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Search Strategies and Information Search Tools Used by Pharmacy PhD Students: A Qualitative Study

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Abstract

Objectives: This study aimed to investigate search tools and strategies of PhD students to access required information.

Methods: Semi-structured interviews with pharmacy Ph.D. students in Tabriz University of Medical Sciences were conducted. We used MaxQDA software to analyze the content of the interviews.

Results: Scopus and Google Scholar were the most popular search tools used by participants. These databases were also recognized as the most common starting points for searches among participants. Participants' search strategies were categorized into two themes (search tools and search strategies) and six subthemes which include: search start up tools, search tools used, reasons to use, keyword selection and modification, type of search and field searching.

Conclusion: Google Scholar has become a serious alternative for specialized databases such as Web of Science, Pubmed and Scopus. The results of this study would be benefit for policy makers and information suppliers in academic settings.

Key word: Information seeking behavior, Search strategies, Students, Bibliographic databases, Database searching.

Introduction

Nowadays, information sources are available to researchers at a large volume through the search engines and databases. Familiarity with these tools and their features affect the quality of the search results and users' satisfaction from the retrieved results. The literature suggest that the effective and retrieving relevant information items has a direct impact on research performance and quality of findings produced by researchers and students.(Intas et al., 2017) Nonetheless, a successful search is clearly depend on the user's ability to develop a search strategy that fits their information needs and individual preferences.

Information seeking skills are components of information literacy. However, a number of studies reported the influence of factors such as personal characteristics, prior knowledge and expertise on information seeking behavior.(Halder, Roy, & Chakraborty, 2017; Khosrowjerdi & Iranshahi, 2011; Rouet, 2003) In addition, a single factor alone does not improve the search strategy(Tsai, 2009) and having both knowledge and experience is essential for conducting successful search.(Clark, 2017) Postgraduate students, including PhD students, as researchers need access to proper and accurate information. Consequently, having information literacy skills and the ability to effectively search information and retrieve relevant resources is important for PhD students because of the impact on their scientific studies quality, which ultimately leads to effective information production. Past studies have addressed information literacy skills as well as information seeking behavior of students in various disciplines. The results of past studies(Daqing, Dan, Zhen, Anna, & Kim Thien, 2012; O'Carroll, Westby, Dooley, & Gordon, 2015; Thomas, Tewell, & Willson, 2017) showed that students use internet and, in particular, search engines and scholar databases, to locate credible information items that meets their information needs. Further examination of information literacy skills in students indicated that students need to advance their skills in using search tools and in the formulation of search strategies.(Rosman, Mayer, & Krampen, 2016) Studies also showed that students can not differentiate between the electronic resources(Williamson, Bernath, Wright, & Sullivan, 2008) when searching for information. The results of Biaz et al.'s study showed that a small portion of postgraduate students employed search tools efficiently to retrieve relevant results , and most of them used this tools

partially and ignored other search facilities.(Biaz, Bennamara, Khyati, & Talbi, 2014) Incomplete utilization of search tools, affects the quality of the search as well as their satisfaction with the retrieved results. In fact, the lack of awareness of the characteristics of information resources and search tools are the main obstacles when using online resources and search tools.(Sajjad & Vivian, 2004)

Studies in Iran have also shown that the lack of students' skills in using resources is one of the main factors for unwillingness to use these resources.(Kahouei, Babamohamadi, Sadat Ghazavi shariat panahi, & Mahdi Zadeh, 2013) Meanwhile, a study that investigate information search skills in pharmacy students was not found. This is evident for scholar community to improve information literacy skills among students. Therefore, the university administrations around the world; supported programs to teach Information skills to students. Understanding the experiences and reasons of students in using databases would help the academia to review the policies and investments regarding information literacy skills improvement programs. This is a qualitative study and we aimed to investigate the experiences of PhD students when searching information. In this study, students search strategies to achieve the required information are identified. Also, due to the lack of in-depth studies on the reasons for using search tools to access information resources (De Groote, Shultz, & Blecic, 2014; Haines, Light, O'Malley, & Delwiche, 2010), additionally, we studied the reasons for using particular search tools and their features when using tools and resources.

