Identifying how novice researchers search, locate, choose and use web resources at the early stage of research

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ABSTRACT

This paper describes the process of identifying novice researchers' information needs. The study sampled postgraduate students at the Faculty of Computer Science and Information Technology, University of Malaya, Malaysia. The study utilized three types of data gathering techniques: (a) observations to gauge further understanding the novice researchers' information seeking behaviour while searching for research related sources on the Web; (b) a questionnaire-based survey to identify the artifact or the resources they use for the research activities; and (c) interviews with expert researchers to gauge further information needs of novice researchers. Results indicate that novice researchers rely on thesis, e-book, journals and conference proceedings as major scholarly resources. The facilitation of searching for research information on the Web is poorly supported by existing search engines. As such, the information seeking behaviour of novice researchers needs to be supported by specific research tools. Five important research information that novice researchers need to be acquainted with are: related literature, centre of research excellence, research trend, experts in specific research area and the specific databases and online resources. The paper put forward features of an institutional repository system that would support novice researchers' scholarly activities based on their research information needs.

Keywords: Novice researchers; Information needs; Information behaviour; Digital repositories.

INTRODUCTION

The emergence of digital libraries and institutional repositories populates the Web with research materials and these research infrastructures have become a free platform for knowledge sharing through scholarly activities among researchers around the globe. Scholarly activities encompass activities such as research, teaching and consultation work which result in research outputs such as theses and dissertations, conference papers and journals articles. The four pillars of these scholarly activities comprise discovery, teaching, application, and integration of knowledge and often start with the process of formulating key research questions. In view of this, information needs of a particular research group especially novice researchers need to be identified in order to provide them with relevant initial resources that address their information needs (Ellis and Levy 2009).

Information needs is defined by Miranda and Tarapanoff (2008) as a "*state or process started when one perceives that there is a gap between the information and knowledge available to solve a problem and the actual solution of the problem*". The information

needs of novice researchers refer to the act of locating and obtaining information to fulfill their initial conscious needs. The conscious needs of novice researchers must therefore be clarified before any recommendation can be made in order to assist the information seeking process. In addition, the tedious process of information discovery and retrieval could lower the chances of novice researchers in finding relevant information. However, discovery and retrieval of information is not always easy, targeted and relevant. This is turn can potentially hinder or restrict the researcher's chances of finding appropriate and significant material and so hinder innovation (Lyte et al. 2009).

CONTEXT OF INQUIRY

Novice researchers are keen users of institutional repositories (McKay 2007) and tend to opt for fast information access with minimum effort (Agosto 2002; Bell 2004). Research in information seeking process involved finding out information needs pattern. Adams and Blanford (2005) stated that users are poorly supported at the initial phase of information seeking process. At the initial phase, users could recognize their information needs for various types of resources. Thus, the type of resources, methods of discovering information and motivational factors need to be identified to understand novice researchers' information need. Devadason and Lingam (1996) proposed seven steps related in the process of identifying information needs:
1. Study the subjects interest of users;
2. Study users and their environment;
3. Study the immediate environment of users;
4. Study the users;
5. Conduct interviews;
6. Identify and record the information needs; and
7. Analyse and refine the identified information needs.

Graziano and Raulin (2000) declared that research is a systematic search for information, which involves a series of inquiring procedures. "Systematic" here refers to the structured sequence of procedures which govern the research process. "Searching" is defined as an act of trying to find information that one needs. The resources used for research purposes are in the form of academic-related literatures, which resides in both open and non-open access repositories.

Brewer et al. (1996) identified four steps in the generic "information journey" (see Figure 1). The initial phase is where information needs are recognized and initial attempts are made to resolve uncertainty (Kingrey 2002). The facilitation of the information to users are realized through systems such as digital libraries, search engine or other resources such as books, web pages and colleagues to make the knowledge easily available (Adams and Blanford, 2005). Next, through interpretation users began to sort the information to what is useful and what is not (Adams and Blanford 2005). Finally, users began to apply of the information to fulfill their information needs on specific domain depending on the role of the users.
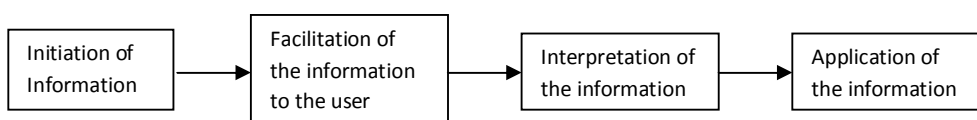
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┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐
│ Initiation of│──▶│Facilitation of│──▶│Interpretation of│──▶│Application of│
│ Information   │   │the information│   │the information │   │the information│
│              │   │to the user    │   │               │   │              │
└──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘
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Figure 1: Information Journey (Brewer et al. 1996)

