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Original Article

The Role of the Medical Students' Emotional Mood in Information Retrieval from the Web

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Abstract

Background: Online information retrieval is a process the result of which is influenced by the changes in the emotional moods of the user. It seems reasonable to include emotional aspects in developing information retrieval systems in order to optimize the experience of the users. Therefore, this study aimed to identify the role of positive and negative affects in the information seeking process on the web among students of medical sciences.

Methods: From the methodological perspective, the present study was an experimental and applied research. According to the nature of the experimental method, observation and questionnaire were used. The participants were the students of various fields of Medical Sciences. The research sample included 50 students of Shiraz University of Medical Sciences selected through purposeful sampling method; they regularly used World Wide Web and google engine for information retrieval in educational, Research, personal, or managerial activities. In order to collect the data, search tasks were characterized by the topic, sequence in a search process, difficulty level, and searcher's interest (simple) in a task. Face and content validity of the questionnaire were confirmed by the experts. Reliability of the questionnaire was tested by Alpha Cronbach. Cronbach's alpha coefficient (PA=0.777, NA=0.754) showed a high rate of reliability in a PANAS questionnaire. The collected data were analyzed using SPSS, version 20.0; also, to test the research hypothesis, T-Test and pair Samples T-Test were used. The P<0.05 was considered statistically significant.

Results: The results showed that there was a significant association between the positive affect and users' successful retrieval (P<0.001). Also, there were significant associations between the negative and positive affect, type of search (P<0.001) and quality of retrieved results of the web (P<0.001) in the simple and difficult search. Finally, the impact of positive and negative affects before and after searching in the information retrieval result showed that there were significant associations between negative affects before the search and while doing the simple search (P<0.001); also, a significant association was found between negative affects in the simple and difficult searches (P=0.020). The results showed that the positive affects before and after the search had no significant effect during the search on simple and difficult search (P >0.05).

Conclusion: Information retrieval systems in the Web should identify positive and negative affects in the information seeking process in a set of perceiving signs in human interaction with the computer. The automatic identification of the users' affect opens new dimensions into users moderators and information retrieval systems for successful retrieval from the Web.

Keywords: Affect, Information storage and retrieval, Information seeking behavior, Shiraz University of Medical Sciences

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Introduction

Based on Kuhlthau, information seeking behavior can be considered as a process that starts with a need for information and during various stages of which a set of information resources is searched, retrieved and assessed using specific strategies and is used in order to supply the need for information (1).

Presently, digital information indexing and retrieval systems are becoming increasingly important

for dissemination of medical knowledge and have the potential to considerably impact the quality of the care provided by clinicians. Accordingly, technologies and applications providing easy access to validated, well-maintained sources (libraries, databases ...) of up-to-date clinical knowledge over a variety of platforms have become increasingly visible.

Nowadays, the Web is proposed for many users as one of the most important information retrieval systems so that access to the required information and successful retrieval of the Web is one of the most important skills for most of them. The conducted researches have shown that, on the one hand, with the emergence of new search environments, the users' behavior of information seeking has been changed and the range of performance of the behaviors used in these systems has been relatively extended and, on the other hand, the users' individual differences and characteristics have affected their behavior of searching information of Web. This has increased the need to improve the human-computer interface and the way computers contribute to the people's text-based communications. "Successful social interaction means successful affective communication, which uses the users' emotions and plays a vital role in effective social interaction" (2-5). Researchers have also recognized the significance of affect with respect to Human Computer Interaction (HCI) (6) and the affective states of the users can be recognized using intelligent User Interface (UI) (5-7). In order to support the individuals in their writing or reading activities, or groups communicating, the researchers have tried to develop techniques for sensing the users' affective states (5).

Since each of the users embark upon the search information on the Web in different environments and with different attitudes and levels of search experience and knowledge, this leads the system designers to the fact that the factors affecting the behaviors of information seeking and the individuals information needs also do not have naturally the same features and conditions (8); given that all information retrieval systems are designed for their users, information retrieval on the Web will be successful only when the existing knowledge about the users behaviors of information seeking is extended; on the other hand, the information retrieval systems that are more approved for the users are accessible for individuals so that these systems are able to satisfy the information needs of different groups of users with various individual characteristics and various tasks (9).

