Factors that Influence Information-Seeking Behavior: The Case of Greek Graduate Students

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Abstract

The purpose of this survey is to determine the information-seeking behavior of graduate students of the Faculties of Philosophy (8 Schools) and Engineering (8 Schools) at the Aristotle University of Thessaloniki. Discipline did not seem to affect information-seeking behavior critically. The Majority of the sample demonstrated a low to Medium level of information-seeking behavior. This survey revealed the need for improving the level of graduate students' information literacy skills.

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INTRODUCTION

This study was undertaken to determine the information-seeking behavior of graduate students of the Faculties of Philosophy and Engineering at the Aristotle University of Thessaloniki (AUTh). Information seeking is the process of searching and finding information, and of producing new knowledge. Factors that influence information-seeking behavior may include the discipline, the demands of faculty members, the curriculum, and personal characteristics. Boyd[1] stressed that information seeking is a fluid and situation dependent activity where a seeker's actions are influenced by access to information, perceived quality of, and trust in, the information source. The combination of all these factors creates an ever-changing information-seeking environment.

To examine some of these factors at work, the present survey was designed specifically to look at the behavior of AUTh graduate students at the Schools of Philosophy, which offer 14 postgraduate programs, and the Schools of Engineering, which offer 13 postgraduate programs. Traditionally, in Greek Universities graduate students are required to conduct research and retrieve relevant information. The study aimed at mapping graduate students' information-seeking abilities. The ultimate goal was to identify whether there are different patterns in information-seeking behavior among graduate students at the AUTh. It is important to note that there have been no previous studies in Greece that discuss information-seeking behavior of either students or members of faculty. Therefore, the present study will add to literature regarding information-seeking behavior of Greek students[Float1]. Also this study may influence the modus operandi of Greek academic libraries in relation to the design and implementation of their information literacy and bibliographic instruction programs. Based on the results, the authors will make proposals for developing information literacy programs focused on the information habits of graduate students.

REVIEW OF LITERATURE

Wilson[2] argued that each individual experiences the same stages in the resolution process, moving from uncertainty to increasing certainty. These stages are: problem identification, problem definition, problem resolution and, potentially, solution statement. Nevertheless, the behavior of users may be different through all the stages. The literature records many factors that play an important role in information-seeking behavior of users. Many studies consider that discipline plays a vital role in information-seeking behavior.[3-5] Specifically, Sadler & Given[6] found that there were differences in the attitudes of social sciences graduate students toward e-journals versus their peers in the sciences and engineering. While Rowlands & Nicholas[7] found accumulated evidence of domain differences in information behavior. In some studies both discipline and work affected information-seeking behavior a lot, since

both comprised basic roles of the individual in social life. However, a number of studies showed that discipline is not the most important factor that affects information-seeking behavior.[8-12] Banwell and Gannon-Leary[13] argued that the use of electronic services had more impact in health studies than in business studies, and both had more impact than in English studies. In other words some other factors must also play role, such as the setting of disciplines in their Faculty, e.g. how demanding their professors are. Heinström[14] showed that personality traits strongly influence information-seeking behavior. Sharifabadi's[15] literature review regarding academics' and researchers' information- seeking behavior highlighted that "neither discipline nor specific academic department was a consistent [information seeking] factor when cross tabulated with other variables such as research method and research objective." Wilson's model,[16-17] based on the context of the information need (Person, Social Role and Environment), identified personal, interpersonal and environmental barriers affecting information-seeking and suggested analysis be made based on "a wider, holistic view of the information user."[18]

An interesting finding of Barrett's[19] study was that humanists did not fear technology as their stereotype would suggest. The survey was conducted at the University of Western Ontario. Consistent with Barrett's[20] research is Francis'[21] survey, which examined social scientists at the University of the West Indies (UWI) in Jamaica. Over 80% of UWI social scientists preferred current issues of journals and online database searches for their research activities. More than half of them preferred journal articles in electronic format over print, while many of them expressed lack of access to more online information and suggested acquiring access to specific online databases. All these preferences were indicative of the fact that social scientists have embraced electronic publishing and did not fear technology. Johnson et al.[22] found that designs and special analytic techniques were only slowly being developed in the social sciences. It is worth mentioning that the literature also reported that scientists faced problems with information retrieval techniques. A survey of engineers in 1996– 1997[23] revealed a severe lack of understanding of basic retrieval techniques, while a survey of veterinary practitioners conducted by Wales[24] revealed that most respondents used conventional journals, textbooks and conferences as their main information sources. These results were consistent with Fidzani's[25] survey of graduate students of Botswana University, which found that the most popular sources of information were journals, library books and textbooks. Wilson[26] explored the problems and difficulties the searchers experience in carrying out their own searches. He interviewed twenty respondents in his study which spanned a wide variety of disciplines. He stated that most of the interviewees expressed some dissatisfaction with their own capacity to search the relevant information sources; they had difficulty in determining the appropriate keywords and did not bother to explore the advanced search capability of any system. Haglund and Olsson,[27] after observing young researchers, found that they were confident that they could manage searching on their own.

