

Is searching self-efficacy related to search performance? A study of University students' Web information searching strategies

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Abstract

This paper investigates the information searching strategies while using Internet search engines. A case study was conducted in which 107 University students participated. The number of students who succeeded in completing the task and the expressed search strategies used in terms of the keywords, the length of the search engine queries used and the frequency of the logical operators in the searches carried out, were identified. The obtained results were described in accordance with their search engine self efficacy. This study revealed correlations between perceived result confidence, perceived satisfaction and effectiveness of search processes developed for the completion of the activity. The results revealed errors the students commit and misconceptions they have while using information searching strategies.

Keywords

Internet, information searching, search engines, information search strategies

INTRODUCTION

People very often in their daily life engage in complex activities that require information seeking and assessment to be tackled. These activities are information problems that demand people to recognize the information they need and to be able to locate, evaluate, and use effectively the needed information (Walraven et al., 2008). As the amount of information increases, there is a need for students to become efficient of solving information problems, either for school work or personal reasons. The basic information resource is the Internet. The information seeking process on the internet is complex, since it involves a series of multiple sub processes and interactions individuals develop while they try to find information (Marchionini, 2003). However, informatics curriculum does not take into account information seeking skills. Therefore, a lack of didactic strategies and teaching approaches is observed. This is due to the lack of deep understanding of the cognitive aspects and strategy interactions with digital information environments.

As a result, student's information seeking on the Web has recently emerged as an important research area. In a previous study, Walraven et al. (2008) reported that people of all ages and with different skills experience problems during the information seeking process. These problems are related to the utilization of keywords in search engines, the evaluation of the search results and the proper organization of the actual search procedure. Another study on the use of the Internet as an information resource by two different groups of users reveals that there are

two distinct types of patterns of information seeking on the Web based on the user's experience: a breadth-first and a depth-first search (Jenkins et al., 2003). In the first case, users tend to browse a fairly large number of results without really reading and evaluating the information while in the other case they focus mainly on the content of two or three results.

Holscher and Strube (2000) noted that experienced Web users tend to use two times the number of search keywords compared to novice users. Experienced users also seem to not have any difficulty when employing Boolean logic. In addition, despite the comfort experienced users feel while using search engines, they seem to have difficulty when having to search for information with specific-domain knowledge they lack. In addition, Fournier and Loiselle (2009) illustrate that students do not develop a plan when they carry out a search procedure, they prefer to use search engines rather than directories, they rarely construct searches using Boolean logic and they usually look at the search engine's results that appear at the top.

The study presented in this paper was conducted to further investigate the information seeking strategies the students develop while using search engines. The rest of the paper is organized as follows: First, the method of the study is presented, followed by analysis of the participants' actions. These actions are seen in relation with the terms of the keywords, the length of the search engine queries and the frequency of the logical operators used in the searches. Finally, the findings of the study are discussed and future research goals are presented.

METHOD OF THE STUDY

Research objectives

The goal of the study was threefold. First, to identify the students' search strategies while performing a given information task in accordance with their search engine self efficacy as reported in a suitable designed questionnaire. Second, to investigate the relationship between the participants' search engine self efficacy and the effectiveness of the expressed search actions. Finally, to examine the correlations between the perceived result confidences, perceived satisfaction and the effectiveness of the search processes developed for the completion of the activity.

The sample

In this case study 107 students aged 19 to 21 years (1 male, 106 females) of the Early Childhood Educational Sciences Department of the University of Patras participated. The students attended two compulsory courses concerning the introduction and integration of ICT in Education during the academic year 2008-2009.

The task

The students had to answer the following question: *When and where did the idea of a large number of interconnected computers initially come up?* The topic of the task was closely related with the subject of the two courses in which the research was conducted. The activity sheet given to the students had also some supplementary questions about the actions they carried out throughout the procedure.

