The effects of work task difficulty on health information searching behaviour

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ABSTRACT

Information needs and information seeking processes depend on contextual factors. Identifying and paying attention to contextual factors such as work tasks can be helpful for personalization of information retrieval. This study aimed to determine the relationship between work task difficulty and interactive health information searching behaviour (HISB). The study was performed through an analysis of transaction logs to identify relation between the work task difficulty and HISB of postgraduate student health ambassadors (PSHB). Thirty participants were purposefully sampled and invited to complete four simulated work tasks. User perception of work task difficulty, satisfaction, and success of search process were measured using questionnaires. A total of 120 log files were analysed. The results showed that with increasing tasks difficulty, PSHB see more results pages, review more information items and finally save more documents. Also, with increasing difficulty, PSHB enter more and longer queries in information retrieval systems and, in addition to changing the query more, they use more keywords and longer queries to search. As the task difficulty increases, the rate of satisfaction and success, as well as the navigational speed decrease. Understanding how work task attributes affect HISB can be effective for designers of interactive information retrieval systems, and developers of personalized health information retrieval systems and recommendation systems based on contextual information.

Keywords: Interactive information searching behaviour; Information retrieval systems; Service personalization; Health information; Health ambassadors.

INTRODUCTION

Health information is directly related to the quality of life of people in the community. Commonly, health information are consumed in order to increase knowledge and control of the disease, make informed decisions, increase physical quality of life, discuss information obtained with health professionals, and decrease anxiety, fear, and distress

regarding an illness (Lambert and Loiselle 2007). Consumption of health information occurs by persons with specific health conditions and their friends and family, and by people with public health concerns (Zhao and Zhang 2017), as well as by health ambassadors - individuals who are committed to helping to improve the health and well-being of individuals in their community.

In Iran, especially at the Universities of Medical Sciences, several calls have been published in order to recruit interested students as health ambassadors (Zareipour et al. 2020). Health ambassadors are considered as a channel for obtaining information in family, friends and acquaintances and they play an important role in increasing public awareness and reducing the number of unnecessary appointments to the doctor (Shakiba et al. 2021). Imagine information retrieval which is designed to assist health ambassador and following his neighbour request for information on stroke patient care, looking for information about proper diet for a patient with a stroke and also, providing recommendation for prevent a stroke. Bystrom and Jarvelin (1995) define each of these tasks as a work task and according to Kim and Allen (2002), these work tasks are motivation of information needs and information seeking. In this regard, Ingwersen (1992) believes that in order to seek effective information, the retrieval system must be able to understand the work tasks or issues that users have. Identifying and paying attention to the work task causes the ability to predict user behaviour in Information Retrieval Systems (IRSs), which improves the efficiency of of these systems (Ingwersen 1992).

In many interactive information retrieval studies, various work task characteristics such as complexity, difficulty, product and interdependence of the work task have been recognised as an important factor affecting users' search behaviour and search performance (Byström and Järvelin 1995; Li and Belkin 2010; Liu et al. 2010). Work task difficulty refers to "the degree to which the activity represents a personally demanding situation requiring a considerable amount of cognitive or physical effort in order to develop the learner's knowledge/skill level" (Orvis, Horn and Belanich 2008, p. 2417) and a person is challenged when a task requires input that is beyond their current ability levels (Van Velsor, McCauley and Ruderman 2010). For example, finding information about the symptoms and treatment of scarlet fever in infants is more difficult than in colic. Previous studies on the impact of work task difficulty on human information interaction have shown that it is possible to predict user behaviour based on their work task difficulty (Gwizdka and Spence 2006; Hertzum and Hansen 2018; Huang et al. 2020; Kim 2006; Liu et al. 2012; Wu et al. 2012).