The literature on information needs and behaviour has mainly focused on employee of organizations (e.g. Bigdeli 2007) or students (e.g. Selwyn 2008), children (e.g. Shenton and Fitzgibbons 2010) and adults (e.g. Wagner et.al 2010) with different levels of "Internet" competencies. Literature that solely focused on novice researchers is lacking. Furthermore, the design of digital repositories should meet the relevant criteria of information need, mimicking the traditional library and encompass services such as searching and browsing or selecting resources (Borgman 2003). There have been several previous studies that looked at how researchers would want to use digital repositories, for example investigations on the requirements of a good digital repository in allowing faculties to cooperatively develop and upload the resources to the institutional repository (Abrizah 2009); information-seeking behaviors of medical researchers to inform the development of customized library services such as institutional repositories (Haines et.al 2010) and information needs expressed by humanities scholars that an institutional repository can address (Seaman 2011). In contrast this work intends to address the issue by identifying information needs of novice researchers. The indirect outcome of the study indicates the features of a digital repository or an information system that will likely be used by novice researchers to address their research information needs. Contemplating the motivating factors such as user friendly interface, free access, keyword search, trend detection and expert detection are believed to be important for scholarly resources to be fully utilized. This study also identifies specific information that novice researchers wish to acquire before the preparation of their research proposal.

OBJECTIVES

The purpose of this study is to identify information needs of novice researchers in order to create a supportive research environment to support their research needs. The specific research questions are:

1. What are the types of resources novice researchers use in institutional repositories?
2. How did novice researchers discover and locate information sources?
3. What are novice's motivating factors in utilizing academic databases for research work?
4. What are the -specific features of a support system for novice researchers?

Dreyfus and Dreyfus (1980, 1985) and Daley (1999) defined novice researcher as those who "*have little experience with real situations, they must rely on the rules they have learned in their preparatory education to function*". First year postgraduate students were considered as early stage researchers because their experience are confined to conducting small scale research projects such for class assignments and final year projects during their undergraduate studies and this experience is considered limited.

RESEARCH METHODOLOGY

This study was carried out in three sequential phases comprising (a) observational study, (b) questionnaire survey and (c) interview with expert researchers. Figure 2 depicts the tabulation of methods used in the study together with their respective techniques of analysis.
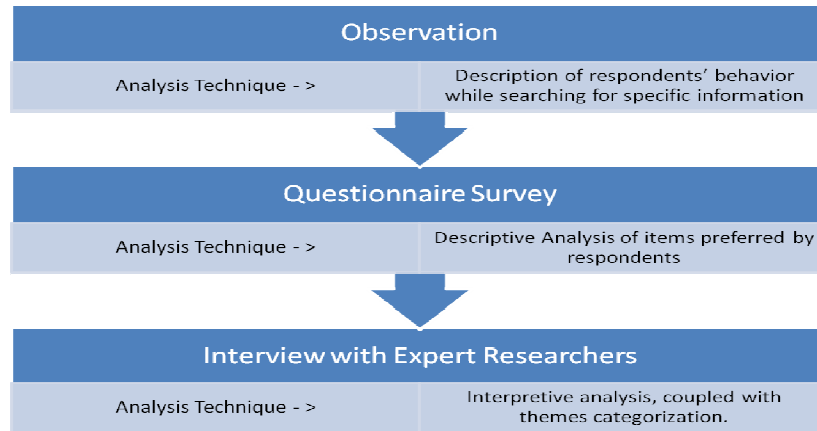
Figure 2: Tabulation of Methods and Analysis Technique**.**

Phase 1: Observing Novice Researchers

This first phase aims to find out whether the current search engines on the World Wide Web could provide novices with the information needed for their work. Novices are observed while searching for research related sources on the Web. Simultaneously, the study aims to find out whether the premise made by Kampa (2002) that the Web does not support research needs holds true.

A criterion-based purposive sampling of postgraduate students at the Faculty of Computer Science and Information Technology, University of Malaya (FCSIT, UM) was done through e-mails to 30 samples inviting them to join the observational study. Only seventeen out of thirty emails were answered, and six participants finally agreed to be part of the study. All respondents met the following criteria:

a) They are first year postgraduate students who registered for the Masters programme with a dissertation component of 12 credits.
b) They admitted having some background knowledge in conducting information search on the Web.
c) They have undertaken a research project during their Bachelor's degree programme.

The observation starts when the respondents were given an instruction regarding the activity that would be observed. Six novice researchers (denoted as R1-R6) were observed separately in a laboratory situation, where the participants were informed in advance on the task that they were required to do. The following three questions were put forward to the novice respondents:

Q1: What are the relevant literatures you can find on "Electronic Commerce" based on the research work from carried out at the Faculty of Computer Science and Information Technology (FCSIT), University of Malaya (UM)?
Q2: Is "Data Grid" a research trend at FCSIT, UM?
Q3: Who are the expert(s) in "Knowledge Management" at FCSIT, UM?

The steps taken by novices in finding the information were observed and recorded on papers. The above questions help trigger the investigation process in finding out the right answers. Novice researchers are expected to get quick and precise answers to these questions to accelerate the research process.