Wilson[28] also referred to the intervening variables in information- seeking behavior, which were the personal barriers (emotional, educational, demographic), social- or role-related barriers and environmental barriers such economic and source characteristics, while risk is another important variable. Wilson[29] argued that personal needs are at the root of motivation to seek information, and these arise out of the role an individual fills in social life. Heinström[30-31] explored the relationship between personality and information seeking. She has found that information-seeking behavior was closely related to the unique combination of personality traits that distinguish each individual. Heinström[32] categorized students according to their motives as follows: extrinsically motivated students who search for information mainly as gathering enough facts to meet the task requirements; intrinsically motivated students whose engagement was guided by a true intention to learn. Weiler[33] had also suggested that information seeking is a highly subjective

process. Moreover, Bystrom and Jarvelin's[34] study indicated systematic and logical relationships between task complexity, information types, information channels, and sources. Vakkari[35] argued that task complexity and the related structure of the problem were connected to the types of information people were looking for and using, to the patterning of search strategies, and to the choice of relevance criteria in tasks.

Many studies claim that most users prefer an intermediary to carry out a search, or they rely on friends or colleagues for suggestions[36-41] while students rely on the advice and guidance of instructors.[42-44] This is confirmed by Wilson[45] who stated that the reason for this "…seems generally to have been a recognition on the part of clients that their own attempts at searching (and occasionally attempts by others) had been less than completely effective." Spink, Griesdorf and Bateman[46] found that seekers were involved in successive searches trying to refine the focus of their information problem and developing a clearer understanding of what is relevant and what is not relevant in relation to their information problem. However, users were not only involved in successive searches, but, as Spink et al.[47] found, they were also involved in multitasking searches. They found that most sessions included multiple topics and that there was a variety of topics in multitasking search sessions. Accordant with these findings were those of the Spink, Ozmutlu, and Ozmutlu's[48] study; humans often worked on multiple information problems concurrently, due to the complex nature of work or living tasks.

Other interesting findings in the literature are that the Internet has been used as the primary source of information by many users in most studies[49-56] and that issues of accessibility and convenience of access, as well as issues of time and constraints or level of difficulty are of concern to students.[57-63] In other words, individuals are not totally free of technical and mechanical barriers which govern their actions. George et al.[64] indicated that information-seeking behavior of graduate students was iterative and became more refined and organized as they became more knowledgeable in their field of research, while Sadler & Given[65] showed that there was a relationship between the level of technical support students were receiving and their willingness to explore new digital opportunities.

RESEARCH OBJECTIVES

The aim of the present research is to determine the information-seeking behavior of graduate students of the eight Philosophy schools and the eight Engineering schools at the Aristotle University of Thessaloniki. The particular objectives of this research were the following:

· To chart the information-seeking strategies that users engage in order to achieve interaction with electronic information sources;

· To find out if the discipline plays in any role in the information-seeking behavior of graduate students;

· To examine the perceived influence of different factors and barriers in developing information-seeking behavior.

METHODOLOGY

In order to accomplish the above set of research objectives, a survey was conducted to all graduate students of both AUTh Faculties; the

Faculty of Philosophy and the Faculty of Engineering. The Faculty of Philosophy consists of 8 schools: School of Philology, School of History and Archaeology, School of Philosophy and Pedagogy, School of Psychology and 4 Schools of foreign languages and literature (English, French, German and Italian) and offers 14 postgraduate programs. The Faculty of Engineering consists of 8 schools: School of Civil Engineering, School of Architecture, School of Rural and Surveying Engineering, School of Mechanical Engineering, School of Electrical and Computer Engineering, School of Chemical Engineering, School of Mathematics, Physics and Computational Sciences and School of Urban-Regional Planning and Development Engineering and offers 13 postgraduate programs. Both Faculties accept alumni from other faculties/schools.

