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Evaluation and analysis of uncertainty in the information seeking behavior of medical post-graduate students

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ABSTRACT

This study aimed to explore and analyze uncertainty in the information seeking behavior among the students of Kerman University of Medical Sciences (KUMS) based on Kuhlthau Information Search Process Model. This is an applied research. Data gathered using questionnaire. Research population included 1075 students from all graduate students of KUMS in M.Sc. and Ph.D. grades. The sample size estimated 263 people .The studied students had relatively similar senses as reported by Kuhlthau in her information search process model. Among demographic variables, only gender affected the presentation stage. Women had better performance in the presentation stage. Ph.D. students performed better than master students when selecting their research topics. These two groups had no clear differences in other stages. Students with previous experience in research activities had better performance in title selection, literature exploration and presentation stages and also had lower uncertainty. The students' performance decreased in different stages as their ages increased. The effect of individuals' age on their performance was considerable in the stages of literature exploration and result presentation. The graduate students of KUMS follow the same stages as Kuhlthau information search process model and have similar feelings with that. Uncertainty was felt in the different stages of information search by graduate students of KUMS. The factors like age, gender, level of education and previous experience were effective in some stages on decrease or increase of uncertainty

Key words: Uncertainty, Information Seeking Behavior, Kuhlthau Information Search Process Model, Students, Kerman University of Medical Science

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INTRODUCTION

Users' uncertainty in the process of information seeking behavior is one of the effective factors on their consent of retrieved information. Uncertainty is a cognitive situation that the first

include anxiety and the lack of certainty, and then continue with confusion, doubt, ambiguity and unclear thoughts about a topic or a question. Because of lack of cognition or break up in the meaning, uncertainty leads to the consent of information seeking process [1].

Different studies defined uncertainty as stimulating factor for information seeking [2, 3], which show itself in the form of cognitive uncertainty in the information seeking process [4]. Wilson introduces uncertainty as 'the ghost at the feast', which play as a natural experience in the information seeking process [5].

Despite broad search in the literature, there was no study about uncertainty in the information seeking behavior of graduate students and a few

researches studied this problem in other fields[6-8]. One of these is Chowdhury study in 2011. She studied uncertainty in search and retrieval of digital information. She concluded that information seeking activities such as selection of channels and appropriate information sources, formulation of query, decision to stop searching and start of using retrieved cases are effective significant factors on uncertainty. Each information user may encounter with uncertainty at each step of information seeking process [7], but it may be negative or positive. So it may motivate users to identify new information sources [9, 10]

Some of other researchers who have studied uncertainty are Davis, Aals, Cooper, Ellis, Holliday, Kracker, Marchionini, Meho & Tibbo, Niedźwiedzka, Van Kampen, Anselme, Borgersa et al., Driscoll et al., Feltwell & Reer, and Crestain & Lalmas [11-25].

Almost all of the mentioned studies have performed in the western countries. So, it is necessary to study the compliance of the model with feelings of Iranian users during information search process.

Information Seeking Behavior Models

Seeking information behavior is a set of processes which eventually lead to useful information [26]. Studies indicated that user's information seeking behavior was effected by different variables to search and use information, then by correct identifying and control of these factors can guide information seeking behaviors into specified and purposeful routes [27, 28]. Using information seeking behaviors' theories and models are the best ways to meet this issue. Two of these are Wilson and Kuhlthau information seeking behaviors models. These two models have obtained the most citations among pervious literatures. These models assess users' information seeking behaviors. Although Wilson model study confounding variables including psychological, demographical and environmental in users' information seeking behaviors, but it does not encompass uncertainty in its model, exclusively. Other information seeking behavior model belongs to Carrol C. Kuhlthau which is based on experimental studies. This model is known as Information Search Process (ISP) [29]. According to this model, the 6 stages of ISP model (i.e. initiation, selection, exploration, formulation, collection and presentation) occur in emotional, cognitive and physical areas. In this model, Kuhlthau emphasis more on the effective feelings such as anxiety, doubt, confusion, excitement, expectation, hesitation and optimism. She stated that information seeker moves stage by stage in this model. Kuhlthau has stated that uncertainty and anxiety are more probable to occur in the initial stages of information search process and then in the selection and exploration stages [30]. Kuhlthau presented a 6 stages model [29] on the basis of her 5 previous papers [32-35].

