# Digital Information Resources Preferences and Evaluation Criteria Used by the Final Year Engineering Undergraduates: A Case Study

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**Abstract**

The purpose of this paper is to present one aspect of the findings of a major study carried out to assess the information seeking and research strategies of the undergraduates of University of Peradeniya, Sri Lanka and the paper serves four objectives; 1) to explore the student's preferences of information resources, 2) to identify the criteria they use to evaluate the digital information sources, 3) to recognize the strengths and weaknesses of their information seeking practices and 4) to make appropriate recommendations to strengthen their information seeking practices. A stratified random sample of second, third and fourth year undergraduates were considered for the main survey and accordingly 10% (40 students) of the final year students of the Faculty of Engineering were considered for this paper. Head and Eisenberg's (2009) survey instrument was used to gather data. Findings established that the final year engineering students rely more on search engines, Wikipedia and classmates while scholarly databases are used only by a smaller percentage. It was established that the engineering students have higher preference for some digital resources than the other types of resources. In using evaluation criteria they predominantly use self-taught methods instead of traditional reliable methods. It could be inferred that they encounter problems in selecting the most appropriate digital information resources for their academic research. The study further established that majority of the engineering students have not received any formal training in searching or evaluating of digital resources. They have commented that it would be beneficial to have training in the use of library and internet resources. The present study fills the gap in research about the information seeking behavior of engineering undergraduates of University of Peradeniya and it will contribute to the global body of literature in this aspect. It is also expected that the findings will underpin the development of future information literacy programs to be offered through the library.

***Keywords:*** Sri Lanka, Undergraduates, Engineering Students, Information Seeking Behavior, Digital Information Resources, Evaluation of Information Resources.

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## Introduction

Librarians always attempt to understand information needs and information seeking behaviors of their users and it is imperative for academic libraries in re-orienting their services and collections in order to satisfy information needs of their users. The term 'information seeking' expresses the process or activity of attempting to obtain needed information by the individuals and during the process of information seeking individuals seek, evaluate, select and finally use the needed information.

Engineering is a fast developing field as a result of scientific and technological advances. The information technology revolution created dramatic changes in information seeking behavior of users as well as their information access, retrieving and also in digital information services. Digital information will facilitate students' access to information irrespective of time and space. As a consequence growth of research literature is exponential and dissemination of this literature is increasingly done through the World Wide Web. It becomes vital for these students to have access to the latest research information, to strengthen their knowledge base, but at the same time searching, locating and accessing information through digital media has become a complex issue. Information offered through surface and deep internet, different publisher platforms, variations in the indexing of material makes searching and using information more complicated than using the printed material offered through their own institutional libraries. Awareness of the availability of information sources in the library, ability to extract information from them effectively and evaluation for quality does not give rise to serious concerns as they have already been evaluated and the students are guided to them by the teachers and the librarians. Yet the sources of information accessible through the Internet do not have this credibility. Unlike publishing books or scholarly articles in engineering, anyone with a computer and access to Internet can post anything and the students need to be guided in using these works in accomplishing their academic research.

This research is theoretically grounded on *Information Seeking Behavior* which is defined by Wilson (2000, p.49) as "the purposive seeking for information as a consequence of a need to satisfy some goal. In the course of

seeking, the individual may interact with manual information systems (such as a newspaper or a library), or with computer-based systems (such as the World Wide Web)." He perceives information seeking behavior as "a sub domain of *Information Behavior* which is the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use." Wilson (2000, p.49) identifies more domains; *Information Searching Behavior and Information Use Behavior. Information Searching Behavior* "is the 'micro-level' of behavior employed by the searcher in interacting with information systems of all kinds. It consists of all the interactions with the system, whether at the level of human computer interaction (for example, use of the mouse and clicks on links) or at the intellectual level (for example, adopting a Boolean search strategy or determining the criteria for deciding which of two books selected from adjacent places on a library shelf is most useful), which will also involve mental acts, such as judging the relevance of data or information." (Wilson 2000, p. 49). *Information Use Behavior* "consists of the physical and mental acts involved in incorporating the information found into the person's existing knowledge base." (Wilson 2000, p.50). He perceives all four domains as a series of nested fields and this study specifically to *Information Seeking Behavior* as it studies the purposive seeking for information to satisfy academic goals by interacting with the digital information resources.