Method of data collection

The following materials were used: a) an activity sheet and a questionnaire using the Web service Survey Monkey, c) the software Wrapper, used to collect participants' log files, d) the software Morae Recorder (TechSmith, Version 2.0.1) used to record the participants' screen actions and to collect their log files and e) a tool that was developed from our research group (Information and Communications Technologies in Education) for data preprocessing of the user's log files.

Procedure

The study took place at the Department's computer lab. The research procedure began with the student's experimental session that involved the task completion. They were not given specific instructions on how to approach the task. They were informed that they had 30 minutes to complete the given task. Each student's Web session was recorded and stored upon task completion. Subsequently, the students had to fulfill a questionnaire referring to the participants' demographic characteristics (e.g., name, sex, year of study) and previous experience in using ICT and basic Internet services. The researcher did not interrupt the participants during the experimental procedure.

ANALYSIS OF RESULTS

The analysis of results reported in this section is based on the observed activity of 98 students. Nine students were excluded from data analysis since they did not perform any activity. Analysis of the students' reported self-efficacy in Internet search engines showed that they were separated in three groups: the first group consists of the students who seem to consider themselves as moderately capable users (22.4%), the second group considers themselves as capable users (46.9%) and the third group as very capable users of search engines (30.61%, see Table 1). The results reported in the following are analyzed according to each group observed performance as well as to the total number of participants.

Participants Characteristics of task performance	Group 1 (N=22)	Group 2 (N=46)	Group 3 (N=30)	Overall (N=98)
Right answer	50.00%	47.83%	56.67%	51.02%
Wrong answer	18.18%	28.26%	33.33%	27.55%
No answer at all	31.82%	23.91%	10.00%	21.43%
Assessment of task performance (1-5)	2.72 (2.00)	2.58 (1.82)	2.76 (1.59)	2.67 (1.78)
Confidence for the result's accuracy (1=not at all certain 5=very certain)	1.77 (1.50)	1.54 (1.12)	2.23 (1.45)	1.80 (1.34)
Satisfaction with the result (1=not at all satisfied 5=very satisfied)	1.72 (1.31)	1.69 (1.13)	2.1 (1.47)	1.82 (1.28)
Perceived task difficulty (1= not at all difficult 5=very difficult)	2.4 (1.2)	1.95 (1.21)	1.7 (34)	1.97 (1.26)
Time on task performance (sec)	733.22 (279.68)	693.77 (341.52)	659.23 (291.99)	692.04 (311.53)
Number of searches	12.9 (10.35)	13.17 (9.94)	10.56 (10.88)	13.03 (10.85)
Number of visited Web pages	26.13 (16.64)	23.53 (17.82)	18.83 (15.39)	22.6 (16.8)

Table 1: Characteristics of participants' task performance

51.02% of the students managed to find the right answer, 27.55% gave a wrong answer while 21.43% did not give any answer to the question (Table 1). The activity sheets also contained answers to questions concerning student's opinion for the level of task difficulty, the degree of satisfaction they felt for the result they gave and the certainty they had for its accuracy. The participants' mean time to complete the

task was 11 minutes and 32 seconds (SD= 312 sec). The mean number of searches performed by the students was 13.03 (SD=10.8) while the mean number of Web sites they visited during the Web search was 22.6 (SD=16.8).

No	Variables	1	2	3	4	5	6
1	Search engine self-efficacy		-.093	.135	.093	-.202*	.002
2	Time on task			-.282**	-.323**	.425**	-.118
3	Confidence for the result's accuracy				.908**	-.634**	.292**
4	Perceived satisfaction					-.711**	.327**
5	Perceived task difficulty						-.239*
6	Assessment of task performance						

Table 2: Spearman correlations between representative participants' variables
Correlation is significant at the 0.05 level (*) or at the 0.01 level (**).

In order to explore the existence of correlations across important participants' variables, the data were statistically analyzed using Spearman's *correlation*. Table 2 summarizes correlation between representative participants' variables such as search engine self-efficacy, time on task, participants' satisfaction with the obtained results and actual task performance as rated by the authors of this paper.