Phase 2: Survey

In Phase 2, a survey was conducted to find out respondent's utilization of academic resources, their roles and information seeking pattern. The survey questionnaire that was first piloted on five postgraduate students revealed the problems faced by novices when accessing information from open access portals which includes information was not up to date, obtaining dead links, availability of limited information and problems in using the right keywords. This differs from advanced researchers who would use intuition and experience to refine their searches. Preliminary findings indicated that the resources selected by novices were academic-related literature, such as conference papers, research reports and journal articles which reside in open-access and non-open-access repositories

The survey primarily focuses on understanding the current situation of scholarly content used by novices (postgraduates) and also their information seeking pattern when using the open-access repositories. The students was selected based on convenience sampling as they were close at hand and convenient (Schonlau et al. 2002). This sampling method is chosen to reduce the number of non-responsive participants. The results apply to the respondents only, as this sampling strategy avoids making erroneous inferences about the larger population. The sampled respondents were students in FCSIT, UM who were in their first year of postgraduates' programmes. A total of 60 questionnaires were distributed at the faculty's café and lobby areas as well as in postgraduates and classrooms at the end of lecture sessions. The questionnaire is divided into four sections. The first section solicited information about students' roles as readers/users and contributors of scholarly content. The second and third sections identified students' pattern of information locating and seeking. The final section asked students what motivates them in utilizing academic repositories for their research activity. A total of 53 (83%) responses were received and analyzed.

Phase 3: Interview with Expert Researchers

In order to gauge further understanding on the process of scholarly activities in carrying out research, interviews were conducted with research practitioners especially those in the ICT area. The practitioners were faculty members at the FCSIT, UM. Again, the sampling is made based on convenience.

The interview was done based on Kampa's (2002) study which attempted to identify important research questions posed by scholars. Additional questions in determining the special interest of researchers in different specialization was posed to the respondents to deduce any patterns that distinguish approaches between these researchers based on their fields of specialization. The respondents were asked to respond to the following questions.

> Q1: What are the main questions that you would want your new masters or PhD students to think of so that they will become competent in the new research area?
>
> Q2: When reviewing a paper for a journal or conference, what are the questions that you would ask yourself in order for you to assess the paper, either to reject or accept the paper for publication?
>
> Q3: What is/are the special needs or research interest that you would want your students to capture in your field of research expertise?

To ensure that the measure would be appropriate for assessing any similarities or differences in the perception on the important activity adopted during the research process, 18 respondents from different specialization and level (out of 45 active academic staff at the faculty) took part in the study. These respondents represented six different

specializations (Artificial Intelligence, Computer Technology, Information System, Software Engineering, Multimedia and Library & Information Science) and they were further divided to three different groups based on research experiences participated in the interview. The three groups are expert researchers (ER, denoted as ERX) (> ten years of experiences), intermediate researchers (IR, denoted as IRX) (>5 to <10 years of experiences) and advanced beginner researchers (AB, denoted as ABX) (< 5 years of experiences). Expert researcher refers to "someone who displays special skill or knowledge derived from training or experience" (Merriam Webster 2011). These experts hold PhD. degree and are Associate Professors. Advanced beginner researchers is defined as "one who has coped with enough real situations (research work) to note the recurrent meaningful situational components" or in another word have experience in research but sometimes face difficulties to distinguish between what is important and what is not (Daley 1999). These advanced beginner group consists of researchers with masters degree and have been involved with supervising students at the masters level. The group in between advanced beginner and expert researcher is considered as intermediate researcher who has the "ability to cope with unpredictable situation" (Daley 1999) such as managing research project without supervision from their senior counterparts. The intermediate researchers are those with PhD degree or have been involved in scholarly work for more than five years with majority of them holding the senior lecturer's position.

FINDINGS

Findings of Observational Study
The qualitative analysis is done based on the recorded results of the observation notes transcribed during the activity and is discussed under the following sections.
(i) Relevant literature on Electronic Commerce
    All six respondents (R1, R2, R3, R4, R5 and R6) used Google search as the main channel to obtain resource. Four respondents started searching by using Google while two respondents used the University of Malaya (UM) Library website. Even though all of them were using Google, different results were returned. For instance, R1 found only one journal article while R2 found three theses and four conference papers. This was due to the differences in the keyword submitted for the search. R1 typed "*Electronic Commerce FSKTM*" while R2 typed "*Electronic Commerce + FSKTM + UM*". Only R2 was observed to be using Boolean search operators while others used free form searching. Other respondents found more than one resources related to Electronic Commerce and each of the resources contain the keywords "Electronic Commerce" either in the title, abstract, keywords or in the body of the papers. None of the respondents succeeded in getting other information which is related to Electronic Commerce research area, for instance, the information that E-Commerce is part of research in Information System Applications, as specified by ACM (Association of Computing Machinery). The average time taken to complete the first task was 7 minutes. This shows that the respondents had struggled in finding answers to the question based on the number of visited websites and the time taken to complete the task.
(ii) Data Grid as FSCIT's Research Trend
    Respondents visited websites which were similar to those used to answer Q1. Only one respondent, R2, demonstrated confidence of his answer in stating that there is a high probability that "Data Grid" is now a research trend in FCSIT, UM due to the increase number of publications in this specific area in the recent years. The duration taken by R2 to finish this task was 8 minutes. Other respondents failed to identify whether "Data Grid" is a research trend after an average searching duration of 7 minutes. As

the recent research trend indicates opportunities for one particular research area to be expanded further, the failure to determine whether a research area is a trend or not might cause duplications in research.