Online information retrieval is a process in which the user's search result is influenced by his/her emotional changes and states. The logical procedure in the development of information retrieval systems is finding a room for the emotional aspects in order to optimize the user's experience. Therefore, those systems that are able to identify and respond intelligently to human emotions must be developed. Kuhlthau (1991) describes the Information Search Process as a "process of construction, which involves the whole experience of a person, feelings, as well as thoughts and actions."

"Kuhlthau drew inspiration from Kelly's personality construct theory that highlights the affective experiences in the construction of meaning from information" (10). Decades of multi-disciplinary research in neuroscience, social psychology, education, computer science, information science and cognitive science has revealed that emotion is integral to perception, decision-making, problem-solving, and learning (11). "Research on the factors that affect the quality of life in the computer science has seen an increased interest in "affective computing" (12). In this regard, for measuring and analyzing the user's emotional experiences, the development of a framework is necessary (12).

"Medical informatics is the field that concerns itself with the cognitive information processing, and communication tasks of medical practice, education, and research, including the information science and technology to support these tasks" (13). "It is an intrinsically interdisciplinary field, with a highly applied focus, but it also addresses a number of fundamental research problems as well as planning and policy issues" (13). With an investigation of some texts, it was specified that no research has been conducted so far on the relationship between temperament and the type and quality of the search results of users in an online search. Due to the subjective nature and its psychological factors, the evaluation and diagnosis of the users' thoughts, mood, and emotions in the process of information search are a rather difficult affair, so these dimensions of the process of information seeking behavior, in particular, have rarely attracted the attention of the researchers of information. "Previous studies have established a causal link between information processing or seeking and emotions" (14). "Information processing is a cognitive component that entails an emotional function in which an individual evaluates the events and objects"(14). Additionally, emotions have a motivational component that triggers direction, behavior, and preparation of actions (14). Therefore, the current research aimed to investigate the role

of the searchers' positive and negative affect in information retrieval from the Web. The findings of this study will help the designers of search engines and information systems to provide more interactive search tools and more approved for users according to their emotional state; in this way, the search results become closer with the information needs of the users. The aim of this research was to investigate the emotional moods and information *retrieval* process of students at Shiraz University of Medical Sciences. Consequently, there was an attempt to verify the following hypotheses:

➢ There is a significant relationship between the positive affect and users' successful retrieval of the Web.

➢ There is a significant relationship between the users' positive and negative affect and the type of Web search.

➢ There is a significant relationship between the users' positive and negative affect and the quality of the Web retrieved results.

➢ The mean scores of the positive and negative affect before and after the simple and difficult search have a significant difference.

A number of studies in Library and Information Science literature have focused on exploring the causes of certain emotions and factors that influence the feelings experienced during the online search. Bilal and Kirby (2002) investigated the difficulties in finding the answer to inadequate knowledge of a system (15). Tenopir et al (2008) found that positive emotions were usually associated with satisfactory search results and negative emotions were associated with frustrating aspects of the systems, uncertain search tasks and confusing search strategies (16). Behzadi et al. (2016) studied the students' emotions in various stages of information retrieval of the Web (17). Yari Zanganeh et al. (2016) investigated emotional aspects in the field of information retrieval and mapping of Web of Science (18). Despite several types of research in this area, none has captured the effect of Emotional Aspects in the Information Retrieval from the Web among Medical Sciences students yet. It is difficult to discuss information literacy devoid of emotions and behavior in the learning process. Since it addresses the gap in the literature on emotions and behavior in information seeking in the field of library and information sciences, this research is a unique to capture this particular group.

Methods

This study was a before and after experimental study conducted on the behavior of searching information.

By designing the experimental/observational conditions, we can provide a suitable context (giving search scenarios - participants search scenarios that might be similar to their routine search activities, possible search in their academic fields, Persian sites,…) for controlling the confounding factors and consequently collecting the useful data. The research sample included 50 students of Shiraz University of Medical Sciences who regularly used World Wide Web and google search engine for information retrieval in their university, personal, or managerial activities that were chosen with purposeful sampling. In the previous studies with the same methods as that of this research, the research sample include 30 participants (12, 15-17).

In this research, for preparing the experimental environment and simulating the environment and the real need for information, the search tasks were designed and simulated. For designing the search tasks, previous researches (12, 20, 21) with minor changes were used. The researchers pre-tested White's tasks in a pilot experiment and selected the two tasks that were most consistently judged as easy and difficult (12-21). Each task included an instruction and a scenario in which the quested work of the subject has been determined. The search task was as close as possible to the real situations. For doing the two tasks, the search session was held and observed for each subject. The search of subjects was recorded in the information retrieval systems.