The survey was carried out during the spring semester of the academic period 2008–2009. Printed questionnaires were distributed to graduate students of both Faculties during classes. Permission for the conduct of survey was given by the Aristotle University of Thessaloniki Rector and the Deans of the two faculties. All professors in the postgraduate programs were invited by email to allow the distribution of the survey questionnaires during their class. Professors (at least one per semester) from 12 philosophy postgraduate courses and 6 engineering postgraduate courses accepted. In general, engineering schools' professors were reluctant to let their students answer the questionnaire, claiming that there was not enough time. During this email communication professors were also asked if they invite librarians for information literacy instruction in their postgraduate classes.

The subjects were graduate students from different disciplines as the literature identifies discipline as an important variable in information-seeking behavior. The population comprised approximately of 870 graduate students and the response rate obtained was approximately 27%. The procedure produced 235 fully answered and therefore usable questionnaires. The instrument of primary data collection was a printed anonymous structured questionnaire, containing a total of 63 variables. The functionality of the questionnaire used and also its validity and reliability were tested.

The first part of the questionnaire contained the following demographic and situational variables of the respondents: gender, age, degree, graduate studies, level of foreign language. The second part of the questionnaire contained a question regarding the frequency of use of resources and consisted of eleven items all measured on a five-point frequency scale, where "never" counted as zero. It also contained three questions referring to how many years they had been using both computers and e-sources and their relevant experience. The last question of the second part was about the convenience of the respondents' access to the e-sources in four categories (in the office, at home, in the library and in a computer lab), measured on a five-point scale from "not at all" to "very much." The third part of the questionnaire consisted of two questions concerning the information retrieval techniques users engage in, the modifications they make, and the way students evaluate the output with regard to relevance. These questions were measured on a four-point scale from "seldom" to "very often," while "never" counted as zero. The next question asked about the frequency of certain activities employed during information retrieval. This question was also measured on a four-point scale from "seldom" to "very often," while "never" counted as zero. The final question consisted of an eight item construct to examine the barriers graduate students face in information retrieval activities. It was measured on a five-point Likert scale from 1 = disagree very much to 5 = agree very much.

Descriptive statistical indices, including frequencies, means and standard deviations, were used for presentation of the data. In order to compare and correlate the frequency distributions between categorical variables, Pearson's χ^2 test was used. The results in which the observed significance level (*p*-value) was found statistically significant (at the 0.01 level) are the only ones reported and discussed.

FINDINGS

The Profile of Students

The vast majority of the respondents (71.9%) were females and only 28.1% were males. Their ages ranged from 22 to 47 years old (M= 27.7, SD= 4.39). The greatest percentage of the respondents belonged to the Faculty of Philosophy (74.5%), while 25.5% belonged to the Faculty of Engineering.

Regarding their competence in foreign languages, 85.6% claimed to have a very good or excellent command of English. They also claimed that the norm was to deliver 2.1 (SD=1.756) assignments per course. When students were asked about the frequency of using different activities for identifying information, 16.9% were engaged in all information retrieval activities every day, 21.0% one to three times a week, 22.7% once or twice a month, while 17.1% had never used any of the information retrieval activities. With regard to specific activities, "searching search engines" was found to be the most common method used by graduate students followed by "consulting reference bibliography by a professor" and "use of personal printed sources." For details about each item included see Table 1.

It seems that searching databases, consulting a librarian and using personalized/alerting services were used very seldom, perhaps once or twice in six months on average. The greatest percentage claimed that they had computer experience (77.4%) and experience of using the Internet (59.6%) of "more than 5 years," while 31.1% and 30.6% had experience of using databases or e-journals for "3–5 years" and "1–2 years" respectively.