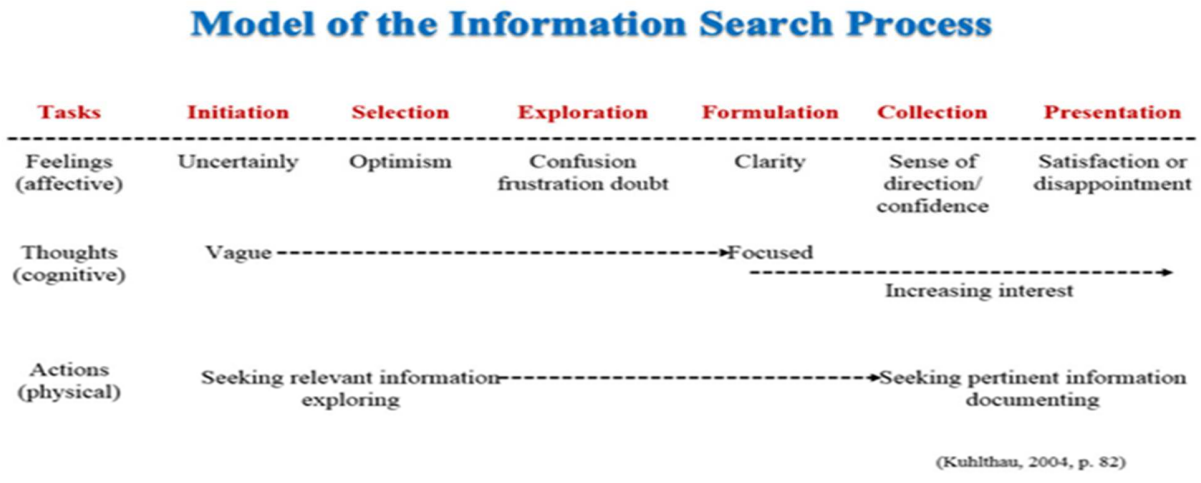

Figure 1. Kuhlthau's Model of the Information Search Process

MATERIALS AND METHODS

This is an applied study that has performed through survey method. The study population includes 1075 graduate medical students in Kerman University of Medical Sciences (KUMS) during 2013-14. Simple randomized sampling used for determination of sample size. So, the sample size was 263 students.

The samples selected randomly from studying graduate students in the 6 colleges of KUMS. A researcher made questionnaire used to gather data. To design this questionnaire, previous literature studied, so that the components related to Kuhlthau information search process model and uncertainty identified. Then, on the basis of these components and other present questionnaires about information seeking behavior and also this study aims, the questionnaire has been made. The questionnaire validity confirmed by the university professors. The questionnaire alpha coefficient was 0.82.

RESULTS

The frequency of persons with certainty and uncertainty feelings and also the average of uncertainty scores in every stage are presented in the tables 1 and 2.

Table 1: The frequency of students with certainty and uncertainty in Kerman University of Medical Sciences

Stages of Kuhlthau model	Stage average	Frequency	Percent frequency	P-value
Initiation	18	Lower than average 104 Higher than average 159	39.5 60.5	0.001
Selection	21	Lower than average 11 Higher than average 252	4.2 95.8	<0.001
Exploration	21	Lower than average 55 Higher than average 208	20.9 79.1	<0.001
Formulation	21	Lower than average 0 Higher than average 263	0 100	<0.001
Collection	18	Lower than average 104 Higher than average 259	39.5 60.5	<0.001
Presentation	21	Lower than average 18 Higher than average 245	6.8 93.2	<0.001

As table 1 indicate, formulation stage is a milestone in the information search model. In this stage, on the basis of Kuhlthau expectation model, uncertainty decrease and self-confidence increase.

Table 2: Study of relation between uncertainty and different stages of information search

Stages of Kuhlthau model	Average	Standard deviation	P-value
Initiation	22.16	2.25	<0.001
Selection	26.05	3.13	<0.001
Exploration	24.73	3.67	<0.001
Formulation	29.99	2.86	<0.001
Collection	21.96	1.88	<0.001
Presentation	25.86	2.92	<0.001

Hypothesis 1. There is relationship between uncertainty and users' starting behavior in searching information.

On the basis of table 2, the average of users' results is 22.16 which is more than the considered average. If the average obtained from the results be more than the questions' average, the users have felt uncertainty at the starting stage of the information search process; and if be lower, the users have felt higher certainty at the starting stage. On the basis of Kuhlthau model, the students of KUMS have not certainty feelings at the first of searching process and suffer from uncertainty. The results of table 1 indicate that most of the students (60.5%) suffer from uncertainty. By attention to $p(sig)<\alpha=0.05$, there is significant relationship between uncertainty and the starting stage.