"Low complexity task was defined as a task that provided the subjects with more information on what needs to be found". "Subjects generally found the tasks in this category more 'clear' and 'simple' than those from other categories" (19). Below is the text of the low complexity search scenario (simple) used in the study: "You have recently inherited a large sum of money left by a recently deceased distant relative"(19). "A number of friends have advised you that it may be worth investing this money in a financial instrument, such as a bond or corporate stocks" (19). At present, you are unaware of stock market trends and lack the knowledge required to make a sound judgment on what to do with this money" (19).

The high complexity task was defined as a vaguely formulated task requiring information from multiple sources. "Subjects found these tasks difficult and classified the tasks in this category as the least 'clear' and 'simple'" (19). Below is the text of the high complexity task:

A friend has recently applied to various universities and courses, but has been complaining that he finds it difficult to get accepted due to the rising numbers

of students. "You were unsure if his assessment was correct, so you have decided to find out how the size of the student enrollment changed over the last 5 years and how it is expected to change in the coming 5 years" (12, 19-21).

Questionnaire "PANAS" was used for a gathering data related to mood, including the positive affect (PA) and negative affect (NA) - before and after each search in this research. This scale consists of a number of words that describe different feelings and emotions. The 10 items for POSITIVE (PA) affect are attentive, interested, alert, excited, enthusiastic, inspired, proud, determined, strong and active. The 10 items for NEGATIVE (NA) affect are distressed, upset, hostile, irritable, scared, afraid, ashamed, guilty, nervous, and jittery (22). The PANAS has demonstrated high reliability and internal and external validity; it is brief and easy to administer (22). Data analysis was performed by descriptive and inferential statistics. Thus, many types of research offer the Positive and Negative Affect Schedule as a reliable, valid, and efficient means for measuring these two important dimensions of mood. In this study, face and content validity of the questionnaire were approved by the experts. Reliability of the questionnaire was tested by Alpha Cronbach. Cronbach's alpha coefficient (PA=0.777, NA=0.754) showed a high rate of reliability in a PANAS questionnaire. "PA and NA questions presented to the participants before the search asked about their mood during the past week" (22); PA and NA questions presented to the participants after search tasks asked about their feelings during the previously completed search (22). The data collected were analyzed using SPSS, version 20.0. To test the research hypotheses, t-test and pair Samples t-test were used. The P<0.05 was considered statistically significant. Data analysis was performed on each part for simple and difficult search separately.

Results

Descriptive data of the distribution of participants by demographic characteristics showed that among the 50 participants, 56% were female and 64% were 20-30 years old. 52% of the participants were on the holders of the Master's degrees. In this study, 60% of the participants used online searching several times a week for information retrieval in their university, personal, educational and research activities (Table 1). In this section, the results are presented based on the research.

Research hypothesis 1: There is a significant relationship between the positive affect and users' successful retrieval of the Web.

T-test was used to compare the means between positive emotions of the users and successful retrieval of the web. The results showed that there were significant differences between the successful retrieval and positive emotions on simple and difficult search (P<0.001). (Table 2)

Research hypothesis 2: There is a significant relationship between the users' positive and negative affect and the type of Web search.

Regarding the second research hypothesis, the researcher aimed to investigate whether mood was related to the type of search task; therefore, the relationship between the difficulty level of the search type and the users' expressed positive and negative affect states was simplicity level) had a significant effect on the mood of users during the search (P<0.001). (Table 3)

Table 1: Demographic characteristics of the participants

Variable		n	%
Gender	Male	22	44
	Female	28	56
	Total	50	100
Age	20-30	32	64
	31-40	14	28
	>41	4	8
	Total	50	100
Education Level	Bachelor's Degrees	24	48
	Master's Degrees	26	52
	Total	50	100
Frequency of online searching	Several times a week:	30	60
	Once a day	12	24
	Several times a day	8	16
	Total	50	100

Table 2: T-test results of the associations between positive emotions and successful retrieval of the Web

Variable	Positive emotions				
	Search task	Frequency (%)	Mean±SD	t	P value
Successful retrieval	Simple search	50(100)	32.88±7.03	2.89	<0.001
	Difficult search	50(100)	34.48±7.40		

Table 3: T-test results of the associations among the type of search and the mood

Variable	Mood				
	Search task	Frequency (%)	Mean±SD	t	P value
Type of search	Simple search	50 (100)	14.70±4.53	4.54	<0.001
	Difficult search	50 (100)	33.48±6.18		

Research hypothesis 3: There is a significant relationship between the users' positive and negative affect and the quality of the Web retrieved results.