Since user perception of digital information is a less focused area and any previous research in the information seeking behavior of the undergraduates of the Engineering Faculty of University of Peradeniya has not been done before, this paper emanates from a research grant provided by the university to carry out a survey on "Information seeking and research strategies of undergraduates in the digital age". This paper presents one aspect of the major study. The objectives of this paper are to establish the student's preferences of information resources, to identify the criteria they use to evaluate the digital information sources, to recognize the strengths and weaknesses of their information seeking practices and to make appropriate recommendations to strengthen their use of digital information sources.

## Review of Literature

Review of literature covers a select number of studies on student information seeking behavior carried out during 2000-2015 periods in the international context with special emphasis on engineering students. Brindesi *et al.* (2013) conducted a study to investigate the information seeking and searching behavior of undergraduates of Greek physicists and astronomers. Results of their study revealed that undergraduate students show a preference for familiar, flexible and easy-to-use information resources i.e. electronic format and rarely or never visit their faculty library.

Ali et al., (2010) surveying the engineering students in Malaysia has concluded that they seriously lacked the necessary knowledge and skills to evaluate internet information, to identify the most efficient search strategy, to use scholarly information to use information ethically. Suggests that intervention program should be introduced to improve students' information skills. Lee, Paik and Joo (2012) investigated the selection of information sources and factors associated with the resource selection of undergraduates including engineering and medicine for academic tasks. They concluded that multiple factors influence the resource selection and they vary according to different types of sources and the findings make several suggestions in guiding undergraduates in choosing information resources for their academic tasks. Barsky et al., (2011) in their study of engineering students investigated the information sources used by them and concluded that they relied most heavily on non-academic internet sources, but they also made use of the academic sources to some extent and suggest that the librarians be invited to classrooms not only to instruct the students in the use of traditional library databases but also in the use of non-academic internet sources. Kerins, Madden and Fulton (2011) studying the information seeking behavior of the engineering students in Ireland comments that the students learn their effective and less effective information seeking patterns from their educators and that they could benefit from greater information literacy training and awareness, enabling them to use the resources more effectively and efficiently. Sheeja (2010) conducted the study to examine the perception of undergraduate students of engineering faculty towards the digital library, and results revealed that almost all students use digital library and further results revealed the students preferred digital format. The study was

conducted by Bridges (2008) to investigate the difference in undergraduate library use by academic discipline and results indicated that students of the Engineering College use the virtual library less than students from Liberal Arts College.

Zang et al.. (2005) in their study sought to answer three questions; 1) Would the level of domain knowledge significantly affect the user's search behavior? 2) Would the level of domain knowledge significantly affect search effectiveness, and 3) What would be the relationship between search behavior and search effectiveness? and concluded that the level of domain knowledge seems to influence search behavior, but not on search effectiveness, and search behavior does not seem to be related to search effectiveness.

In the Sri Lankan context studies on information seeking behavior of engineering students are few. Punchihewa and Jayasuriya (2008) have explored the use of online databases, user perception towards online databases, user satisfaction with facilities provided by the library for using online resources and undergraduates is one category of users they have studied. They conclude that relatively a lesser usage was observed in the online journals compared to print journals and other major findings include the, lack of computer and Internet facilities, lack of awareness of electronic resources provided by the library, ineffective communication channels, and irrelevancy of articles in the provided databases and inefficient support of the library. Senevirathe and Wickramasinghe (2010) surveying the architecture, engineering and IT students conclude that the undergraduates have difficulties in identifying variety of types and formats of potential information sources as well as assessing economic, legal and social issues surrounding the use of information irrespective of the discipline.

**Methodology**

To achieve the objectives of this study, the survey research method was used. The original survey instrument of Head and Eisenberg (2009) administered online was revised to suit the Sri Lankan context and to be administered as a printed questionnaire. This instrument was particularly considered for several reasons; it is available open access, its content and construct validity has been already established by Head and Eisenberg (2009 and 2010), a pilot

survey proved that it is suitable for the Sri Lankan context and the original instrument was being used with some customizations in several other Asian countries in 2012 hence many of the findings would be comparable in the future. Although the original instrument contained two parts; on academic research and everyday life research, for this study only the academic part was considered with a few terminological changes and six new questions were added to survey the access to computers and Information Literacy (IL) training.