Most of the respondents (76.2%) perceived themselves as very experienced in retrieving information from search engines, while only 33.2% perceived themselves as very experienced in retrieving informa-

Table 1
Frequency of use of different practices for the identification of information in descending order of importance

	Mean	Std. deviation
Searching Internet search engines	4.50	0.874
Consulting reference bibliography by a professor	3.39	1.188
Use of personal printed sources	3.30	1.565
Consulting a fellow-student	3.15	1.362
Consulting the bibliography of an article/a book	3.04	1.489
Searching library's web page	2.88	1.564
Browsing library shelves	2.80	1.308
Searching e-journals	2.49	1.554
Searching databases	1.62	1.603
Consulting a librarian	1.49	1.354
Personalized/alerting services	1.04	1.568

	Never, %	SeldoTh, %	Often, %	Quite often, %	Very often, %	Total, %

Table 2
Use of techniques for obtaining relevant information

	Never, %	SeldoTh, %	Often, %	Quite often, %	Very often, %	Total, %
Keyword	3.0	3.8	14.5	15.3	16.4	100
More than one keyword	1.7	1.7	4.7	25.5	66.4	100
A phrase (using quotations)	11.5	23.8	21.3	22.1	21.3	100
Boolean operators	47.2	28.5	11.9	8.9	3.4	100
Proximity operators	61.7	24.3	8.9	4.3	0.9	100
Truncation	51.9	30.6	8.9	6.4	2.1	100
Searching within results	14.5	20.9	28.1	19.1	17.4	100
Searching for similar results	18.7	29.4	23.0	17.9	11.1	100
Searching in specific time range	40.4	31.1	12.8	10.6	5.1	100

tion from databases or e-journals. The descriptive statistics also indicated that the sample found access to electronic resources at home and in the office more convenient (Means 3.27 and 3.01 respectively) than in the library or in a lab (2.66 and 2.49 respectively).

Information-Seeking Behavior of Students

With regard to search techniques they have used to retrieve relevant information, 27.8% had "never" used any technique, 21.6% have used one technique "very seldom," 14.9% one technique "often," 14.5% "quite often" and only 21.2% "very often." As for each of the techniques, it seems that "Boolean operators," "truncation" and "proximity operators" are "seldom" used for retrieving relevant information. For more details about each search technique see Table 2. When they were asked how they modify their search strategy if the initial statement does not retrieve satisfactory results, 20.1% claimed that they had "never" modified their search strategy, while 22.2% had "seldom" made any modifications, 15.9% "often," 16.4% "quite often" and 25.4% "very often." More specifically, they mostly "change the keyword or keywords" followed by "choose another source." The means of the use of techniques for modifying the search strategy are presented in Table 3.

As for the criteria they used to decide whether the results are relevant or not, they mostly considered "the title of the source," followed by "the title of the periodical," the "descriptors," the "abstract of the source." Two other options were used as criteria for relevance whether "the source is included in the bibliography of a relevant book or article" and whether "the source is reviewed." Over half the respondents (52.3%) used one of the criteria mentioned above "quite often" or "very often," while 23.1% have "never" or "seldom" used any of the criteria. The means of the criteria used to decide whether the results are relevant or not are presented in Table 4.

Referring to the relevance of the retrieved records, students were asked to indicate their perceived level of frequency with regard to a

series of statements. The greatest percentage of the respondents (43.0%) found relevant results "very often" when searching search engines, while only 23.0% found relevant results "very often" when searching e-journals and/or databases. One fourth of the respondents (26.4%) considered that "very often" the identification of relevant results is due to the "choice of the appropriate source"; while one third (32.3%) considered that it was due to the "appropriate strategy and/or search techniques." Finally, a considerable percentage (45.1%) considered that the identification of relevant results is due to the "choice of the appropriate search terms." The means of the identification of relevant results are presented in descending order in Table 5.

Respondents' experience with computers and in using search engines seemed to have affected the choice of certain search techniques, modification of initial statements and the way they perceived relevant results, since there were statistically significant relationships between respondents' experience and certain variables. More specifically, there were statistical significant relationships between experience and a) the search techniques "keyword," "more

Table 3
Use of techniques for Thodifying the search strategy

	Mean	Std. deviation
Change the keyword or keywords'	3.57	0.810
Choose another source	2.29	1.195
Change search strategy	1.57	1.307
Quit the effort	0.77	0.900

Table 4
Criteria

	Mean	Std. deviation
Title of the source	3.19	0.973
Title of the periodical	2.94	1.054
Descriptors	2.49	1.099
Abstract of the source	2.40	1.308
The source is included in the bibliography of a relevant book	2.34	1.178
The source is reviewed	1.55	1.162