(iii) The experts in Knowledge Management at FSCIT

The observation shows that respondents utilize similar websites used for answering Q1 and Q2 to answer the third question, Q3 (identify experts). However, two respondents, R3 and R5 were able to determine the expert based on the results obtained from the Web. R3 searched Google Scholar and found a few "knowledge management" related papers with one particular author that received high citations. On the other hand, R5 used one distinct website, *Malaysian Abstracting and Indexing System* (MyAIS, http://myais.fsktm.um.edu.my) in order to get the answer on the expert of "Knowledge Management (KM)" at FCSIT, UM. R5 found two researchers who have actively published more than five papers in KM. Based on the high number of publications, R5 was certain in stating that these two researchers are experts at FCSIT, UM. The other four respondents failed in resolving Q3. The average time taken to perform the task (solve or not able to solve) was 8 minutes.

Findings from the Survey
The Resources Preferred

(i) The first section of the questionnaire addresses the types of resources sought after by researcher in an institutional repository. Figure 3 shows that the highest materials preferred in academic repository among undergraduates and postgraduates were theses with 73.6% (n=39). The importance of theses in providing the breadth and depth of a piece of research work contributed to this preference. E-Book (60.4%, n=32) is rated second by the postgraduates because they need as much credible references as possible to support the research questions and information on the latest technology abroad. Furthermore, technology-based books were expensive and students often could not afford to buy them. Less than half of the respondents chose other type of resources such as e-research report, software, post-prinst, e-postgraduates presentation and pre-prints. Students also wanted the manuals and software codes attached with the actual research work. Attached items are currently provided in the university's DSpace and EPrint digital repository platforms as well as institutional repositories worldwide.

Respondents indicated prefering theses compared to other resources such as journals or conference papers perhaps because they believed theses are the most trusted source which examplify the type of end product that they needed to produce ultimately. From theses, students obtained guidance in term of the format and the organization of reports required by their institution and estimated the amount of work needed to complete their research reports, theses and dissertations. Figure 3 identifies the items that students want to refer to from institutional repository sites.
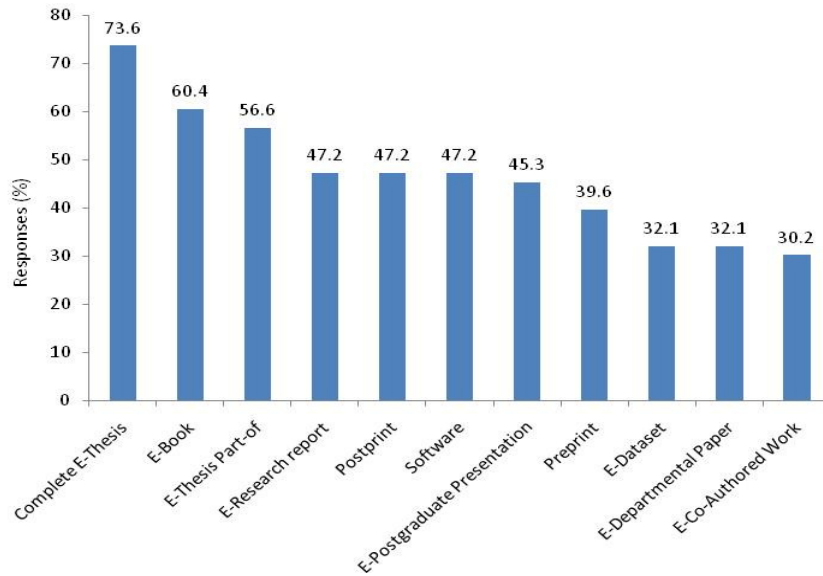
Figure 3: Types of resources sought after in Institutional Repository
(N=53)

(ii) **Channels Used to Locate Information**

The questionnaire also revealed the channels respondents use to discover and locate new information. Figure 4 shows that respondents have chosen online search engines which was rated the highest as a channel used for information searching (94.5%, n=50). Sharif (2004) claimed that the Internet usage at the initial stage of the study is important to familiarize the students with the requirements of their projects. Sharif and Zainab (2004) also reported undergraduates' dependence on search engines especially Google to search for information. This dependence on search engines was also observed by Oblinger and Oblinger (2005), who found that students use Google Scholar and other research engines to obtain information resources and seldom consult library web pages, catalogs and databases. In other words, they prefer a simplistic approach.

This reliance on generic search engines could expose students to another problem that is retrieving unreliable sources of information. Although the results from search engine queries give large number of information, not all resources are suitable as scientific references. Research shows that students, most of the time, could not sufficiently evaluate the reliability and quality of web resources (Oblinger and Oblinger 2005). The use of academic databases therefore should be encouraged and grounded at the early stage of the students' research.