Quantitative data were gathered on biographic details, types of assignments the students have to answer, frequency of consulting human, print and e-resources, methods used to evaluate them, use of e-productivity tools, preferred research styles, difficulties in the research process, difficulty of tasks involved in the research process, their access to computers, training received in using digital and other information sources and details of the training programs. The topics they would like to follow if the library to offer a program were also inquired.

A random sample of 10% of the total final year students (408) representing the six academic departments of the Faculty of Engineering were selected for the survey. Only final year students' information seeking behavior was considered for this study because as part of the final year, and in partial fulfillment of graduation requirements, undergraduate students in the Faculty of Engineering need to carry out a final-year research project and therefore final year students seek research literature frequently.

Questionnaire was administered through the faculty library and the data collection was completed within one month. In order to complement the findings of the questionnaire, telephone interviews were conducted with a sample of 10% of the respondents. In addition, faculty Websites and annual reports as well as some faculty members and administrators were also consulted to triangulate the findings. To provide the theoretical foundations for the study and support the findings, international and Sri Lankan research literature in information seeking behavior were also used.

For the content of this paper, Questions 1 to 5 on biographic details and Question 6, 7, 9 and 10 on types of assignments received by the students,

resources consulted, evaluation methods of web-based resources, people consulted for assistance were considered. For Question 7, 9 and 10 students were given seven choices (Almost Always, Often, Sometimes, Rarely, Never, Do Not Know and No Experience) to express their responses on frequency of using information resources and methods of evaluating them. In presenting data the response categories "Almost Always" and "Often" were conflated in to a new category of "Often Used" and this new category was used to present the findings throughout this paper. "Sometimes Used", "Rarely Used", "Never Used", "Do Not Know" and "No Experience" were not considered for the analysis as they did not receive a significant number of responses. Analyzed data were presented in forms of tables and bar charts.

Since the responses are personal judgments of the respondents of their information seeking strategies, and the findings are mostly based on their responses, the reliability of the findings depends on the accuracy of their revelations to a greater extent. Nevertheless, the findings can be generalized to the total student body of the faculties concerned as the sample is representative and the student cohorts are homogenous to a greater extent.

## Findings

Forty Questionnaires were distributed among randomly selected students through the faculty library and the response rate was 93% (37 responses). Of the respondents, 65% were 21-23 years and 35% were 24-26 years while 76% were male and 24% were female. This response pattern emerged without any human intervention, representing the general gender segregation in the faculty. Table 1 illustrates the sample and response rates.

**Table 1: Sample and Response Rates**

| Department | Final | | | |
|---|---|---|---|---|
| | Total Population | Sample | Responded | % |
| Civil Engineering | 150 | 15 | 14 | 93 |
| Chemical Engineering | 24 | 2 | 2 | 100 |
| Computer Engineering | 60 | 6 | 5 | 83 |
| Electrical & Electronic Engineering | 100 | 10 | 10 | 100 |
| Mechanical Engineering | 41 | 4 | 3 | 75 |
| Production Engineering | 33 | 3 | 3 | 100 |
| **Total** | **408** | **40** | **37** | **93** |

***Information Resources Consulted***

To assess whether the students had a learning environment conducive for the use of a wide variety of information sources, they were asked about the different types of assignments they received and whether they were expected to use different information sources. One telephone interviewee from the engineering students summarized the types of assignment they received as follows;

> *"We get two types of assignments; firstly, course work which is mathematical problems we have to solve and hand over. Secondly design problems in which we are expected to design something. In completing these we use log books to do the calculations manually (and use computer to check them) and then drawing the designs using Auto CAD. We get printouts of these drawings and handover both the log books and drawings for assessment. We need to use many information resources to complete these assignments".*

Therefore, one of the questions of the survey inquired about the types of information resources consulted by the undergraduate students for their assignments and during course-related research process. Figure 1 illustrates the different types of digital, printed and human resources often used by the engineering undergraduate students.