Methods

In this qualitative study, the study population included the PhD students from Faculty of Pharmacy in Tabriz University of Medical Sciences (TUOMS). The faculty of pharmacy had seven academic departments. These were: Pharmacology, Pharmacognosy, Medicinal Chemistry, Pharmaceutics, Pharmaceutical Biotechnology, Clinical Pharmacy, and Pharmaceutical & Food Control. The participants were selected using convenience sampling (one of the main types of non-probability sampling methods) according to the research objectives. For selecting students, the interviewer, an MSc student in medical librarianship and information science (S.F), created a friendly relationship with the study population and the students who were close to hand, were selected. In total, 21 PhD students participated in the present study (nine female and 12 male). 13 participants were fourth-year students, six were third-year students and two of them were second-year students. The interviews took place between December 2016 and June 2017 and we conducted the interviews at a venue convenient for participants. Data were collected through interviews using of semi-structured questions. Several examples of the questions asked in the interviews were as follows: Which database or search engine do you use to start searching for meeting educational or research Information needs? What tools or databases and why do you use to search (or to complete searches)? How do you find the keyword you want to search? How do you search by keywords in the databases or search engines? How do you limit or filter your search results? What problems do you face when searching, accessing and retrieving relevant items? To resolve any ambiguity and to effectively use experts' viewpoints, if necessary, we asked additional questions to generate further discussions and promote the comprehensive exploration of the subject matter. The interviews lasted between 45 and 60 minutes and the participants were assured that the information would be kept confidential and the recorded sound tracks would be destroyed after the completion of the investigation. Sample size criteria in this study were similar to qualitative studies to achieve data saturation and sampling was stopped when we reached data saturation and we did not obtain new data during the interviews. Content analysis method was used for data analysis and the analysis was assisted by MAXQDA software package. Content analysis is suitable for summarizing the content of

spoken and written information collected as Creswell reported.(Creswell, 2009) After each interview, the transcription was sent to the participants to read the text and add their comments if necessary. This helped the researcher to modify the other questions for next interviews and to better lead the study. After coding the text of the interviews, the codes that were similar in meaning were merged and placed in the same category. Then by putting together similar categories, the main themes were extracted and the relationship between categories was determined.

This study was part of an MSc thesis supported and funded by TOUMS and approved by the Ethics Committee of TOUMS (under the code: IR.TBZMED.REC.1395.837).

Results

Through the analysis of the data obtained from the interviews, we extracted the criteria considered by the participants and classified them into two themes: "search tools related" and "search strategy related"(Table 1):

Search tools related

The results showed that participants tended to use both of search engines and databases to locate information items, so that they didn't prefer each of them to another. The Google Scholar was the most commonly used tool that majority of the participants used to search (15 participants), and the next database was Scopus. Pubmed, Google search engine, ScienceDirect, Web of Science were less used.

One of the questions asked participants was their starting point, meaning that which of these tools or databases they use to initiate the search process. Among the search tools, participants pointed to Google Scholar (10 participants) and then Scopus (seven participants) as the most common starting point for search and access to required information.

Some of the participants used Google Scholar as a starting point for searching and for completing searches, because of: availability, ease of search, and access to more information sources. Availability was one of the most prominent feature, although some mentioned the usefulness and reliability of databases such as Scopus, but the reason for their search with Google Scholar was its availability without time and location limitation. The capability of Google Scholar to retrieve more information sources related to their needs from other various databases was another reason for their willingness to use it, and this assures participants that this database could be searched more comprehensive and get more relevant results. One of the participants pointed to the access restrictions of some databases:

"I usually start with Google Scholar because I do not have access to Scopus at home" (Interviewee 5)

Scopus database was the second search tool used by participants (10 participants). They pointed to some features of Scopus as reasons to use this database such as: covering credible information sources, easy searching, providing author information such as h-index, access to other articles of an author, access to similar articles, presentation of article citations. A student explained the reason for using Scopus:

"It's available, of course, if the university payed subscription fee. Google Scholar is not bad, but it require a lot of time, because it has little search limitation capabilities. My first option to search was Scopus." (Interviewee 12)

The third database mentioned by the participants was the Pubmed of National Library of Medicine. Seven participants preferred to use this database for searching information items and they highlighted the convenient search features of PubMed when locating information resources. Search facilities such as searching by the author name, limiting the search results, and the possibility to perform searches based on different limiting fields, were the reasons for using Pubmed. The remarkable point was that, despite the use of Pubmed, they didn't use mesh thesaurus to find their own keywords and design a search strategy. However, a small number of participants pointed that they were familiar with the mesh, but didn't need to use it.