Interactive information searching behaviour provides context to improve health information retrieval systems, so that these systems can predict the interactive behaviour of users' health information search based on their work task and take the necessary measures to increase user satisfaction and success in the information search process. The literature is limited in its investigation of interactive search behaviour of students as health ambassadors, therefore the motivation for this research study is to identify and analyse information search behaviour of postgraduate students as potential health ambassadors when searching across varying levels of task difficulty. Specifically the objective of this study is to examine the relationships between work tasks and postgraduate student health ambassadors (PSHA). It is expected that the results of this study will be used to improve the design of interactive IRSs and thus provide better support for user interaction and health information in the system. In addition, an effective step has been taken towards the personalized IRSs with the aim of facilitating access to information. Also, by examining the effect of work task characteristics on interactive

behaviour of PHSA, theoretical and practical foundations for the development and improvement of IRSs are provided. In this regard, this study was designed to answer the following research questions:

a) Is the degree of difficulty of PSHA work tasks significantly related to their selection behaviour in IRSs?
b) Is the degree of difficulty of PSHA work tasks significantly related to their query behaviour in IRSs?
c) Is the degree of difficulty of PSHA tasks significantly related to the performance of their interaction in IRSs?

LITERATURE REVIEW

Various researchers have analysed the relationships between work tasks and user interaction with IRSs by adopting different dimensions of work tasks. Among the different dimensions of the work tasks, task difficulty has attracted a lot of attention. Previous researchers have shown that in difficult tasks, users refer to web pages more (Gwizdka and Spence 2006; Kim 2006). Users formulate more diverse queries (Aula, Khan and Guan 2010; Liu et al. 2012; Wu et al. 2012) and spend more time on search results pages (Aula, Khan and Guan 2010), ultimately feeling less satisfied with their search results (Crescenzi, Capra and Arguello 2013). The aforementioned studies are related to relation between work task and general information. Hu and Kondo (2017) explored the relationship between task complexity and difficulty in music information retrieval, and Shao et al. (2019) conducted a similar research legal information case retrieval in China. In this review, we will specifically consider the field of health information.

Health information is increasingly available online, but this vast amount of information is not necessarily accessible to general consumers. To design effective health information systems, it is necessary to gain an in-depth understanding of how consumers interact with health IRSs. Various studies attempt to explore health information searching behaviour in information systems on the web such as MedlinePlus. Zhang et al. (2012) explored consumer health information searching behaviour in web-based health information spaces by observing undergraduate students search behaviours in MedlinePlus and the impact of the search tasks. The study found that for tasks with relatively lower multiplicity (one or two concepts), single strategy, either browsing or searching alone, was used to complete the tasks; and searching was a dominant choice. It showed that although MedlinePlus has strong support of browsing by categories and topics, participants in this study mostly used searching strategies to find information as MedlinePlus's health topics lack of medical conceptual structure. Browsing strategy was mainly used in situations where the participants were familiar with the structure of the source, such as encyclopedia and dictionary, or the terms given in task description. To reduce such difficulty, Zhang et al. (2012) suggested that the system should design mechanisms to connect lay terms with medical terms. One of the implications of the influences of task complexity is to design cognitive assistance to help users at different stages of a search. In another study, Inthiran, Alhashmi and Ahmed (2015) assessed the information search behaviour of 60 medical students when searching on a difficult task. One personal task and three simulated situations were used to invoke the information search process. After completion of the first simulated situation, the participants rated their perception of task difficulty, whether it was easy, neutral (neither easy nor difficult) or difficult. The study found that medical students exhibited these behaviours when searching on a difficult task, - they issued long queries, were active in locating results and were slow and unproductive.

Yilma et al. (2019) believes that knowledge and skill gaps exist between people from developing and developed countries in locating and using health information. These gaps can be minimized through improved Health Information Seeking Behaviour (HISB) which has the potential to reduce knowledge gaps across social groups and to educate individuals. Thus, Yilma et al. (2019) in a quantitative cross-sectional study and an interactive information retrieval experimental research examined the HISB and its associated factors among undergraduate students from a university in Malaysia. The experiment involves 58 students as users using a computer to search on three simulated and one personal task. Participants' perception of task difficulty was assessed based on difficulty level, such as very difficult, difficult, neutral, easy and very easy. The study concluded that contextual features such as frequency of health information seeking, mother tongue, and health status influence query formulation and affect query length. The findings could be useful for health information retrieval systems to learn and predict users' information needs to aid effective retrieval.