In the present study, respondents have chosen the library as a second option to search for information (66%, n=35). Postgraduate students use the library as major sources for information more than undergraduates (Ismail et.al 2008a). The student did not seem to appreciate scholarly databases (ranked third) and perceived them as not being able to provide them with the information they wanted. The least popular methods were to contact authors directly and to purchase the materials online (7.5%, n=4). Respondents were willing to pay for information that they wanted if it was perceived to help them in their research.
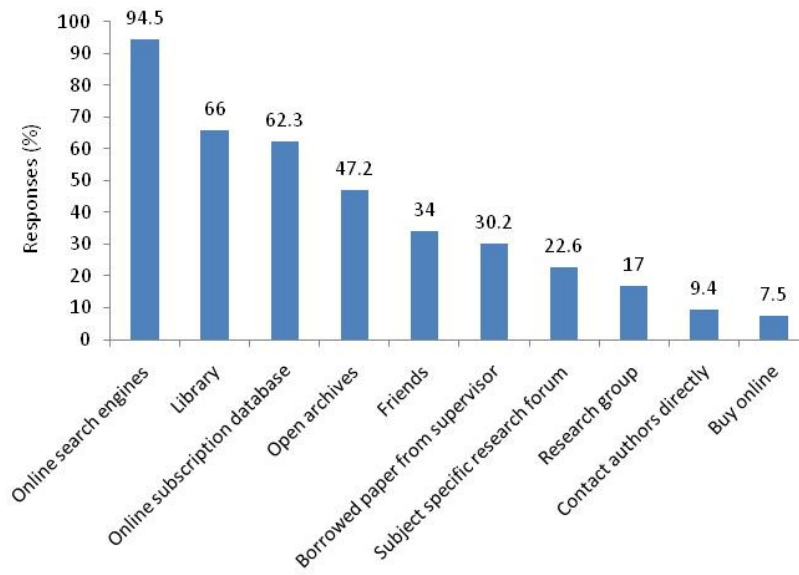
Figure 4: Methods used to locate information

Novices not only have chosen online search engines to locate relevant information they needed and also preferred resources that are freely accessible (94.5%, n=50). Generally, the results indicate the importance of online search engines especially Google in providing relevant information for both groups of students (Oblinger and Oblinger 2005).

(iii) **Searching Behaviour**

a) Search Options Used

Table 1 shows the search options used by respondents when querying search engines. Navarro-Prieto, Scaife, and Rogers (1999) identified three types of searhing pattern: top-down, bottom-up and mixed-strategies. About 71.7% (n=38) respondents applied the top-down strategy where they identified the general idea first and refine the search based on the links or information given in the resulting pages. About 60.4% (n=32) novices used the bottom-up strategy. In this type of strategy, they directly type specific keyword(s), look at the resulting pages, choose the highest ranking result, evaluate the information and return to the list of the result until they find the relevant information. For example, a student looking for Fuzzy Algorithm started searching using the term and looking for tutorials or guide on how to apply the technique his research work. Navarro-Prieto, Scaife and Rogers (1999) pointed that this kind of strategy is employed by experienced researchers or scientists and is used for fact-finding purposes. The postgraduates sampled in this study also applied the mixed-strategies as the majority of them chose both top-down and bottom up strategy. A total of 11.3% (n=6) postgraduates specified others as their research strategy. Respondents described that they would "find related papers and look for other works by the author from the bibliography section" , "type the whole text", "look for definition of keywords" which actually falls under top-down strategy.

Table 1: Information Seeking Method Using Search Engines

Questions	Attributes	Percentages (%) N=53
Start Searching	Type any keywords	71.7
	Look for keyword under specific domain, refine search	60.4
	Others	11.3
Specific information look for while searching	Document title	77.4
	Type of document	64.2
	Author	26.4
	Others	5.7
Stop Searching Factors	Good results	64.2
	Nothing is relevant	54.7
	Document cannot be downloaded/dead links	49.1
	Complicated terms	39.6
Special documents characteristics	Technical explanation	69.8
	Year of publication	45.3
	Well known author	35.8
	Others	3.8
Next strategy if most results were irrelevant	Narrow down research scope	56.6
	Look for more abstract topics	52.8
	Use other database	34.0
Consider reading article from other discipline	Yes	81.1
	No	18.9

(b) Specific Information Looked for while Searching

The respondents in this study started their searches by choosing mainly "*document title*"(77.4%, n=41), followed by "*type of document*" (64.2%, n=34), "*author*" (26.4%, n=14) and "*others*" (5.7%, n=3) such as subject. From document titles, respondents gauged relevance from the content of the document. Respondents would end their search when they felt they have obtained *"Good results" (64.2%, n=34)* or found "*Nothing is relevant*" (54.7%, n=29) or found "*dead links*" (49.1%, n=26) and when the "*search leads to more complicated term(s)*" (39.6%, n=21). This pattern corroborates with the study by Griffifhs and Brophy (2005) who observed users' searching behaviour when using Evaluation of the Distributed National Electronic Resource (EDNER) and found that 70% of the respondents would stop trying to locate information when they were "*Unable to find Web site within time allowed*", or "*Could not find a Web site and gave up*" and "*Technical problems affected search*".

(c) Special Characteristics of Documents

The majority of the respondents chose "*technical explanation*" (69.8%, n=37) over "*year of publication*" (45.3%, n=24) and "*well-known author*" (35.8%, n=19) as the special characteristic to choose a document. Technical explanation here refers to the abstract or extended keywords provided as metadata description for the document or article. Respondents appreciated the search for the year of publication and well known authors to identify the trends and experts in a particular research area.

When most results were found to be irrelevant, respondents would "*narrow down the research scope*" (use more specific terms – 56.6%, n=30) or "*look for more abstract topic*" (52.8%, n=28), or "*use other databases*" (34%, n=18). One plausible explanation is probably because postgraduate students have more experiences in searching the information for research as compared to undergraduates and they are able to

construct a bigger picture of the research topics and formulate new specific search terms.