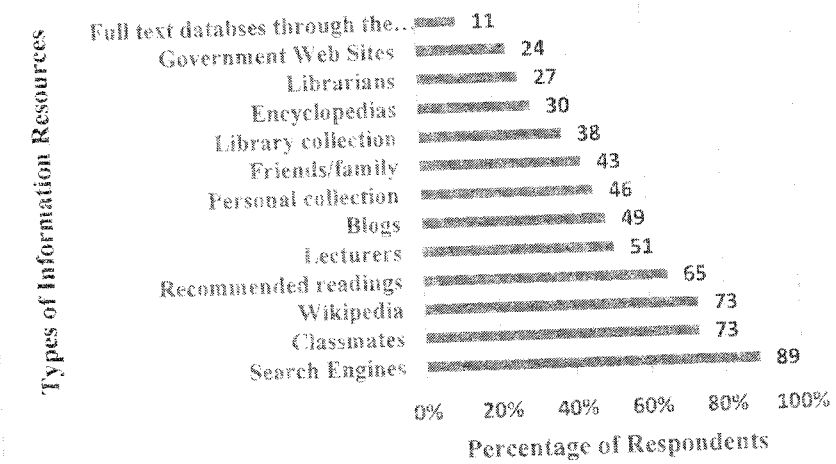


**Figure 1: Information Resources consulted by the respondents**

Search Engines (Google and Yahoo etc.) are the most often used information resource used by the majority (89%)of the engineering students and Wikipedia and classmates is the second preference with each used by 73%.Recommended readings are used by 65% and lecturers by 51%. A slightly less number of students (49%) use Blogs and personal collections by 46%. This pattern indicates that the first two preference are for digital resources, but not all digital resources seem to be equally used, for instance Government Websites are used only by 24% and the full text databases (ftxt dbs) offered through library are used only by 11%.

While the poor usage of Government Websites may be attributed to the fact that they do not contain relevant information for the engineering students, poor usage of full text data bases by them can be attributed to the absence of any engineering related databases through the library and lack of awareness about the availability of databases may be another reason. A visit to the engineering branch library web page on e-resources during the study period indicated no listed resources.

Telephone interviews with some of the respondents revealed that they are given clearly defined source to use and only a few copies of the recommended texts are available in the library therefore they attempt to download at least parts from internet. They also use Google, Wikipedia, engineering codes and other relevant sites but never heard of web search engine like Google Scholar which can retrieve scholarly literature. They also revealed that they have obtained personal memberships of professional engineering associations and receive access to databases through these memberships and but confirmed that they have not used the full text databases like Science Direct through the library even during the periods of trial access.

However, only 27% of the students have said that they often turn to Librarians for information. This could be further endorsed by the fact that 62% of the engineering students have mentioned that they did not have any training in Internet and Library usage and therefore they have not been exposed to the ways in which librarians can help them in their information seeking process.

According to previous research, student engineers have a preference for channels that require the least effort such as Internet (Breton 1981 and Kerins, Madden *et al.*2004). Engineering students perceive that Internet as a speedy, current information source which satisfied their information need quickly and they also identified that the students turned to Internet to get a general idea of the topic initially (Brindesi et al., 2013, Kerins et al., 2004). Some studies (Ercegovac 2009, Kerins et al., 2004 and Ward 2001) have also established that they tend to rely heavily on informal information sources and consult one another within their own social spheres (Ellis and Haugan 1997) in their information seeking process and engineers tend to prefer oral communication over written communication (Anderson et al., 2001). These findings explain why 89% and 73% turn to search engines and Wikipedia respectively, why 73% turn towards their classmates, 51% towards their lecturers and 43% to their family and friends to satisfy their information needs.

Gender is also identified as a factor affecting the information seeking behavior. Baro, Endouware and Ubogu (2011a) established in their study of 224 health science students in Nigeria that the usage of online information resources is very low and the use of online resources by the female students was less than their male counterparts.