With a different perspective, Huang et al. (2020) distinguished between subjective and objective difficulty to compare the effects of the task difficulty on users' search behaviours. The authors designed five tasks of three types: factual and exploratory, and abstract, on 30 participants to complete the assigned tasks. The participants' perception of task difficulty was measured on a 5-Likert scale after each task. When measuring subjective difficulty, tasks with ratings above 3 were considered difficult and for objective difficulty, tasks with ratings higher than the average difficulty score of the 30 participants were considered difficult. The findings indicate that in searching for difficult tasks, users often had to use more queries and search terms. Moreover, users viewed more Search Engine Results Pages (SERP) and had more mouse scrolling on these pages. This confirms that completing difficult tasks requires users to spend more time browsing the result set page presented in the result list. When users deal with more difficult tasks, they have to do more analysis, and they must perform more comparisons and trade-off activities as they interpret the multiple results of their searches. Huang et al. (2020) believe that subjective and objective difficulty can have different effects on users' search behaviours and also, subjective rating yield better and more stable task difficulty prediction models.

Past studies show that the difficulty of work tasks has an effect on the interaction of users with information retrieval systems. But health information behaviour has not been paid as much attention as it should be in Iran, where it seems important to investigate the effect of work task difficulty as a contextual and effective factor on the interaction of medical students as health promoters with information retrieval systems. In previous work tasks studies, task difficulty was rated by participants (Huang et al. 2020; Inthiran, Alhashmi and Ahmed 2015; Zhang 2012). Liu, Kim, and Creel (2015) and Liu and Kim (2013) showed in their research that the difficulty of the work task has different measures, including uncertain about information need, subjective complexity of task, specific requirements, too much (unrelated) information, topic knowledge, need to read/comprehend information, resource credibility or quality and time limitation. In fact, it is possible to obtain a measure closer to the mental difficulty of the work task through indirect questioning of the subject to measure the difficulty of the work task. Therefore, in this study, the difficulty of the task is measured based on these parameters, which is the point of distinction between this study and previous studies in this field.

METHOD

The study is performed through a transaction logs analysis. Transaction logs are one source of usage information, and the approach is applied in the field of Library and Information Science (LIS). The information on user behaviour can be obtained automatically, through calculation of summary statistics, and manually, by examining search query and searching strategy. Peters et al. (1993) defined it as a "study of electronically recorded interactions between online information retrieval systems and the persons who search for the information found in those systems" (p. 37). The log files contain data about many of the details of the users' patterns of use and interaction with the system (Jamali et al. 2005).

A total of 30 postgraduate medical students in an academic institution in Iran participated in the study. Purposeful sampling method was used to recruit the participants. Purposive or judgmental sampling happens when a researcher is interested in selecting subjects or other elements that have particular characteristics, expertise or perspectives (Kelly 2009). Among purposeful sampling strategies in Palinkas et al. (2015), criterion-i sampling (criterion of inclusion in a certain category) was used to identify and select all cases that meet some predetermined criterion of importance. As the inclusion criteria, the participant must have: (a) at least moderate searching experience using search engines and databases; (b) at least average search skills in search engines and databases; and is (c) willing to be part of the study. These inclusion criteria were to control the impact of individual characteristics (such as experience and search skills) on the search process. Data were collected using a researcher-made questionnaire (see Appendix A).

