaining respondents to complete the questionnaire. Follow up surveys were sent to those respondents who had not returned their survey within one month period. No incentives were provided to respondent to complete the questionnaire.

RESULTS

Demographics Profile of Respondent

A total of 140 respondents out of a target population responded to the questionnaire. Of the 140 respondents, 58.4 percent are male. Ages of the respondents can be classified as 25 years or below (24.7%), 26-30 years (50.6%), 31-40 years (22.1%) and 41 years or above (2.6%). Types of study of the postgraduate student are Masters by Coursework (6.5%), Masters by Coursework and Research (61%), Master by Research (15.6%) and PhD (16.9%). The majority of postgraduate student's modes of study are fulltime student with 84.4%. 48.1% are Malaysians and 50.6% are non-Malaysian like students from Iraq, Iran, Indonesia, Bangladesh and Sri Lanka. Refer Table 1 to see the distribution of the respondent's demographic profile.

Table 1: Respondents' Demographic

Demographic Profile (n=140)		Responses (%)
Gender	Male	54.3
	Female	45.7
Age	25 years or below	21.7
	26-30 years	45.7
	31-40 years	22.5
	41 years or above	10.1
Types of study	Masters by Coursework	14.7
	Masters by Coursework and Research	42.6
	Master by Research	31.8
	PhD	10.9
Modes of study	Full time student	86.0
	Part time student	14.0
Research Area	Artificial Intelligence	17.8
	Data Communication	12.4
	Information Technology	4.7
	Library and Information Sciences	18.6
	Management Information System	19.4
	Multimedia	3.9
	Software Engineering	11.6
	Others	11.6
Nationality	Malaysian	51.9
	Non-Malaysian	47.3

Recognizing and defining the problem

A question was asked in order to identify whether computer science postgraduate student can recognize or defining their problem while seeking for information. Due to their background in IT and their experience in doing a research, 54.3 per cent reported not having difficulty in recognizing and defining their problem. However, 45.7 per cent of the respondents reported having difficulty in defining the problem.

Choosing a search engine system

There are various types of search engine systems available that students can choose to retrieve the desired information. Different students access and use these different search engine system for different reason (Cooke, 2001). First, we asked respondents whether they had used a variety of search engine systems or were they only focusing in one type of search engine system. The findings revealed that most of the respondents had used more than one search system with Very Often (56.6 per cent), Often (28.7 per cent), and Sometimes (13.20 per cent). There were only two students who rarely and almost never use more than one search system. Both of them are from Masters by Coursework and Research programme. We believe that these students are still in the beginning of their research.

From the survey we found out that Internet search engine is the most popular search system with 73.4% of respondents reporting using it as a first search engine system and 94.6% of respondents reporting using it frequently. This findings are consistent with Saiti and Prokopiadou (2008) findings that revealed the Internet search engine to be the most preferred search engine system. This is followed by online database with 52.7% of respondents reporting using it frequently. Other search engine system such as library catalogue, digital library, and UM library were only used occasionally. Table 2 below displays the findings.

Table 2: Rating of Using of Information Search Engine System

Search Engine System (n=140)	Mode Response	Average Rating
Internet search engine	1	1.07
Online Database	1	1.53
Library Catalogue	2	2.12
Digital Library	2	2.10
UM Library	2	2.04

1-3 scale where 1= Use it frequently, 2= Use it occasionally and 3= Never Use

Most participants reported the use of a variety engine search systems. Even though most of them reported using the Internet search engine as their first source but they only used it as the first step to know about the subject. After that they will use other search engine system to search for more information especially the trustworthy one like Digital Library and online database. Postgraduate students use online databases to identify journals for their research and this is different with the findings from undergraduate studies where they were found to prefer books because they are not familiar with journals (Barret 2005; Mohd Sharif and Zainab 2009). Below are some of the comments reported by the respondents:

“There are many resources available now and it is difficult to read all that is being published. One need to be an expert to know how to select the most relevant resources based on the study area and not gets carried away by so much information. Better to begin

with Google Scholar and then get the articles from library's subscribed databases or via document delivery.” (R17)

“Normally, I use Google and the university main library to get the information that I seek” (R14)

“Mostly I use internet search engine (Google scholar)” (R36)

“Search engine such as Google, yahoo help a lot” (R53)

“It’s only Google for now” (R75)

The findings show that postgraduate students reported relying on Internet to seek for information. This finding is consistent with findings from Becker (2003), Barret (2005) and Julien and Barker (2009) that reveal students to have relied heavily on Internet resources especially Google.