Nearly all respondents opted for "*reading article from other discipline*" due to the multidisciplinary nature of research work in the field of computer science and information technology. About 81.1% (n=43) have chosen "YES" over 18.9 % (n=10) who have chosen "NO". This indicates that respondents were willing to compensate the relevance criteria of search result over accuracy of resulting documents from just "keyword(s)-matching". In the other words, respondents valued a result of searching that contained related documents to the keywords supplied, even though the keywords were nowhere to be found in document retrieved. This behaviour could further be supported with the utilization of ontology in the searching algorithms.

(iv) Motivating Factors when Searching for Information

This section was intended to find out what students expect from research repositories in order for them to use and appreciate them (see Figure 5). Novice researchers need to identify key research areas in their listed field of research. To do this, they have to undergo the tedious process of locating the right information and hence need the most support in the process of information searching at the initial stage of their research. About 54.7% (n=29) of the postgraduates chose "emerging research trend" as a motivating factor to start their research. The next factor, "expert identification" was chosen by 45.7% (n=21) of the postgraduates. They searched for prominent authors or experts in a particular research field so that their research work could be further explored. Furthermore, extensive literature reviews of related researches were viewed as important to understand current trends and respondents related this to result obtained at the later stage of their research.
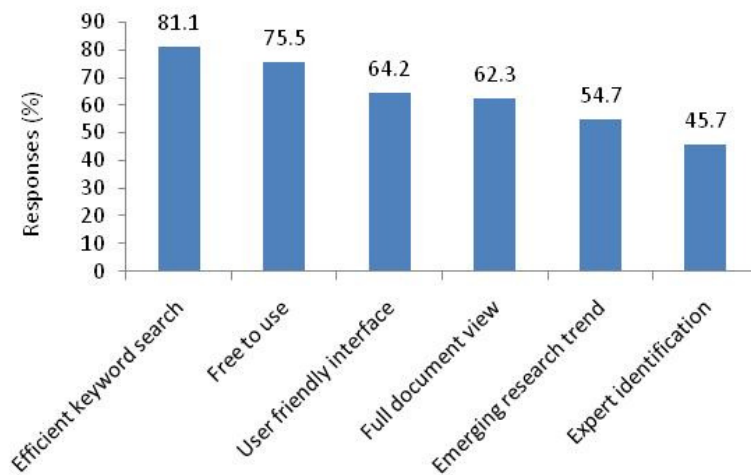

Figure 5: Motivating Factors in Searching Research Repositories

Findings from the Interviews

The results of the interviews revealed several issues regarding scholarly research activities. The activities involved providing research proposals, writing a research paper and preparation for research presentation. Weiser (1996) observed that students discovered

new knowledge, developed new technologies and integrated the knowledge with the standard required by the institution during the research activities. Most of the students would only uncover important information after undergoing the tedious process of searching and locating information needed.

Research Questions Expert Researchers Expect Novice Researchers to Answer

Table 2 presents the answers given by the respondents based on the interview questions posed during Phase 3 of the data collection technique. Senior and intermediate researcher were able to provide more detailed answers to the questions as compared to the advanced beginner. The majority (17 out of 18) of the respondents emphasized on the importance of their students to obtain the relevant literature for the specific research topic. On the other hand, advanced beginner (those with less than five years of research experience) emphasized on the "surface' aspect of the research. The answers given were considered "shallow" as the majority stressed on the importance of relevant literature yet were unable to relate other importance criteria such as current trend in research or the state-of-the-art to resources they used. Research has shown that the performance aspects of researchers changed from novice to expert (Dreyfus and Dreyfus 1985; Daley 1999). The experts working pattern depended on abstract foundation to solid past experience, from viewing situations as "unrelated part" to viewing the "situations as part of a whole" and were more involved in performing the research work (Daley 1999).

Table 2: Respondents' Answer Based on Research Questions

Pertinent Questions /Respondent	Relevant Literature	Experts	Trend	Institution	Specific Resources
ER1	x		x		
ER2	x	x	x	x	x
ER3	x	x		x	x
ER4	x		x		
ER5	x		x		
ER6	x		x		
IR1	x		x		
IR2	x				
IR3	x				x
IR4	x		x		x
IR5			x		
IR6	x		x		
AB1	x	x			x
AB2	x				
AB3	x				x
AB4	x				
AB5	x			x	
AB6	x				x

*Legend ER – Expert Researcher
IR – Intermediate Researcher
AB – Advanced Beginner

Experienced researchers were more "engaged" in the research undertaken by their students and used their past experience as a researcher to help the students in their research work and were able to provide guidelines for the students under their supervision. On the other hand, the advanced beginner in this study stressed on quality because they do value the importance of literature study and also their ability to

successfully supervise their undergraduate and postgraduate students. It is expected that over time, the advanced beginner would develop research skills and could provide better guidance to their students. This finding would not only benefit the students (postgraduates and undergraduates) but also novice researchers (lecturers) in supervisory position to enrich their knowledge and skills for future supervision activity.

Based on the interviews with experts, the questions that need to be answered by novice researchers at the early stage of research were:
- What are the related literatures in this field of research?
- Who are the experts (specific researchers) in this research area?
- What is the current trend in this field of research?
- Which institution (research group, clusters and centers of excellence) is involved in this type of research?
- What are the specific resources (Online Databases) for this research?