Data Collection

(a) Simulated work tasks

Since information search behaviour is influenced by the context, situation and user's emotions, through designing laboratory situation, a suitable condition can be provided to control the interfering factors and thus collect useful data (Kelly 2009). Therefore, in this study, work tasks were designed to provide a laboratory situation and simulate the environment, as well as the actual or real information need. The Repository of Assigned Search Tasks[1] and search tasks in previous studies (Broussard and Zhang 2013; Mu, Lu and Ryu 2010) were used to design the simulated work tasks. Work tasks designing is based on Borlund (2000) work task framework. Participants were asked to complete four simulated work tasks in the topics of "amniocentesis tests", "hypertension", "migraine" and "diabetes" (see Appendix B). The selection of these four tasks was based on the structure, number and type of information required and different characteristics, so that different levels of difficulty could be considered. To search information, participants were not limited to choose specific search engines or databases.

Before the beginning of the search session, the study protocol (see Appendix C) was given to each of the participants. In this instruction, the participants were asked to complete a questionnaire for each work task (before and after the search) to measure the difficulty of the work task and also the two components of interaction performance (satisfaction and success). All participants used an Internet-connected laptop to search. Through FlashBack Screen Recorder, the process of user interaction with information retrieval systems (such as system selecting, searching, clicking, and mouse movements) was recorded. The maximum search time for each task was 15 minutes, and to control the impact of learning during the search, the task was rotated for the subjects to search.

[1]See RepAST https://ils.unc.edu/searchtasks/search.php

(b) Pre-search and Post-Search questionnaire

In order to assess the difficulty of the work tasks, a 9-item pre-search questionnaire (see Appendix D) and a 12-item post-search questionnaire (see Appendix E) were designed to measure the difficulty of each work task, user satisfaction and user success. The items were extracted from the study of Liu, Kim and Creel (2015) and Liu and Kim (2013).

To validate the instruments through content validity, information science professionals were invited to judge them based on relevance and clarity. Also, in order to assess the reliability of the questionnaire, Cronbach's alpha test was used; whose high coefficient (0.813) indicates the high reliability of the instruments (the amount of subject knowledge about the work task, 0.872; uncertainty about information need, 0.84; search time demand, 0.71; need for a specific type of information, 0.774; subjective complexity of the task, 0.786; large amount of available information, 0.758).

Data Analysis

After searching for all the simulated work tasks and recording their search log files, 120 search files were finally analysed to measure information search behaviour. Table 1 lists the components of selection behaviour, query behaviour, and interaction performance and how each variable is measured. Components of user interaction performance are measured by indicators such as user satisfaction and success, search completion time, dwell time on search result pages and web pages, as well as navigational speed and the number of mouse click(s). It should be noted that the level of user satisfaction and level of success were assessed through a questionnaire and the rest were extracted from log files.

Table 1: Components of Health Information Search Behaviour

Variable	Components	Measuring tools
Selection behaviour	Number of IRSs selected Number of IRSs searched Number of result pages viewed Number of web Items viewed Number of web Items selected	Log file
Query behaviour	Number of query iterations Number of unique queries Mean query length Unique query terms	Log file
Performance of interaction	Level of user satisfaction	User satisfaction about the search process
	Level of success	User self-evaluation from success in searching the information needed for the work task
	Search completion time	Log file
	Number of mouse click(s)	Log file
	Navigational speed	The ratio of number of mouse click(s) to time of searching
	Dwell time on search result pages	Log file
	Dwell time on web item	The ratio of search completion time to number of web page viewed

Using content analysis, data obtained from the log file were analysed. Therefore, in each work task, the components of selection behaviour, query behaviour and interaction performance were extracted and analysed using SPSS software version 18.

Reliability of content analysis is defined as the extent of agreement between coders. More precisely is related to agreement coefficients between encoders (Kelly 2009). Accordingly, in order to obtain reliability of the data extracted from the log file, the intercoder reliability was calculated by Krippendorff alpha (kalpha) coefficient. After extracting the components of Table 1 from the data of the seven log files by two coders, the Krippendorf alpha was calculated. A coefficient of 0.902 indicates a significant agreement in the content analysis process.

Ethical Considerations

The purpose of the study was explained to the participants and their verbal and written informed consents were obtained. Only data relevant to the purpose of this study were collected, and all data were stored and managed in a secure storage drive.