**Evaluation Criteria**

The web offers incredible opportunities to student researchers, because it makes a superfluity of material readily accessible which is convenient to use, yet the web also has its own pitfalls. Search Engines are generally the starting point of student information seeking process (Doyle and Hammond 2006), but there are many concerns as these authors point out; order in which the search engine ranks the sites does not necessarily portray their reliability because of the mechanisms use to rank the sites. They often get ranked high by paying a fee or getting frequently accessed. The credibility of the content of most Websites does not have any guarantee unless the traditional criteria of authority, objectivity and sponsoring institution (Alexander and Tate 1999) are used to make in judgments of the quality of the Websites. Question

9 of the survey inquired about the criteria used by the students to evaluate digital resources and the findings are illustrated in Figure 2.

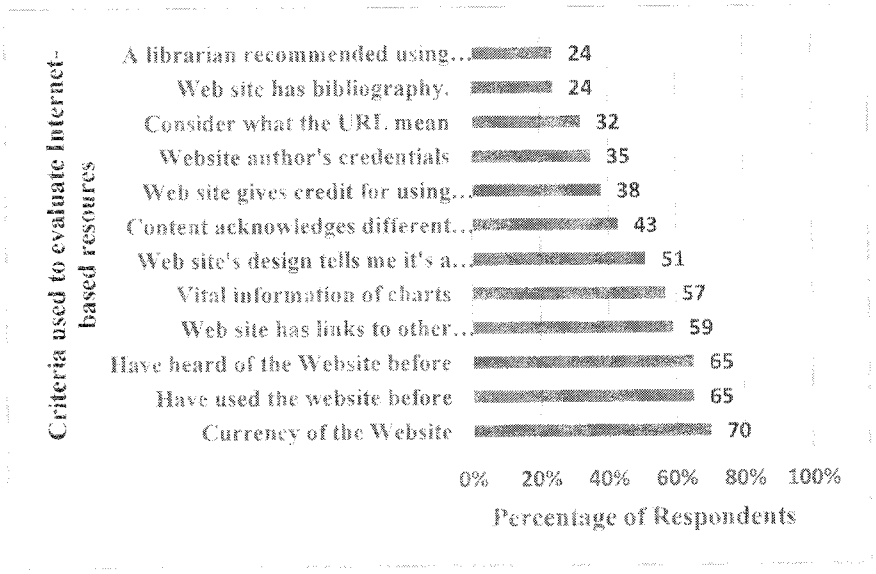


**Figure 2 : Criteria used to evaluate Internet-based resources**

Findings determined that more final year engineering students use currency (70%), whether the Website has been used before (65%), whether the Website has been heard before (65%), whether Website has links to other sites (59%) and availability of vital information on charts (57%). Design of the Website (51%), acknowledgement of different viewpoints (43%), giving credit for use of someone else's ideas (38%), author's credentials (35%), meaning of URL (32%), availability of a bibliography (24%) and librarians' recommendations (24%) are used by a lesser number of students.

To find out whether the students seek professional help in selecting and evaluating information sources the study asked the students whom they consult to obtain help in evaluating information resources. Findings are depicted in Figure 3.