Five of the participants also referred the ScienceDirect when searching the literature. They stated that ScienceDirect allowed the sort the search results based on the relevancy of retrieved items. In addition they could access similar article to any article they selected in the list and it helped a lot to save the time.

In total, features such as: availability, user friendliness and convenient search on the database, retrieving credible information, retrieving relevant information, providing information about the author, as well as access to other articles of an author were the participants' reason in selection of these tools.

In addition to the features associated with the search tool, previous familiarity with the search tool or the recommendation to use it also affect the use of it. For instance, three participants mentioned that they selected a database based on their supervisors' recommendations.

"I first found a lot of articles but my supervisor didn't confirm them, and told you should search the Pubmed." (Interviewee 7)

[Table 1 place]

Search strategies related

The steps of search strategy begins with choosing the keyword/s for the search and then judging the relevancy of the retrieved results. They identified the most appropriate keywords to retrieve the information in terms of number and relevancy of the records. Some participants argued that they would start searching with broader terms to become enough mastery by retrieving and studying resources. Some also pointed out that some of the keywords were retrieving a lot of results, and because of the lack of time to study this amount of resources, they said they would prefer to use narrower terms in search.

The next step is how to perform a search. After finding the most suitable search term(s), participants used it to search in given database. Participants used more simple and topic searches, however in some occasions they used author search to study more papers from an author or to obtain information for familiarizing themselves with the author's expertise and experience in a subject area.

The publication date was important criterion to most of the participants (17 participants). They tend to retrieve latest publications by limiting searches to a specific time period. "Publisher name" and "journal name" other filters used to obtain credible information from reputable publishers and authors. In addition, the "place of publication" or "country name" is considered by participants when looking for information. In other words, participants tend to limit their searches to the most reliable sources.

Participants did not mention the use of the boolean operators when searching, though; they used phrase searching to narrow their search.

Another objective of this study was to investigate the limitations that participants encountered in searching databases. One of the most important restrictions for participants was access to the full text articles. All of the participants mentioned this limitation in their searches, and this indicates the importance of this issue. Participants were asked about the solution they used to resolve the issue. They pointed to solutions such as: requesting from the author, and getting help from friends living in overseas countries. Off campus access to the subscribed databases such as Scopus was also considered as another search restrictions mentioned by participants.

Discussion

Findings of the current study show that using search tools depends on the features of those tools.(Komissarov & Murray, 2016) One of the most important concerns of participants was availability of search tool without time a nd location restrictions. Free search tools were listed at the highest rank when explaining the reasons of use thus participants seemed to use of Google Scholar off-campus. Similarly, the results of past studies pointed(Brennan et al., 2014; Ollé & Borrego, 2010; Sedghi, Sanderson, & Clough, 2012) that free access to a databases and tools leads to higher usage rate.(Adeoye & Popoola, 2011) Their great attention to free tools reflects the difficulties in accessing to subscribed databases.

Although participants tend to use Google Scholar because it is free, it allows users to conduct comprehensive search of the literature. Recent studies have shown that Google Scholar's search scope has grown substantially.(Gehanno, Rollin, & Darmoni, 2013; Harzing, 2014; Harzing & Alakangas, 2016) Google Scholar appears to have been able to solve the problem of developing countries scientists in search and access to bibliographic information of information sources, and even the full text of a portion of the information sources by accessing to open access information sources.

The use of open source information sources and the lack of use the other researchers' outputs published in commercial journals will affect the quality of studies conducted by the students. The access limitation to full text of articles is an important problem for researchers.(Dukić, 2014; Intas et al., 2017; Shpilko, 2011) They have used a variety of methods to access the full text of the article, such as sending a request to the author and also sending a request to a colleague at another institution to obtain a full text of information.(De Groote et al., 2014)

Past studies have shown that access to information resources has become a major barrier for researchers in developing countries and unlike researchers in developed countries, which rely primarily on institutional (library) access to scholarly journals, They use informal methods to access information due to the institute's inability to provide the required information resources.(Davis & Walters, 2011) The access limitations to

information resources at off campus on the one hand, and no access to full text of papers through databases due to lack of subscription of some sources on the other hand, seems to have led researchers to use open access articles with searching through Google and Google scholar. This has led some students to prefer Google and Google Scholar to special databases such as Pubmed and Medline. The central library, which is responsible to supply information resources, can allocate part of the budget for purchasing information resources to the information delivery unit, helping to increase the quality of students' studies by activating this unit and meeting the students' information needs.