To verify the third hypothesis, the final result of the search, based on the participants' written responses at the end of each search session presented in the search questions was considered. Regarding the quality of the presented answers, the full texts of the participants' answers were examined using a 3-points scale, 0=weak, 0.5=average and 1=good. This had been used by Gwizdka and Lopatovska (21). The users' expressed affect states were obtained based on PANAS questionnaire. Paired sample T-test results showed that there was a significant difference in all search tasks between the quality of the results of the information retrieval from the Web and mood of the participant during the search (P<0.001). (Table 4)

Research hypothesis 4: The mean scores of the positive and negative affect before and after the simple and difficult search have a significant difference.

The impact of positive and negative affects before and after the search in the information retrieval result showed that there were significant relationship between negative affect before doing a search and during the simple search (P<0.001); also, significant associations were found between negative affect in simple search and difficult search(P=0.020) were significant associations. Also, the paired sample T-test results showed that the positive affect before and after the search had no significant effect during Simple and difficult search (P>0.05). (Table 5)

Discussion

The present study examined several factors that influence the positive and negative affects experienced during the online search. During the search for information, the users did not search the information with the same emotional states. Some could retrieve their needed information associated with negative emotions such as sadness, anger, and hatred or some others unlike the previous cases do so in a happy or neutral state; or they could face with various emotions during the search. The present research was carried out aiming at identifying the users' emotional states at various stages of information retrieval in the Web environment.

As to the relationship between the users' expressed positive emotions and successful information retrieval of the Web, the results showed that there was

Table 4: Paired sample t-test result of the associations among quality of the results and the mood of users

	Search task	MOOD		Paired - sample T-test	
		Frequency (%)	Mean±SD	t	P value
Quality of results	Simple search	50(100)	-14.02±4.69	21.136	000
	difficult search	50(100)	-32.89±6.21	-37.450	

Table 5: Paired Samples t-test to compare the means scores reported before and after search

Mood	Mean±SD	T	P value
PA before search and PA Simple search*	-1.86±7.1	-1.835	0.073
PA Simple search and PA difficult search**	2±7.48	1.891	0.065
NA before search and NA Simple search	7.34±6.58	7.877	<0.001
NA Simple search and NA difficult search	2±5.80	-2.410	0.020

*Simple search was a first task search, **difficult search was a second task search, PA=Positive affect; NA=Negative affect

a relationship between the users' positive emotional aspects and their successful retrieval of the Web. The positive emotions as the factors facilitating the individuals' teachings such as attitude, motivation, creativity and problem-solving skills have been considered in most of the conducted researches. While influencing the individuals' cognitive processes, the positive emotions also increase their intrinsic motivation (23). In line with the results obtained from this research, various researches (24) have also shown that positive emotions play a key role in various cognitive processes such as data processing, communication process, process of dialogue, process of decision-making and creative problem-solving process so that a suitable interaction is made possible with the user's intermediary environment and access can be made to a pleasant experience and strengthening of individuals' scientific behavior and change it into a factor for achieving the expected result. Regarding the mentioned cases, we can say the searchers' behavior of taking information is confused by the negative emotions and facilitated by positive emotions. Successful information behavior depends on continuous copying procedures to regulate negative and positive affective forces operating on individuals in information intense environments. Stronger affective responses were stimulated by the task and its context rather than the search(11). Stronger affective responses were stimulated by the task and its context rather than the search (25). Personal, contextual and task-based constraints, and the values people (actors) hold influence their information behavior (26). Attention to the success of searchers in the search and information retrieval by increasing positive affect can affect the performance and success of Web information retrieval systems (Table 2).

The simplicity or difficulty level of search tasks can affect mood and emotions, as expressed by Fisher (27). The findings of this research showed that the type of emotions had a significant relationship with the type of search and the emotions expressed in the individual in a simple search were not similar to one's emotions in a difficult one. In the research conducted by Wang and Erdelez (9), it was also found that the search tasks significantly affect the search tactics used by the users. The findings of this research along with those of Behzadi et al. (17) showed that changes in the level of difficulty of search tasks are associated with the type of the users' expressed emotions. Our findings are also consistent with a part of the findings of Poddar and Ruthven (28) based on which the individuals' negative emotions increased during more difficult search tasks. The final result

is that since the amount of expression of negative emotions increase during the response to difficult search tasks, the difference in the type of emotions is inevitable. Findings of this research are consistent with those of Lopatovska (21), based on which there is no significant relationship between the individuals' temperaments and theme of the search and difficulty of search tasks (Table 3).