Query Formulation

In order to seek for information, students must be able to identify and understand their problem and research area. They should be able to formulate a query that is related to their problem area. From the findings, 48.8 per cent of postgraduate students often are able to formulate their keywords. With their experience in doing a research, computer science postgraduate students usually do not have any problem to formulate the appropriate keyword if they understand their information needs. Only 2.3 per cent reported that they were not able to formulate an appropriate keyword. Most of them (49.6 per cent) often are able to use combine keywords. Refer Table 3.

Table 3: Respondents Ability to Formulate Keywords (n=140)

Respondents ability to formulate appropriate keywords	Responses (%)
Often	75.9
Sometimes	24.1
Respondents ability to combine appropriate keyword	Responses (%)
Often	79.8
Sometimes	20.2

Duration to Find Information

Information seeking behavior is a labor intensive as well as time consuming. Students usually will spend a lot of time to seek for information. Most of computer science postgraduate students (94.5 per cent) reported that information seeking consumes more time than they expected: Very often (22.5 per cent), Often (33.6 per cent) and Sometimes (38.3 per cent). Only 5.5% reported that they rarely or almost never take more time in seeking information. Most of them reported that they have problems seeking information such as journals. There are some journals that they cannot access and sometimes they can only access the abstract. This makes them spend more time to find the specific journals.

As a student, they need to spend a lot of time in research activities especially information seeking. Most of the respondents reported spending between 0-3 hours (14.0 per cent), 4-6 hours (31.8 per cent), 7-9 hours (27.9 per cent) and more than 10 hours (26.4 per cent). It is also important to determine the time needed by the respondents to search for the desired information as shown in Figure 2.

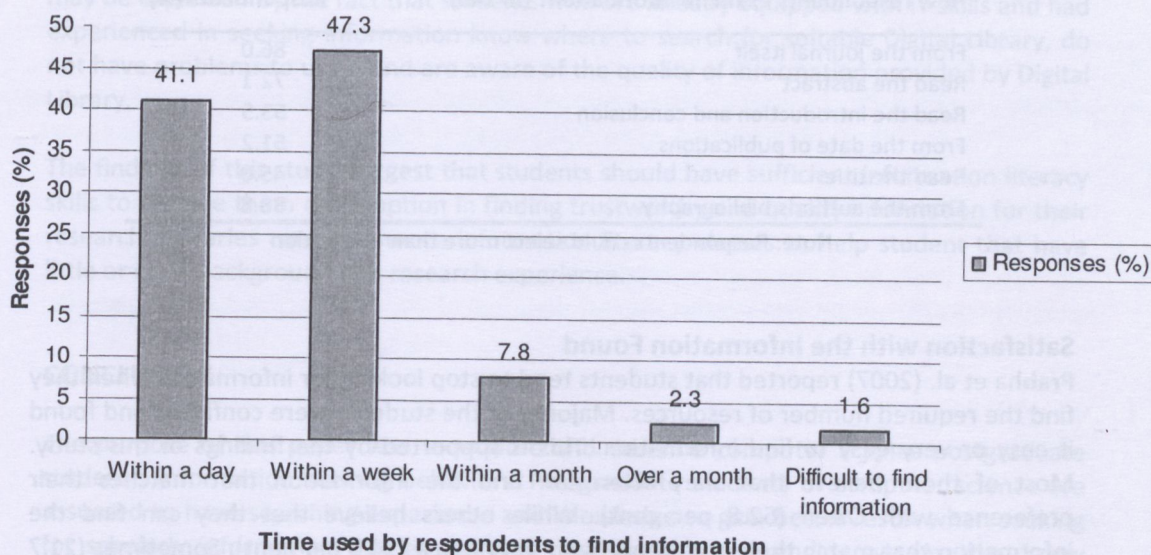


Figure 2: Duration to Find Information (n=140)

Figure 2 above display the amount of time respondents take to search for information. Most of the take time within a day (41.1 per cent) or a week (47.3 per cent) to find the information that they want. This finding reveals that Computer Science Postgraduate students do not have problem in seeking information. One of the respondent's commented that he required a lot of time to filter and another one said that he or she has excessive information but it requires a lot of time to understand the information. It shows that students can find information that they desired in a short time but they will need a lot of time to evaluate and filter the information they found. Only 1.6 per cent reported that it is difficult to find the needed information without proper guidance. Proper guidance here means that they need help from others as example from their supervisor to find the information.