"Ease of use" was the feature that participants in this study and other studies referred to.(De Groote et al., 2014) The ease of use feature depends on the of familiarity with the search tool, the time spent for searching and Graphic User Interface(GUI) of selected tools.(Hearst, 2009) Participants need training courses to increase their information literacy and maintain their information seeking behavior. In line with the results of this study, other studies show that users mostly tend to use simple search tools.(Farokhzadian, Khajouei, & Ahmadian, 2015; Haines et al., 2010; Khan, Zaidi, & Zaffar Bharati, 2009; Sedghi, Shormeij, & Tahamtan, 2018) Students are not interested in using advanced search attributes because they didn't need to use more features to search.

All of the participants in this study use the keywords in their searches and decide on retrieved results to modify them. They had the ability to make their search terms general or specific in order to increase the quality of their search. In spite of the fact that participants had passed the course of medical information systems, they said they did not use search operators to create search statements. Other studies reported that search operators such as Boolean operators are not used by users in search of information in scholar databases.(Bloom & Deyrup, 2015; Farokhzadian et al., 2015; Holman, 2011) Increasing the ability of search tools to process and search natural language as well as the default use of search operators has caused, users did not feel the need to use search operators.(Lowe et al., 2017)

Users preferred using default and simple search tools rather than using advanced search attributes such as Boolean operators or phrasal search because search engines in PubMed and other databases process their search queries using text mining and NLP techniques.

Conclusion

Google Scholar has become a serious alternative for specialized databases such as Web of Science, Pubmed and Scopus. With the current trend, perhaps in the near future, it will become the only database used by researchers. Despite the high cost paid of the university to subscribe these databases, students increasingly use Google scholar. Google scholar's vast coverage has led to an increase in need for full text of articles. In addition to increasing access to relevant and more information resources by searching Google Scholar and access limitations to databases outside the campus or lack of provision of full text of the articles required, tend to use Open Access articles. This ease of access will gradually lead to neglect and forget most of the available papers through subscribed databases and will have a direct impact on the quality of studies and related outcomes. Therefore, the central library of the university, while actively acting to provide the required documentation and also, university IT management should provide students' access to subscribed databases with the possibility of using them outside the campus. Further studies are needed on the coverage of the Google scholar, Web of Science, Pubmed and Scopus databases in the field of medical sciences in order to determine whether Google Scholar has been able to cover all of their indexed sources. Also another study is necessary to compare the effectiveness of two search methods: using keywords and operators such as boolean, and natural language searching in order to decide on modifying the information literacy program based on research findings. In this study, although we knew that students had passed one course of medical information systems course but we still did not know the extent of their skills and ability to search databases. If we were able to study the user's search skills, a better understanding of the students' abilities and their search strategies would be achieved.

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Table 1. Search Tools and Strategies Used by Students' Themes, Subthemes and Issues Extracted from the Qualitative Content Analysis

Themes	Subthemes	Issues	Frequency
Search Tools Related	Search Start up Tools	Google Scholar	10
		Scopus	7
		Pubmed	3
		ScienceDirect	1
	Search Tools Used	Google Scholar	15
		Scopus	10
		Pubmed	7
		Google	8
		ScienceDirect	5
		Web of Science	1
	Reasons to Use	Using Free Databases	19
		Ease of Use	9
		Access to Databases Anywhere	11
		Include Credible Information	4
		Selectable Search Option	5
		Recommended by Professors	6
		Access to a Large Number of Journals	4
		Recommended by Friends	4
		Access to WOS* Indexed Journals	2
Search Strategy Related	Keyword Selection and Modification	Use of Keywords in Search	21
		Use of Same Search Terms in Several Search Tools	21
		Finding the Best Keywords by Trial and Error	7
		Keyword Modification Considering Retrieved Results	8
		Using Broader Terms to Expand the Search	6
		Using Narrower Terms When Retrieved Results is so Much	6
	Type of Search	Simple Search	21
		Author Search	7
		Topic Search	6
		Phrase Searching (Using Quotation Mark)	5
	Field Searching	Date of Publication	17
		Journal	9
		Place of Publication	7
		Author	8
		Publisher	5

WOS=Web of Science Databases