(i) Expert's Assessment of Journal or Conference Papers

Reviewing research papers is part of scholarly activities conducted by researchers. The processes involved in reviewing academic articles are: identifying the key research questions, the current trends in the research and the novelty and originality of the paper to the society at large. Thus, support that could help reviewers to answer these types of research questions would be of great help. Basically, the common guidelines for reviewing a journal article are as follows:
   a) Content, includes references to relevant literature, assumptions or speculation made based on existing work, significance of results, originality and making comparisons with previous works.
   b) Quality of presentation includes the organizations of figures, grammar, proper citation and references.

The experts explained that the task for content reviewing could become less complicated with a supportive environment that could provide the researchers with fast access to relevant materials such as from relevant IEEE (Institute of Electrical and Electronics Engineers) and ACM (Association of Computing Machinery) online databases in order to find significance resources.

(ii) Specific Research Interest of Experts at FCSIT, UM

Every science discipline has its own special interests which differentiated one field from the other. Supportive environment would be a great help to novice researchers who are looking at specific requirements needed in their field of research. For instance, Kling and Mckim (2000) deduced from their study that researchers in the field of Information Systems are concerned with deciding the following: the type of organizational activities that needed to be computerized, the criteria for an effective information system in an organization, information system's evaluation and recognizing how people would use an information system in different organizational environment or how employees were coping with organizational change. From the results of the interviews, the areas of special interests and needs in six fields of Computer Science and Information Technology at the case setting were identified and shown in Table 3.

Table 3: Special Interest / Needs in Computer Science and Information Technology Research at FSCIT, UM

Field	Special Interest/ Need
Information Science	• User Acceptance Model • Research Methodology
Artificial Intelligence	• Intelligent Techniques
System and Network Technology	• Protocol for Network Communication • Algorithm for Encryption and Decryption Techniques • Network Management Tools
Library Information Science (LIS)	• Suitable Methodology and Models for LIS research.
Multimedia	• Usability Study Method • Multimedia object in Learning Application • Cognitive Methods of User Interaction with Multimedia Technology
Software Engineering	• Architectural Design of a System • Available Framework in Software Engineering

DISCUSSION

Phase 1: Observational Study

Based on the observation, several conclusions can be drawn:

a) Respondents faced difficulties when searching for relevant information related to their research despite using search engines such as Google and Google Scholar. Users were usually presented with bundles of information which needed to be properly filtered for accuracy and relevance.

b) There are few scholarly tools which are available that can be utilized to find specific type of scholarly resources but searching options provided were complicated. For instance, Malaysian Abstracting and Indexing System (MyAIS), which is an open access system of abstracts and full-text articles published in refereed scholarly Malaysian journals provides a simple analysis of scholarly papers published by Malaysian journals and conference proceedings in terms of authors, journals, subjects and few other criteria. The statistics for ranking the top most authors are determined by the highest total downloads of one particular article which might not be the best indicators to determine expertise in a field. Even though citation received by one author is counted as one of the factors that determined authors' expertise, other factor such as number of published papers in one particular areas and the sequence of authors' appearance in scholarly document should also be taken into account.

c) Search engines were highly utilized due to the lack of specific tools which can help users find answers to some of the important questions at the early stage of research work.

d) The utilization of other searching tools such as the Malaysian Abstracting and Indexing System (MyAIS, http://myais.fsktm.um.edu.my) and Electronic Journal of University of Malaya (http://ejum.fsktm.um.edu.my/) showed that respondents were aware of other resources that could be utilized in order to obtain the needed information in answering the given questions. However, the respondents perceived that the tools did not provide much help as they switched back to search engines when they could not find the information needed. This might be due to insufficient support to help respondents get the information needed.

e) Questions that need users to analyze varieties of resources (such as scholarly documents and related websites) seem to prolong the investigation processes which eventually delayed the research work.

The respondents who were observed came from similar background as they were all novice researchers. The similar web sites used to answer the three questions posed might contribute to the failure of giving the right answers by majority of the respondents. This might be due to huge returns retrieved when searching for information using keyword. None of the respondent searched for specific tools which could help them find answers to specific questions such as "*Who are the experts?*" and "*What is the* research trend?" The reasons might be that they were not aware on the existence of such tools.

Phase 2: Survey
Generally the findings from the survey are summarized as follows.
a) The utilization of academic resources for research purpose among postgraduates was low because they were inclined to use generic search engines, such as Google to search for information that will result in the non-scholarly resources derived from personal blogs, companies' websites and few others.
b) The results indicate that students need a common access point to academic related resources to assist them in the research process.
c) A majority of the postgraduates are motivated to use the institutional repositories if they provide free access, have user friendly interface and provide efficient search option, which include support in identifying trends and research experts.