Determining the Reliability of Information

In doing research, students must examine whether their information is reliable or not. Over 93.8 per cent of postgraduate students evaluate the trustworthiness and reliability of the information that they find with Very Often (31 per cent), Often (46.5 per cent) and Sometimes (16.3 per cent). In this study, we were focusing on trustworthy information source like journal since most of the postgraduate students depend heavily on it in doing a research. Results display in Table 4 showed that majority of them examines the information from the journal itself (86 per cent) and read from the abstract (72.1 per cent). This findings add weight to those of (Nicholas et al. 2009) who found that most of the students like to view the abstract.

Table 4: How Respondents Examine Information

How respondents examine information? (n=140)	Respondents (%)
From the journal itself	86.0
Read the abstract	72.1
Read the introduction and conclusion	53.5
From the date of publications	51.2
Read the title	45.0
From the author's bibliography	38.8

Note: Respondents could select more than one option

Satisfaction with the Information Found

Prabha et al. (2007) reported that students tend to stop looking for information when they find the required number of resources. Majority of the students were confident and found it easy or very easy to find information. This is supported by the findings of this study. Most of them believe that they often can find the information that matches their preference with Often (62.8 per cent). While others believe that they can find the information that match their preference with Very Often (14.0 per cent), Sometimes (21.7 per cent), and Rarely (1.6 per cent). They also believed that they can find the information that they desired with Very Often (12.4 per cent), Often (58.1 per cent), Sometimes (25.6 per cent), and Rarely (3.9 per cent). This is related to the findings from Barret (2005) that students sought to find enough information to fulfill course requirements.

If respondents cannot find the information at the first attempt, majority of them will try another search engine system (85.3 per cent) and try another combination of keyword (82.2 per cent). They will also consult an expert (57.4) and discuss with friends (49.6 per cent). Refer Table 5.

Table 5: Respondents Action Taken

Actions Taken By Respondents (n=140)	Responses (%)
Try another information resources	85.3
Try another combination of keyword	82.2
Consult an expert	57.4
Discuss with friends	49.6
Others	1.6
No Action	0

Note: Respondents could select more than one option

IMPLICATIONS FOR DIGITAL LIBRARIES

Previous studies have reported that a new generation of users prefers Internet Search Engine to find information rather than other IR tools like Digital Library (Becker 2003; Barret 2005; Salisbury et al. 2006; Saiti and Prokopiadou 2008; Julien and Barker 2009). Human factor problems that influence the use of Digital Library are Digital Library is not a well known information retrieval service, it usability is complex and not user friendly, and

many users especially undergraduate aren't aware of the suitability of Digital Libraries for quality information retrieval (Nir Yom Tov and Frank 2006).

The results of this study indicate that postgraduate students of computer science will turn to trustworthy IR tools such as Digital Library to find their scholarly information. This result may be explained by the fact that students who are already equipped with IT skills and had experienced in seeking information know where to search for suitable Digital Library, do not have problems to use it and are aware of the quality of information provided by Digital Library.

The findings of this study suggest that students should have sufficient information literacy skills to provide them more option in finding trustworthy and quality information for their research. Libraries can offer more information literacy classes to help student that have little or no IT background and research experience.

CONCLUSION

The purpose of this paper was to explore and describe computer science postgraduate student's information seeking behaviors. Postgraduate students of computer science are assumed to have searching experience and knowledge to gain better result when seeking for scholarly information. For example, in choosing a search engine system, they know which one is suitable for a particular level of problem. They usually start with Internet search engine such as Google to find general information and then turn to online database and digital libraries to find scholarly materials that are more trustworthy for their research. They also rely on journals rather than books.

Computer science postgraduate students do not face difficulties in finding and combining keywords to find their information. Their ability in conducting information seeking is different than other students because in general they know which key to trigger in every step of information seeking process. Normally, they are acquainted with how the query process work and how keywords can be combined through Boolean Operators. They are able to conduct an information seeking session in a short period because of their familiarity in using IT. The students however, spend a lot of time in filtering and evaluating the reliability of the information they found. If they encounter any problem in seeking information, they will never give up and take action until they are satisfied with their results.

In summing up, the findings indicate that Computer Science postgraduate students encounter problems of information overload during the information seeking process. Being more skillful in using IT as compared to students in other fields, Computer Science postgraduate students are able to find abundant information from the Internet. The main problem is the information overload has lead to difficulties in evaluating the information. Therefore more research should be done to resolve this problem through categorizing information according to their level of knowledge, information presentation or learning style in digital library design. This could help student to find trustworthy and suitable information for their research.

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