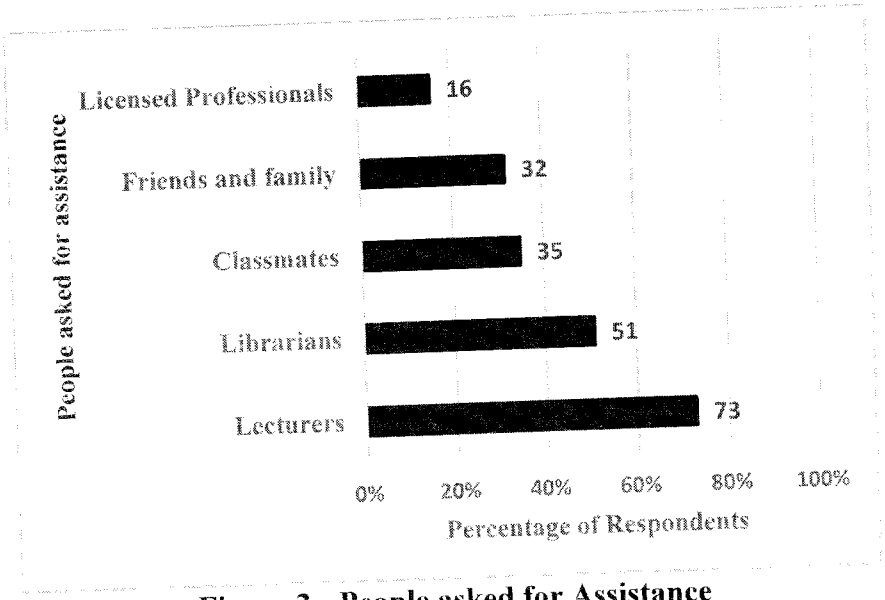


**Figure 3 : People asked for Assistance**

Responses pointed out that 73% of the engineering students turned to their lecturers, 51% to librarians and 35% to classmates, 32% to friends and family and 16% to licensed professionals indicating more reliance on individuals than on resources.

Telephone interviews with the students revealed that they use reputation of the publisher, compare with other works and if three or four are consistent accept them, consider whether it is a pdf file and read about 20 or more pages to check relevance. About the people consulted they commented that they sometimes discuss with classmates or ask the lecturers. They also commented that they did not worry about library material because they are relevant to the topic and can trust the library books.

Head and Eisenberg (2010) have identified three criteria for evaluating digital resources; 1) traditional standards of timeliness and authority (use of publication date, credentials of the author, meaning of the URL and librarians recommendations), 2) Domain specific standards (reliability, authority and credibility of web content and 3). Self-taught standards (methods acquired from friends, classmates or other informal contacts). According to the authors these criteria tend to be personal and highly qualitative. The most often used criteria by the engineering students indicate

that they use three self-taught methods (previously used, previously heard and availability of vital information in charts), one traditional method (currency) and one domain specific standard (availability of links to other sites).

This indicates that a small group uses the traditional standard evaluation criteria while the majority uses the self-taught criteria. Findings indicate that the students do not have an adequate idea of the traditional standards. The findings expressed that the students need more guidance in evaluating digital resources. "The web offers tremendous opportunities to student researchers, because it makes so much material available and because it is so convenient to use. But it also presents pitfalls to the unwary" (Doyle and Hammond 2006,p.56). These authors further mention that the print resources have a presumptive claim to validity because of the stringent quality assurance process they undergo in the production, but most of the Websites have no such assurance.

**Discussion**

The summary of findings indicated that, the final year engineering students rely more on search engines as their first choices and their second choice is Wikipedia and classmates while scholarly databases are used by 11% even though the library does not subscribe to any. This proves that the engineering students have a higher usage of digital resources. In evaluating the digital resources, they predominantly use self-taught methods instead of traditional reliable methods, therefore it can be inferred that they encounter problems in selecting the most appropriate digital sources for their academic research. The students have confirmed that training offered through the library will be beneficial.

A detailed interpretation of the information seeking behavior demonstrated by the final year engineering students studied can be made using the *Information Behavior Model* of Urquhart and Rowley (2007). Their model attempts to augment the other models of information seeking behavior(Foster 2004, Kulthau 1991 and Wilson and Walsh 1996) on the grounds that these other models only concentrate on the information seeking process but not on the factors affecting the decision to use or not to use certain information

sources. The Information Behavior Model illustrates (Figure 5) eleven factors that can affect the student's information seeking behavior and these are categorized as micro (Individual) factors that impact directly on specific students information behavior (information literacy, search strategies, support and training, pedagogy, academic's information behavior, and discipline/curriculum and macro factors, the contextual or organizational factors in which information behavior occurs (information resource design, availability and constraints to access, information and learning technology infrastructure policies and funding and organizational leadership and culture.