Table 5
Identifying relevant results in descending order of importance

	Mean	Std. deviation
The identification of relevant results is due to the choice of the appropriate search terms.	3.19	0.902
How often do you find relevant results when searching search engines?	3.17	0.883
The identification of relevant results is due to the choice of the appropriate strategy and search techniques.	2.90	0.960
The identification of relevant results is due to the choice of the appropriate source.	2.78	0.987
How often do you find relevant results when searching e-journals/databases?	2.66	1.047
The identification of relevant results took you more time than expected.	2.25	0.951
The identification of relevant results is due to good luck.	1.37	0.9.41

than one keyword," "Boolean operators" and "truncation," b) the techniques used to modify initial statements, such as choosing "different keyword or keywords," "change strategy" and c) the criteria in identifying relevant results "the title of the article," "the title of the journal," the "descriptors" and the "abstract of the source." In addition, 50.7% of the respondents with "more than 5 years" experience claimed that "very often" the relevance of the records was due to the "right choice of searching terms." Similarly, experience in databases or e-journals affected the use of the same techniques. It is worth mentioning, though, that experience in databases or e-journals affected the use of "Boolean operators" as search technique, as well. The statistical significant relationships are presented in Tables 6 and 7. Moreover, their perceived ability in searching search engines had statistically significant relationships with more or less the same variables.

The frequency of use of e-sources which contributes to experience was also a significant factor in the profile of students with regard to information-seeking behavior; since there were statistically significant relationships between "Internet" and the variables: a) "key- word," "more than one keyword" as search techniques, b) "different keywords" as a way to modify the initial strategy, c) "the title of the

of the records. Statistically significant relationships existed also between those that used databases and e-journals and the variables "Boolean operators," "proximity operators," "change the strategy for better results" (see Table 8).

It is worth mentioning that there is no statistically significant difference in the responses referring to information-seeking behavior with regard to discipline. In other words, the information-seeking behavior of respondents seems not to be affected by their discipline.

Barriers Students Face in Information Retrieval

With regard to barriers graduate students face in information retrieval activities that were measured on a five-point Likert scale from 1 = disagree very much to 5 = agree very much, the mean score (23.99) indicated a rather moderate level of encountering problems when using electronic resources. It seems that the main barrier was "retrieve records with high recall and low precision" and then "too

much time necessary to retrieve the needed information," followed by

"face problems to retrieve records of good quality and relevant to the information need." For more details of each item see Table 9.

As it was expected some barriers were affected by experience. More specifically, "face problems locating the most appropriate information resource" had a statistically significant relationship with experience of computers, experience in the use of search engines as well as with perceived experience in retrieving information from search engines and databases and e-journals. 52.6% of those who had computer experience of "1–2 years" agreed that the above was barrier for them. The 42.9% of those that had "more than 5 years" of computer experience and experience of the Internet and 40.4% of those who had "more than 5 years" experience of databases and e-journals disagreed that this was a barrier to them.

Statistically significant relationships also existed between "lack of knowledge of search techniques to retrieve information effectively from e-sources and search engines" and computer experience, experience in using databases and e-journals, and also perceived experience in retrieving information from the Internet and from databases. 33.0% of those with "more than 5 years" of computer experience and 34.0% of those with "more than 5 years" of experience in using databases/e-journals did not face this as a barrier, while 47.4% of those that had computer experience of "1–2 years" agreed that it was a barrier.

Similarly, "too much time necessary to explore the needed information" had statistically significant relationship with the use of databases and or e-journals and perceived experience in retrieving information from search engines. Finally, there was statistical significant relationship between "too much time necessary to retrieve (full text) the needed information" and "Experience in the use of search engines and WWW" (see Table 10).

Clusters According to Information-Seeking Behavior

The method of Hierarchical Cluster Analysis (HCA) was then employed in order to create homogenous groups of participants (in clusters) according to their information-seeking behavior using Ward's merging criterion and squared Euclidean distance. HCA is useful for finding similar groups of cases in data sets when it is not known *a priori* how many groups are present.