RESULTS

Given that the variables of work task difficulty, namely selection behaviour, query behaviour and interaction performance, have a quantitative scale, correlation tests are used to measure their relationship. Prerequisite of this test (i.e. existence of normal distribution of variable data) was examined by the Smirnov-Kolmogorov test. The significance level of the Smirnov-Kolmogorov test for all variables was less than 0.05. Considering abnormality of distribution variables, the "Spearman correlation" test was used. Table 2 reports the relationship between work task difficulty and components of selection behaviour in the IRSs.

Table 2: Spearman Correlation Test Results for Measuring the Relationship Between Work Task Difficulty and Components of Selection Behaviour in IRSs (n = 120)

Selection behaviour	Difficulty of work task	
	Spearman's correlation coefficient rho	Significance level
Number of selected IRSs	0.163	0.125
Number of searched IRSs	0.163	0.125
Number of result pages viewed	0.708	0.000
Number of viewed Items	0.703	0.000
Number of selected Items	0.685	0.000

As shown in Table 2, no significant relationship was observed between the level of the work tasks difficulty and the number of IRSs selected and searched ($p \geq 0.05$). While there is a significant and positive relationship between the level of the work tasks difficulty and the number of results pages viewed, the number of viewed items and the number of selected information items ($p < 0.05$). Generally, this means that as students' work tasks become more difficult, they will see more results pages, review more information items, and save more documents.

According to Spearman correlation analysis (Table 3), there is a positive significant correlation between all components of query behaviour and work tasks difficulty. In other

words, with the increasing difficulty of the work tasks, users enter more and longer queries in IRSs and reformulate their queries further. The more difficult the tasks, the more keywords they use to search.

Table 3: Spearman Correlation Test Results for Measuring the Relationship Between Work Task Difficulty and Components of Query Behaviour in IRSs (n = 120)

Query behaviour	Difficulty of work task	
	Spearman's correlation coefficient rho	Significance level
Number of query iterations	0.427	0.002
Number of unique queries	0.627	0.032
Mean query length	0.411	0.004
Unique query terms	0.303	0.000

In examining the relationship between the components of interaction performance and work task difficulty, the Spearman correlation test results showed that there is a significant negative relationship between user satisfaction and his/her success and work task difficulty (Table 4). In other words, with the increasing difficulty of the work task, users feel less satisfaction and success in their search. There is also a significant relationship between search completion time and work task difficulty. This means that as the work task becomes more difficult, the users spend more time trying to find the information they need. As such they spend more time on the results pages and more time examining the documents. In general, as work tasks become more difficult, the number of user selections in the search process increases. However, there is a significant negative relationship between navigational speed and work task difficulty, therefore as the work task difficulty increases, the user's navigational speed decreases.

Table 4: Spearman Correlation Test Results for Measuring the Relationship Between Work Task Difficulty and Components of Interaction Performance (n = 120)

Interaction performance	Difficulty of work task	
	Spearman's correlation coefficient rho	Significance level
Level of satisfaction	- 0.469	0.000
Level of success	- 0.408	0.006
Search completion time	0.421	0.000
Dwell time on search result pages	0.700	0.002
Dwell time on web item	0.679	0.005
Number of mouse click(s)	0.762	0.000
Navigational speed	- 0.607	0.000

DISCUSSION

The current study investigated the relationship between work task difficulty and health information search behaviour on the web among PSHA in an academic institution in Iran. The findings show that work task difficulty affects the components of selection behaviour. As the difficulty of the PSHA work tasks increases, they view more result pages, examine more information items, and finally save more documents. These findings are consistent

with the findings of Gwizdka and Spence (2006), Huang et al. (2020) and Kim (2006). Gwizdka (2009) refers to the variables in HISB as cognitive actions and believes that in more difficult work tasks, users perform more cognitive actions. Huang et al. (2020) also found that when users are dealing with more difficult work tasks, they need to do more analysis, and while interpreting their multiple search results, they need to do both comparisons and more exchange activities. These results support the cognitive model of Ingwersen (1992), who states that there is an interaction between all components involved in information retrieval (such as user cognitive space, information items, and IRS environment).