As this study was about understanding the utilization of academic resources from the students' point of view and the motivating factors that encouraged them to use the resources, it could be deduced that the utilization level of academic resources was still low due to factors such as the absence of such resources in the repository they have searched or if these resources existed, searching the repositories was complicated. Furthermore, the distributed resources made access to multiple repositories difficult. The survey revealed that students faced difficulties in getting the resources in academic repositories due to the unavailability of support in the process of searching for relevant information. The students demonstrated similar behaviour found in previous studies by Griffifth and Brophy (2002; 2005), except that postgraduates seem to appreciate the usage of scholarly resources for research work more than the undergraduates. The DEvISE project (Johnson, Griffiths and Hartley 2001) found that efficiency was strongly correlated with users' general satisfaction which seemed to "suggest that the amount of time and effort required from the user matters more than the relevance of the items found". The postgraduates in novice researchers' position seemed to agree that three conditions were useful in assisting them at the early stages of their research work. These are finding related literature, identifying research trend and experts in specific research area (Ismail et.al. 2008b). Thus, further study in identifying other relevant support features for novice postgraduate researchers will be helpful because these students resemble traits of scholarly researchers.

Phase 3: Interview
The specific research needs of novices could be used as part of a requirement specification or competency question that needed to be answered by proposed ontology that have been created for the field of Computer Science (Ismail et.al 2007). Five pertinent research questions which were important for novices were related literature, centre of research excellence, research trend, experts in a specific research area and specific databases and online resources.

In order to support these need, novices will be provided with sets of relevant terms to assist their information searching process. This specification could be used to assist the novice researchers in identifying the related research area that requires their attention in the field of Computer Science and Information Technology, especially at the case setting, FCSIT, UM.

DISCUSSION AND CONCLUSION

The results found from this study indicated the following:
   a) the Web has not provided sufficient support needed by novice researchers in helping them to accelerate their search for information. These novice researchers seem to struggle in obtaining the required information. Novice researchers expressed their need for the following types of information: literature related to their research area; centres of research excellence; research trends; experts in specific research area; and specific databases and online resources.
   b) there is a need to provide a common access point to support searching for relevant web resources. Common access point refers to a standardized interface that allows users to access all the information that are "*expressed using a diverse vocabulary and inaccessible format*" (Falbo et al. 2002b). The data test beds in this study involved heterogeneous scholarly databases (comprising journal, conference and theses databases) which are individually developed and separately maintained by different research groups at the case setting. Thus, a common access to this information is imperative since it is a valuable source for research work. The ultimate goal is to help new researchers to easily obtain relevant information, such as research trends and experts, in the shortest time possible with improvement in recall and precision (Falbo et al. 2002a, 2002b).
   c) students face problems while dealing with scholarly activities to meet their research information needs. Most of the basic steps in identifying the right information at the early stage of research could be accelerated if novice researchers have suitable support to do so. Any extra support at the earlier stage of the study would definitely be helpful. Throughout this research, several conditions that encourage and nurture research culture among novice researchers have been identified. These conditions, among others are (i) individual passion for knowledge, (ii) full support from the research community, (iii) freedom to create the researchers' own masterpiece, and (iv) a conducive research environment. Conditions (i) and (iii) are directly related to the individual self-adjustment which can be influenced by conditions (ii) and (iv).

The study implies that a new approach is needed to assist novice researchers in utilizing the Web as a platform for scholarly activities, as reported elsewhere by Ismail et al. (2008b). A support system for novice researchers (SSNR) using semantic web technology (Figure 5) to provide the necessary support needed would be the next step of the research, which is beyond the scope of this paper. It is expected that the emphasis of the "push" factor such as SSNR, which could help in accelerating the relevant information gathering, would definitely help in cultivating a research culture amongst students.
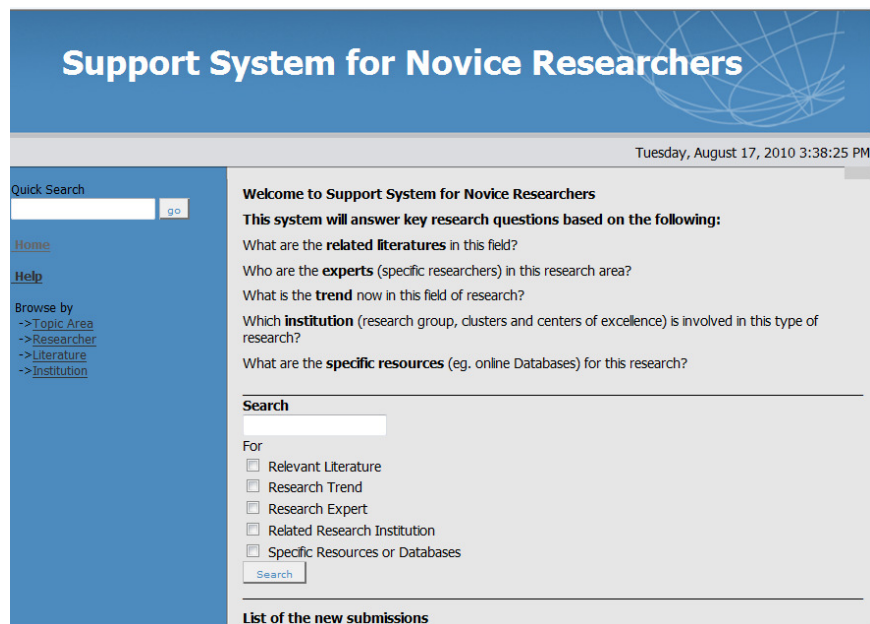
Figure 5: Support System for Novice Researchers

ACKNOWLEDGEMENT

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