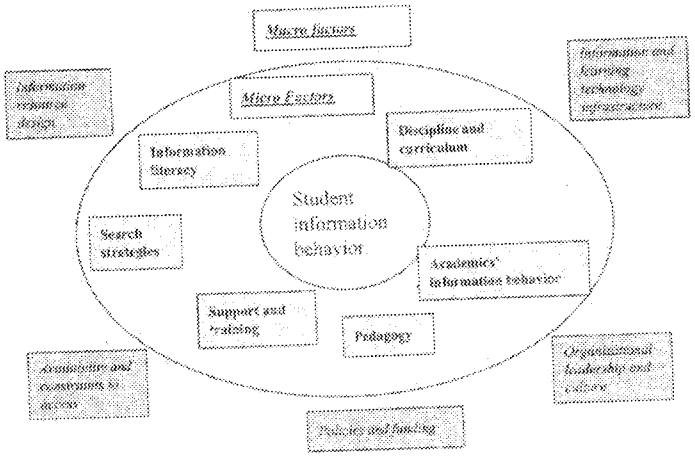


**Figure 5 : Information Behavior Model**

[Source: Urquhart and Rowley (2007, p. 1190)]

At *micro level*, it was evident that no information literacy program or any other formal support and training program by the library staff or in collaboration of library and faculty staff is not available for the engineering students to introduce search, identifying, evaluating and using information effectively. The only introduction they encounter is the 30-45-minute orientation program given at the very first enrollment. Arora (2005), Dee and Stanley (2005) and Kingsley and Kingsley (2009) have confirmed that the computer skills of students, lack of formal training in accessing medical databases and lack of computer skills of students has a negative impact on their use of digital resources. Nevertheless, their higher use of digital resources and obtaining access through professional associations imply that they do have role model academics. As a discipline engineering is not

established as one which is active in information seeking. Whitmire (2002) in her study of over 5000 undergraduates, based on Biglan's (1973a, 1973b) model of disciplinary differences[3] on information seeking behavior, concluded that undergraduates in soft, pure and life science are more active in information seeking than hard, applied and non-life science undergraduates. Contrary to these findings engineering students seem to be active due to other factors affecting them[4]. As the study did not delve into pedagogical approaches it is hard to make direct comments but the description of the student on their assignment types imply that the pedagogical approach encourages students to use many up to date information sources.

At *macro level*, it was evident that information resource design does not have a direct impact as many engineering students do not have access to scholarly databases, but since the information literacy programs or any formal support is absent it is inferred that they have little training in adapting to different publisher platforms. Engineering students proved there is no problem with availability, access to computers or IT infrastructure; 73% use their own laptops/notebooks and 59% use the faculty computer centre which has 110 computers. The adequate access to computers, encouragement to obtain memberships of professional associations and pedagogical approaches that encourage multiple use of information sources imply that the organizational culture and leadership are contributing positively towards their information seeking behavior. However, absence of subscribed scholarly databases imply that funding is limited but the enthusiasm of the academics to obtain e-resources must lead to allocation of more funding to acquire at least the core engineering databases. At macro level, only this could be identified as a negative factor.

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[3] Hard disciplines = physical sciences and engineering
Soft disciplines = humanities, business, social sciences and education
Pure disciplines = physical sciences, humanities and social sciences
Applied disciplines = engineering, business and education
Life disciplines = social sciences and education
Non-life disciplines = physical sciences, engineering, humanities and business Whitmire (2002; p. 633).

[4] Telephone interviews revealed that the library collection is mostly outdated, they find it difficult to locate material, while the curricula uses European standards, the library only has British standards andthat the library closes early. They confirmed that these reasons drive them from the library towards internet which is convenient and accessible all the time.

Allard et al., (2009), and Fidel and Green (2004) have established that access to computers and to resources is vital. However, Assignment of projects and papers that encouraged and require use of databases, exposure to information needs and educational contexts which drives the students to seek information from various sources, substantial age gap between the professors and the students which can affect the motivation of students to use internet and presence or absence of technology-enhanced pedagogy and curricula are significant factors contributing to the information seeking behavior of students (Eskola 2005, Fidel and Green 2004, Jones 2008, Kingsley and Kingsley 2009).

## Conclusion

It denotes that there are many micro and macro level factors which affect the students' information seeking behavior negatively even though they have access to most relevant scholarly databases. In contrast to the factors identified by Urquhart and Rowley (2007) in Figure 5, engineering students have only a few negative factors affecting the information seeking behavior. With some policy decisions to allocate funding for more scholarly databases and concentration on providing more focused information literacy programs for students of all academic years would improve their information seeking behavior significantly.

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