In investigating the effect of work task difficulty on users' query behaviour, the study showed that with increasing work task difficulty, users enter more and longer queries in IRSs, change the queries more, and use more keywords to search. In this regard, Huang et al. (2020), Wu et al. (2012), Liu et al. (2012), and Aula et al. (2010) achieved similar results. This finding indicates that the user uses the retrieved health information to reformulated query to achieve more satisfactory and relevant results. It is argued that the increasing difficulty of health-related work tasks leads to exploratory searches (Marchionini 2006).

In contrast to iteration a simple search query, exploratory search involves a series of knowledge acquisition and cognitive learning, planning and query reformulation cycle. With exploratory search, a more complete picture of the knowledge domain is being built during the search, which implies the existence of both learning and investigating activities (Pang et al. 2015). In exploratory search, users are not aware of the concepts in their information needs due to the anomalous state of their knowledge. As a result, they try to find concepts that can express the scope of their information needs (Vakkari 2010).

Today’s search engines play an important role in Internet searches. Search engine giants such as Google have become part of people’s lives. Most modern search engines are designed to work with keyword queries and have no special adaptation for health-related searches. Laypeople usually have only limited knowledge of the medical domain (Zhang 2011) and face difficulties in searching due to insufficient knowledge of technical and medical language (Pang et al. 2015). Therefore, using recommender systems that display suggested concepts and queries related to the initial query, and provide linked data between different IRSs can increase the user's satisfaction and success in finding the required health information.

The user's knowledge domain of the work tasks is one of the components affecting the difficulty of the work task, thus the less the user's domain knowledge is, the more difficult is the work task (Liu et al. 2012; Liu, Kim and Creel 2015). Therefore, it can be argued that in difficult tasks, the user is less familiar with the subject of the work task. The current study shows that as the difficulty of the work task increases, the user queries become more diverse and longer. This result is contrary to that of Vakkari (2000), who believes that the more familiar users are with a topic; the longer and more detailed their search terms would be. Therefore, it is suggested that further study be conducted on the effect of work task difficulty and users' knowledge domain on their interaction with health information.

As Li and Belkin (2012) had pointed out, studying the effect of work task difficulty on the performance of user interaction with IRSs establishes that with increasing work task difficulty, user satisfaction and success decreases. In this regard, Britt (2005) believes that the difficulty of the work task affects the user's anxiety, motivation and hope for success, which ultimately affect the quality of work task performance.

Similar to the study of Liu et al. (2010) and Hu and Kando (2017), the results showed that with increasing work task difficulty, search completion time and number of clicks increase and user navigational speed decreases. Users use a variety of strategies in information searching. It seems that with increasing work task difficulty, users use more clicks and chaining more links. In other words, they expand their searches in a browsing style. As a result, the users spend more time on results pages and information item pages, and their navigational speed decreases. Therefore, it is necessary for IRSs, especially for health information retrieval, in addition to acting as personalized systems by extracting information from the users' context, to move towards machine learning based search and recommendation systems (Liu, Liu and Belkin 2020).

CONCLUSIONS

This study has established difficulty of work task as one of the dimensions of the work task that affects the users' interaction with health information on the web. By implementing solutions to reduce the difficulty of work task will allow users to access the required health information and ultimately, feel more satisfied and successful. In the health context, it is recommended to consider the user's expertise in information retrieval, for the reason that there is a difference between the information needs of a patient and a physician about a particular health issue or illness. The retrieval systems should be personalized by analyzing the user's previous searches, and the latest and non-repetitive information should be provided. Additionally, weighting or classification systems should be designed to determine the degree of difficulty of content indexed in retrieval systems. It seems that representing the suggested concepts and queries related to the initial query through the thesaurus and ontological structures and the possibility of using linked data between different IRSs can increase the user's satisfaction and success in finding information. Besides, it is recommended that Question Answering (QA) systems in health information services is implemented. QA systems have emerged as powerful platforms for automatically answering questions asked by humans in natural language using either a pre-structured database or a collection of natural language documents (Soares and Parreiras 2020). The demand for QA systems increases day by day since it delivers short, precise and question-specific answers (Pudaruth et al. 2016).