HCA was applied to indicator matrix containing values 0 or 1 with dimensions 235 by 132, where there were 235 subjects and 132 categories of the 27 variables, all concerning the information retrieval techniques users employed, the modifications they made, the way they evaluated the results, and the frequency of certain activities during information retrieval. The results produced the following four

Experience with computers

	Pearson chi-square value	Asymp. Sig. (2-sided)
Keyword	19.945	0.011
Boolean operators	18.832	0.016
Truncation	20.107	0.010
Different keyword or keywords	22.138	0.005
Change strategy	24.689	0.002
Title of the article	32.867	0.000
The title of the journal	22.292	0.004
Descriptors	28.579	0.000
Abstract of the source	38.459	0.000

Table 7
Experience with e-sources

Experience in the use of search engines and WWW			Experience in the use of databases and/or e-journals	
Pearson chi-square value	Asymp. Sig. (2-sided)		Pearson chi-square value	Asymp. Sig. (2-sided)
54.572	0.000	keyword Boolean operators	33.541	0.006
80.152a	0.000	more than one keyword	40.867	0.001
74.552	0.000	choice of a different keyword or different keywords	40.786	0.001
50.279	0.000	the title of the source	50.280	0.000
48.305	0.000	the title of the journal	34.638	0.004
42.389	0.000	descriptors	35.065	0.004
41.252a	0.001	Abstract of the source	33.760	0.006

clusters that were named non-users, novice users, average users and experienced users of search techniques.

People of the first cluster (3.8%) used neither keywords for searching and refining, nor any criteria for the relevance of the obtained results and they "never" found relevant results when searching databases.

The novice users who comprised the second cluster (38.7%) "quite often" used more than one "keyword," they "often" used a "phrase" with quotation marks, but they "never" used "Boolean operators," "proximity operators" or "truncation." If they were not satisfied by the initial results they often quit, considering that they could not find any satisfactory results. They "seldom" used as criteria for examining the relevance of the obtained results either "descriptors" or "the abstract of the source" and they considered that the identification of relevant results was "seldom" due to the choice of an appropriate strategy or search techniques.

The average users (third cluster) consisted of those students (45.1%) whose main characteristics were that they "quite often" used

a "phrase" for locating and retrieving relevant information, "often" used the techniques of "finding similar results" and using "date range," and "seldom" used "proximity operators" and "truncation." They also "often" changed search strategy when the results were not satisfactory.

Finally, experienced users, the fourth cluster (12.3%), were the ones who "very often" used a "phrase," "Boolean operators," "proximity operators," "truncation," "searching within results," "finding similar results" and "date range." When they were not satisfied by the results they "very often" used to change their strategy, while the criteria that they used to judge the relevance of the results were "very often" "the review of other authors for the source" and "the inclusion of the source in the references of other documents which are relevant to the information need."

Table 8 Frequency
use of e-sources

	Pearson chi-square value	Asymp. Sig. (2-sided)
Internet/WWW		
Keyword	40.276	0.005
More than one keyword	50.538	0.000
Different keywords	35.353	0.018
The title of the source	41.696	0.003
The title of the journal	43.052	0.002
Databases		
Boolean operators	65.194	0.000
Proximity operators	49.679	0.000
Changed their strategy for better results	48.296	0.000
E-journals		
Boolean operators	41.807	0.003
Changed their strategy for better results	46.174	0.001
The title of the journal	49.990	0.000

Table 9
Barriers encountering when using e-sources in descending order

	Mean	Std. deviation
I retrieve records with high recall and low precision	3.54	0.973
Too much time necessary to retrieve (full text) the needed information	3.08	1.031
I face problems retrieving records of good quality and relevant to my information need	3.00	0.956
I face problems formulating the quest to retrieve neither more nor less e-sources than needed	2.97	0.999
The cost for accessing to the information that interests me is too big.	2.94	1.301
Too much time necessary to explore the needed information	2.92	1.041
Lack of knowledge of search techniques to retrieve information effectively from e-sources and search engines	2.91	1.226
I face problems locating the most appropriate information resource	2.63	0.976

Table 10
Barriers across experience

	Pearson chi-square value	Asymp. Sig. (2-sided)
Experience with computers		
I face problems locating the most appropriate information resource	23.530	0.003
Lack of knowledge of search techniques to retrieve information effectively from e-sources and search engines	20.714	0.008
Experience in the use of search engines and WWW		
I face problems locating the most appropriate information resource	47.693	0.000
Too much time necessary to retrieve (full text) the needed information	43.281	0.000
Experience in the use of databases and/or e-journals		
Too much time necessary to explore the needed information	34.334	0.005
Lack of knowledge of search techniques to retrieve information effectively from e-sources and search engines	43.588	0.000
Experience in retrieving from search engines		
I face problems locating the most appropriate information resource	36.211	0.003
Too much time necessary to explore the needed information	43.943	0.000
Lack of knowledge of search techniques to retrieve information effectively from e-sources and search engines	36.783	0.002
Experience in retrieving from databases		
I face problems locating the most appropriate information resource	50.747	0.000
Lack of knowledge of search techniques to retrieve information effectively from e-sources and search engines	40.955	0.001