No correlation between search engine self efficacy and the effectiveness of the expressed search actions was revealed from the analysis of data (Spearman's $\rho=0,002$, ns). However, correlation between the participants perceived confidence for the accuracy of the obtained results and their actual search performance was observed (Spearman's $\rho=0,292$, $p<0.01$) and between the participants' search result satisfaction and the actual effectiveness of the search activity (Spearman's $\rho=0,327$, $p<0.01$). Data analysis also showed there is a correlation between search engine self efficacy and the participants' assessment of the activity's difficulty (Spearman's $\rho= -0.202$, $p<0.05$).

Searching Strategies	Participants			
	Group 1 (N=22)	Group 2 (N=46)	Group 3 (N=30)	Overall (N=98)
Use of multiple keywords	68.18%	67.39%	73.33%	69.39%
Natural language	9.09%	6.52%	6.67%	7.14%
Natural language in quotation marks	4.55%	2.17%	3.33%	3.06%
Use of Boolean operators AND, OR, NOT	4.55%	0.00%	3.33%	2.04%
Use of the exact question as given in the task description	13.64%	23.91%	13.33%	18.37%
Number of keywords used	3.06 (1.33)	3.09 (1.44)	2.9 (1.41)	3.02 (1.39)

Table 3: Student's information searching strategies

All students chose the Google search engine to carry out the given task. Most of the students (69.39%) used a combination of multiple keywords in their first search. 7.14% of the students used natural language, 2.04% used logical operators and 3.06% used natural language in quotations marks. Moreover, 18.37% of the students used the exact question given in the task description to execute a search. The strategies the students used in their first search attempt are presented in Table 3.

Furthermore, from the log files' analysis it is observed that students commit errors and have misconceptions while employing information searching strategies. They seem to experience difficulties to formulate a search query, since they used the same keywords in more than one search attempt. They did not attempt to use a Boolean operator other than "AND", which often was erroneously typed. Students also seem to have misconceptions about the way the search engines work. A significant number of students (18.37%) seem to believe that search engines are capable of interpreting the semantic of the queries they formulate, since they used the exact question posed at the description of the task.

CONCLUSIONS

In this paper, a case study designed to investigate University students' information search strategies was reported. Most students used multiple keywords while attempting to find the required information. However, the participants' limited use of logical operators and other logical expressions illustrated their relative low knowledge of how to use search engines while seeking specific information. In addition, the data analysis showed that student's self efficacy and satisfaction are related with their expressed task performance. However, no significant differences in the information search strategies used by the students according to their reported experience in using search engines were shown. Furthermore, as shown from the data analysis, no correlation between participants' search engine self efficacy and task performance was observed. More research is required in this point, since it cannot be concluded whether the aforementioned finding is due to the nature of the specific given task or erroneous participants' beliefs concerning their information seeking skills.

These findings could facilitate derivation of appropriate instructional design schemes that will contribute to the student's acquirement of information seeking skills. For instance, it became evident that the majority of the participants were not able to use and apply effective search strategies (e.g. limited use of Boolean expressions). Based on these findings, we can conclude that there is a need to the design of effective didactical situations (Walraven et al., 2008). Proper learning activities should contain suitable cognitive conflicts and should be presented through students' everyday information needs, in order to contribute to the deeper acquiring of relevant competencies. It is argued that such findings constitute the first step towards the aforementioned goal.

Further research goals are the in-depth investigation of the information search strategies and how these are affected by the design features of online environments (Tselios et al., 2008, Katsanos et al., 2010), as well as the examination of the effect of perceived utility and usability of search engines and other users' psychological characteristics on the behavioral intention to use and the expressed users' practices. In addition, similar studies with a variety of required information gathering tasks will be applied, having participants with different characteristics and skills to further explore the issues affecting successful information seeking.

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Biography



Marioleni Parissis is a Phd Candidate. Her main research interests concern information technologies in education, the didactics of informatics and information seeking on the Web. She is a member of the Information and Communication Technologies in Education – ICTE Group since October 2005.



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