Finally, in order to investigate the effect of work task difficulty on health information retrieval, it is suggested that future research engage with the following topics:

- The effect of other work task characteristics (such as, subjective complexity, product) on the interactive HISB;
- Comparison of interactive HISB in evidenced-based databases and retrieval systems;
- Interaction effect modeling to investigate the moderating effect of cognitive style and work task difficulty on users' interaction with IRSs;
- The effect of work task difficulty on the relevance judgment of health information from the user's perspective.

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AUTHOR DECLARATION

There are no conflicts of interest involving the authors of this paper.

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APPENDIX

Appendix A: Participants Identification Questionnaire

Dear student
The present questionnaire has been prepared in order to select the student to collect information in research work, entitled "The Relationship between work task Difficulty and Health Information Searching behaviour". Given that the results of this questionnaire will affect the selection of the research team to conduct the main research, so your accurate answers will be helpful in choosing efficient research participants. All the questionnaires answered will not be kept in any record, therefore, the responses will remain confidential only to be used by the researcher.
Kind Regards
Research Team

1. Gender: Male☐ Female☐
2. Education field: ……
3. Age: 20-25y ☐ 26-30y☐ 31-35y☐ More than 35y ☐
4. How would you describe your experience in using a computer?

Very low				Very much
1	2	3	4	5

5. How would you describe your experience in using the Internet?

Very low				Very much
1	2	3	4	5

6. Please indicate your skill level in using the computer.

Novice				Professional
1	2	3	4	5

7. How experienced are you in search engines (like Yahoo, Google, etc.)?

Very low				Very much
1	2	3	4	5

8. How much experience do you have in searching online library catalogs?

Very low				Very much
1	2	3	4	5

9. How much experience do you have in using scientific databases (such as: Scopus, Pubmed, etc.)?

Very low				Very much
1	2	3	4	5

10. How often do you find the information you need in a web search?

Rarely				Always
1	2	3	4	5

11. Please indicate your skill level in information searching on the Internet.

Novice				Professional
1	2	3	4	5

12. Totally, how many years have you been finding the information you need on the Internet? …… years

If you wish to participate in the main research, please complete the following information.

1. Name and last name: .....
2. Mobile number: .....
3. E-mail: ……

Appendix B: Simulated Work Tasks

Work Task 1: Amniocentesis test for pregnant women
Suppose that your friend (Maria) and her husband both have the genetic disease, Thalassemia minor. Maria found out she is pregnant (eight weeks). According to information she received in pre-marital classes, she knows she should have a CVS or amniocentesis test during the 12th week of pregnancy, but she has no information about the type of tests and how to prepare for tests. You're interested in finding information about the tests on the Internet for helping Maria. What is a CVS test? What is amniocentesis? Which is more appropriate? What are the potential risks of these tests? Please Gather information to complete this work task.

Work Task 2: Blood pressure
Your brother (Daniel) complains of constant headaches. One night when his headache is accompanied by nausea, you go to the medical center with Daniel and find out that Daniel's blood pressure is 21. You want to know: what causes high blood pressure? What diseases raise blood pressure? What are the ways to control high blood pressure? Help your brother by gathering relevant information and refer him to a specialist. Please gather information to complete this work task.

Work task 3: Migraine
Suppose you have recently had a migraine. You want to know more about migraine treatment modalities. You heard from another patient about the effectiveness of migraine treatment with beta-blockers or calcium channel blockers and decided to do some search about them. At the same time, you want to know about treating migraines without medication (such as diet or exercise). Please gather information to complete this work task.