DISCUSSION

According to this survey, and as many other studies have showed,[66-70] discipline did not seem to affect information-seeking behavior critically. Engineering and philosophy graduate students of the Aristotle University demonstrated similar information-seeking behavior, which can be explained by the fact that there are no significant differences in their academic environments. The levels of eligibility regarding search experience are identical in both faculties, since both engineering and philosophy students were to deliver the same (more or less) number of assignments per course. Therefore, it seems that other variables, such as search experience, computer and web experience, perceived ability and frequency of use of e-sources played an important role in shaping their information-seeking behavior.

The majority of the sample demonstrated a low to medium level of information-seeking skills. They did not seem to be well acquainted with information retrieval activities or information source evaluation techniques. They probably have not attended any of the information literacy programs delivered by the Aristotle Library System, which aim at training the attendees mainly in information retrieval techniques (keyword, phrase, Boolean search, truncation, etc.) and use of Library online resources and tools (e-journals, online databases, e-books, OPAC, AUTh's federated search engine, etc.). Moreover professors teaching in postgraduate programs are reluctant to invite library staff for instruction in their classes. Only one professor (School of Psychology) out of 59 professors (37 from Philosophy and 22 from Engineering) that accepted distribution of the survey questionnaires

during their class admitted to have invited the Library's staff for teaching her postgraduate students information literacy and/or information retrieval techniques. Indicative of the low level of information literacy integration into AUTh's curricula are the statistical data provided by AUTh's library training staff; only a 4.73%, that is 1857[71] (Laftsidou et al., 2008[36]) out of 39254 undergraduate and postgraduate students,[72-73] attended during the first semester of 2008 any of the information literacy programs delivered by the Aristotle Library System. Regarding the sample's low to medium level of information-seeking skills; it is also worth mentioning that, even though search engines seemed to be the most popular tool, 17.1% of the graduate students of both faculties have never used any of the information retrieval activities (e.g. searching search engines/e-journals/databases/library website, browsing library shelves, etc.) If the average age of the sample is taken into consideration (27.7 years), this finding is consistent with Lippincott's[74] remark regarding students "born in the 1980s and later"[75] also known as Millenials or the Net Generation, "who although [they] generally can multitask, learn systems without consulting manuals, and surf the Web, they lack technology and information skills appropriate for academic work."

As the sample belongs chronologically to the Net Generation, it is of no surprise that searching search engines was the most popular activity, which was also found in many other surveys.[76-83] Searching databases or e-journals was not as popular as search engines.[84-87] The greatest percentage of graduate students in the study, regardless of their discipline, had more than 5 years of experience in using computers and the Internet and less than 5 years of experience in using databases and e-journals. Accordingly, most respondents perceived themselves as very experienced in retrieving information from search engines. Even graduate students in the field of philosophy did not fear technology, as found in the studies by Barrett[88] and Francis.[89]

With regard to their information-seeking behavior, one third of the respondents have never used any techniques to retrieve relevant

information, while more than a keyword and a keyword were the most popular techniques.[90] Boolean operators, truncation and proximity operators were seldom used for retrieving relevant information. Consistent with the findings of Kerins, Madden & Fulton,[91] Makani & WooShue,[92] Vezzosi,[93] the students in the present study did not invest time and effort in using complex tools in their research process. A significant percentage (42.3%) had never or very seldom modified the initial statement if the results were not satisfactory.[94-96] Even though their information-seeking behavior revealed their low to medium level of information literacy skills, most respondents' criteria for evaluating the relevance of the records obtained were the title of the source, followed by the title of the periodical and the descriptors, while 23.1% had never or seldom used any of the criteria. In contrast to other surveys[97-98] the method of

"chaining,"[99] that is the method of tracking relevant information results by consulting books' and/or articles' lists of references, was not

among the favorite retrieval techniques and evaluation criteria. According to the present survey's respondents, identification of relevant results most often was due to the choice of appropriate search terms. They also believed that searching search engines contributed to the identification of relevant results.