According to Lopatovska (2009) and Lopatovska (2011), "the positive emotional valence is mainly associated with starting and expanding information seeking even though it may also appear in the context of limiting and terminating information seeking if the individual is satisfied with the outcome. Some emotions, e.g. anxiety, may motivate in multiple ways, ranging from starting information seeking to information avoidance, while other emotions such as joy are typically experienced while starting or expanding information seeking" (12-21). It is obvious that strong emotions such as fear or thrill can predict better certain information behaviors while the motivating force of milder emotions such as irritation or curiosity may be fairly weak. In the latter case, the decision to seek or avoid information may depend more strongly on situational and cognitive factors such as the urgency of a task at hand or human propositional attitudes (29).

As to the relationship between the users' positive and negative affects on the quality of results retrieved from the Web, the results of the research showed that in retrieving the weak results, the greatest expressed emotion on the part of the users has been fear in difficult search and sadness and neutrality in simple search. In the retrieval of the mean results, the greatest expressed emotion of the users was shown to be happiness, neutrality, and surprise in difficult searches with the highest frequency and in simple searches the neutral emotion. In retrieving the good results, the greatest emotion on the part of the user was the happiness emotion in the simple and difficult searches. "Positive Affect (PA) reflects the extent to which a person feels enthusiastic, active, and alert. High PA is a state of high energy, full concentration, and pleasurable engagement, whereas low PA is characterized by sadness and lethargy (22) In contrast, Negative Affect (NA) is a general dimension of subjective distress and lack of pleasurable engagement that subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness, with low NA being a state of calmness and serenity". (22). Thus, this research showed that users with PA Affect present high quality (successful) in the responses and users with NA Affect have the

lowest quality answer (weak) to the search questions.

The impact of positive and negative affects before the search in the information retrieval indicated that doing a difficult and simple search led to a reduction of negative affect before the search. The results of the significant difference among the negative aspects of the simple and difficult search also revealed that doing a difficult search led to a reduction of the negative affect in a simple search. Examining the findings did not show any significant difference between the positive affect before and after the simple and difficult searches. The results obtained from analyzing this hypothesis are consistent with the findings of Bilal and Bashir (30) and Lopatovska (21) based on which the emotional experiences during a search are influenced by the users' positive and negative affect states before their involvement in the search.

The category of affect, mood and related research areas in the field of information retrieval as one of the main branches of informatics and the theory of knowledge can provide some new approaches for the researchers in this field. Given that the information retrieval systems should be designed so that they are based on the searchers physical and psychological characteristics and have more pleasure, be more user-friendly, and cause interaction between the users and system designers, this has caused the models of information retrieval pay attention as well to such concepts as feeling, psychological aspects, and emotions in designing their patterns (10). In this regard, it is necessary to recognize a better understanding of the ways in which the emotional variables affect the users' interaction with information, which is an important step in the interactive design of retrieval systems. This process is the main characteristic of interactive systems of information retrieval. By using the background data and knowledge-based principles, this system facilitates the user's access to information.

Conclusion

In this research, there was an attempt to study the role of the emotional moods of medical students in information retrieval from the Web using the Positive Affect and Negative Affect Scale. Based on the results of this study, there was a significant association between the difficulty level of searching and type of the users' emotions, quality of information retrieval results, emotional positive aspects of users and their successful retrieval of the Web. Therefore, in practice, the systems of information retrieval should provide an environment for the users that satisfies the immediate cognitive needs of the users and motivates the new needs in them. The researcher hopes that findings related to the role of moods in online searching will advance the science of designing and optimize IR systems. The users' moods detection is the first step in building interactive affective systems. Once it becomes possible to build systems capable of recognizing ever-changing moods and relate them to specific search behaviors, we can focus on developing a set of appropriate system reactions to specific recognizable users' moods. The results of this research may help develop the interactive models of information retrieval and design the user-oriented systems; also, they can have a contribution in explaining theoretically the emotional characteristics and interactive behaviors.

Conflict of Interest: None declared.

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