Work task 4: Diabetes
Suppose there is a pregnant woman in your family with gestational diabetes. Therefore, you decide to find out more about gestational diabetes. In other words, you want to know: what are the ways to control or treat this type of diabetes? Which solution is suitable for her condition? Finally, seek more about how to adopt the considered therapeutic solutions. Please gather information to complete this work task.

Appendix C: Study Protocol

Dear participant,

In this experiment, you will be given 4 work tasks. You will be asked to search for information for each of these work tasks. In this regard, you are free to choose an information system (eg databases, online library catalogs, search engines and other websites) that provides useful information for the task at hand. In summary, the process of performing this test is:

1. Declare readiness for doing the work task and search.
2. Study the first work task.
3. Imagine this is a real job.
4. Complete the questionnaire before searching
5. Do the search:
   Select the system that you feel is suitable for doing the work task 1 and start the search
   During the search you can search several systems, but you have a maximum of 15 minutes to search.
   You may to find documents that you think are useful for doing the work task at hand and choose a way to save them for future use, such as: save, bookmark, print, email, take notes, and so on.
6. After completing the search for work task 1, complete the post-search questionnaire.
7. Repeat steps 1 to 7 for work tasks 2 to 4.

If you have any questions about the testing process, please ask before testing.

Best wishes

Appendix D: Pre-Search Questionnaire

Dear student

This questionnaire is intended to gather information about what you think about "Work task" that you just read a few minutes ago. Therefore, help us in doing this research by answering the following questions.

Thank you.

1. Please comment on this task:
   - ☐ I have dealt with this type of work tasks many times.
   - ☐ I have done this type of work task before.
   - ☐ This is the first time I have done this type of work task.

2. Imagine this is a real work task, how long does it take to do this work task?
   Less than a day Less than a week Between one and two weeks Between 3 and 4 weeks More than 1 month

Please comment on the following items.

No	**Description**	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
3	This seems to be a challenging work task.					
4	The work task requires a lot of thought.					
5	The work task includes many sub-tasks and activities.					
No	**Description**	Very low	A little	Neither much nor little	Much	Very much
6	How much do you know about the subject of this work task?					
7	How much do you know about the process of doing this work task?					
8	How difficult do you think this work task is?					
9	How complexity do you think this work task is?					

Appendix E: Post-Search Questionnaire

Dear student, Please answer the following questions based on your search.
Thank you for your effort

1. Did you run out of time to search for information in this work task? Yes☐ No☐
2. Do you have enough information to do the work task? Yes☐ No☐

If your answer is no, please indicate how much you would like to do more search for this type of work task to get enough information?

Very low				Very much
1	2	3	4	5

3. During the search, I selected the document / web page for the task if:
☐It was quite useful ☐It was almost useful ☐It was a little useful

4. About the documents or web pages I have selected:
☐ I am sure all of them are useful for this work task.
☐ I am sure most of them are useful for this work task, others may be useful.
☐ I am sure half of them are useful for this work task, the other half may be useful.
☐ I am sure that only a small part of them are useful for this work task, the rest may be not useful.
☐ I am not sure if all of them are useful for this work task.

Please specify your status for the following items.

No.	Description	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
		1	**2**	**3**	**4**	**5**
5	Defining a search term was difficult for me.					
6	I did not know exactly what to look for.					
7	Some of the work task terms were vague and unfamiliar to me.					
8	It was difficult to decide whether the content of the document was useful for the work task.					
9	I had to search various databases to gather the information needed to do the work task.					
10	This work task required a lot of activity to identify and gather useful information.					
11	I feel that this search was hard and difficult for me.					
12	I felt frustrated while searching for information.					
13	The search for this work task required a lot of thought.					
14	To do the work task, I have to read a lot of resources.					
15	I believe that I was successful in searching and selecting information for this task.					
16	I am satisfied with my search process to complete this work task.					