The role that web experience plays has been highlighted by Hölscher & Strube[100] in their survey of search behavior of Internet experts and novices. Hölscher & Strube[101] demonstrated that web- experienced students used advanced search options frequently. Their findings and those of the present survey coincide; computer experience affected the choice of one keyword, the use of Boolean operators and truncation, the modification of the initial statement by choosing a different keyword or keywords and changing strategy and the judgment of retrieved records as relevant by the title of the article, the title of the journal, the descriptors and the abstract of the source. Experience in databases or e-journals showed similar results. Web experience and experience in search engines affected the use of one keyword and more than one keyword as a search technique, while the modification techniques were the choice of a different keyword or different keywords and the title of the source, the title of the journal and the descriptors were ways to assess the relevance of retrieved records. It seems that respondents who did not use databases or e-journals did not make any use of searching techniques such as Boolean operators, truncation or proximity operators. Their perceived ability in using search engines had statistical significant relationships with more or less the same variables, as well as the frequency of use of e-sources. It is worth mentioning that frequent consultation with a librarian by graduates (7.7%), on a weekly base, seemed to affect the use of more than one keyword, a phrase and different keywords to modify the initial statement. This result is in agreement with other studies[102-104] showing that personal communication with librarians and colleagues play a significant role in information-seeking behavior. The present survey showed that the barrier "face problems to retrieve records of good quality and relevant to the information need" was reduced by increased experience of computers, and in retrieving information from the Internet, databases and e-journals. It was also brought out that when computer experience and experience in retrieving information from databases and e-journals increased, lack of knowledge of search techniques to retrieve information effectively from e-sources and search engines decreased. Similarly, as the perceived ability in retrieving information from search engines or databases and e-journals increased, the barriers "I face problems to retrieve records of good quality and relevant to my information need," "Too much time necessary to explore the needed information," and "Lack of knowledge of search techniques to retrieve information effectively from e-sources and search engines" were reduced. These findings are in agreement with those of Jenkins, Corritore & Wiedenbeck[105] and Marchionini,[106] who found that search experience and computer/web expertise affected some barriers regarding

retrieval of quality and relevant results. Despite the rather moderate level of graduates encountering search and retrieval problems, high recall and low precision in retrieving records is still a major barrier. Other common problems that graduate students encountered were time-consuming searches, results of poor quality and little relevance. These problems are usual among students and scholars, as other studies have demonstrated.[107-113]

With regard to the clusters that have been found, 3.8% of respondents seem not to use any search techniques to identify relevant literature. The novice users (38.7%) also did not exploit the available techniques enough. So, it can be said that their information- seeking behavior profile was not consistent with graduate studies. However, the other two clusters, of average and experienced graduate students, made the most of the available search techniques.

IMPLICATIONS AND FURTHER RESEARCH

As more of the half the graduate students in this study consulted some information sources for more reading material, the Faculties of Philosophy and Engineering of Aristotle University should take into account the results of this study and find ways to improve the level of their students' information literacy skills. It seems that students of these two Faculties are underserved in terms of information literacy programs. Therefore librarians working in the departmental libraries of these two faculties should broaden their objectives by establishing greater cooperation with the teachers and tutors on the graduate programs and become more actively involved in the information literacy process. Taking into consideration a survey conducted in 2007[114] among academic librarians it was identified that in any level most libraries, including that of Aristotle University, did not deliver information literacy program, but some kind of library instruction. Therefore, a viable solution could be the introduction of a mandatory online course in information literacy accompanied by an examination that students have to pass.

This present survey can be utilized as a basis for further research, as the most important limitation of the methodology is that students' information-seeking behavior was not observed directly; only the self reported of attitudes, preferences and abilities have been presented and discussed. Nicholas et al.[115] pointed out that log analysis, surveys and interviews should be used in conjunction with self report to build a clear picture of students' information-seeking behavior and to provide an explanation for the observed behavior. Aula[116] found that searches performed by experienced users proved to be more successful, probably because of better choice of keywords, while Heinström[117] considered that more successful searches were due to increased self-confidence. Therefore, it is necessary a follow up with qualitative research which will help to find the relationship between experienced searchers and their choice of search techniques, or the main personality factors that may affect their information-seeking behavior. Qualitative research will help to identify factors that generate affective and cognitive needs and will result to the development of an information-seeking behavior model. Further research is also needed to examine the applicability of these findings to other contexts.

APPENDIX A. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.acalib.2011.02.008.

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