Hypothesis 2. There is relationship between uncertainty and users' selection behavior in searching information.

On the basis of table 2, the average of users' results is 26.05 which are more than the considered average. If the average obtained from the results be lower than the questions' average, the users have felt uncertainty at the title selection stage of the information search process; and if be higher, the users have felt higher certainty and optimism at title selection stage. On the basis of Kuhlthau model, the students of KUMS feel optimistic in selecting title for their researches or their uncertainty feeling is becoming into optimistic feeling. The results of table 1 indicate that most of the students (95.8%) feel optimistic about the selected title. By attention to $p(sig)<\alpha=0.05$, there was significant relationship between uncertainty and the selection stage.

Hypothesis 3. There is relationship between uncertainty and the users' follow up behavior in searching information.

On the basis of table 2, the average of users' results is 24.73 which is more than the considered average. If the average obtained from the results be more than the questions' average, the users have felt uncertainty at the exploration or literature follow up stage of the information search process; and if be lower, the users have felt higher certainty at the starting stage. On the basis of Kuhlthau model, the amount of doubt and uncertainty have increased between the students of KUMS. The results of table 1 indicate that most of the students (79.1%) suffer from uncertainty. By attention to $p(sig)<\alpha=0.05$, there was significant relationship between uncertainty and the users follow up behavior.

Hypothesis 4. There is relationship between uncertainty and the users' formulation behavior in searching information.

On the basis of table 2, the average of users' results is 29.99 which is more than the considered average. On the basis of Kuhlthau model, the student's self-confidence should increase and their uncertainty decrease. The obtained results were similar to the model. If the average obtained from the results be more than the questions' average, so users certainty and confidence have increased; and if be lower, users have felt lower certainty at the literature formulation stage of the information search process. The results indicate that the negative feelings of the students have been replaced with the positive feelings such as certainty and self-confidence. Also, the results of table 1 indicate that the students' self-confidence have increased in this time. By attention to $p(sig)<\alpha=0.05$, there was significant relationship between uncertainty and the users' formulation behavior.

Hypothesis 5. There is relationship between uncertainty and the users' collecting behavior in searching information.

On the basis of table 2, the average of users' results is 21.96 which is more than the considered average. If the average obtained from the results be more than the questions' average, so users certainty and confidence have increased during the literature collecting stage; and if be lower, users have felt lower certainty at the literature formulation stage of the information search process. On the basis of obtained results, this stage of the information seeking behavior is similar to Kuhlthau model. This mean that the amount of users' uncertainty and doubt have been decreased and their self-confidence have been increased. On the basis of Kuhlthau expectation model, the students of KUMS in collecting research literature have lower uncertainty and search literature with more confidence. Also, on the basis of table 5, most of the students' self-confidence (60.5%) is still increasing. By attention to $p(sig)<\alpha=0.05$, there was significant relationship between uncertainty and the users collecting behavior.

Hypothesis 6. There is relationship between uncertainty and the users' presentation behavior in searching information.

On the basis of Table 5, the average of users' results is 21.96 which is more than the considered average. If the average obtained from the results be more than the questions' average, so users feel comfort and tranquility during their presentation stage; and if be lower, users feel anxiety and worry. This stage of students' search behavior is in accordance with Kuhlthau model. This mean that the users feel comfort and tranquility. Also, on the basis of table 5 results, most of the students felt comfort and tranquility. By attention to $p(sig)<\alpha=0.05$, there was significant relationship between uncertainty and the users' presentation behavior.

Hypothesis 7. There is relationship between uncertainty and the users' demographic factors.
Demographic factors include age, gender and educational level. At the first, we explore the relationship between gender and uncertainty in the Kuhlthau information search stages. 263 students studied in this paper, including 213 females (81.2%) and 50 males (18.8%) students.
After reviewing the normality assumption in the groups using Kolmogorov-Smirnov test, two independent samples T-test used to compare the average of uncertainty in the students' information search behavior on the basis of Kuhlthau model. Results indicated that there is no significant difference between males and females in the starting, selection, exploration, formulation and collecting stages in terms of uncertainty (table 3). In the presentation stage, by attention to the obtained significant level ($p<\alpha=0.05$), the hypothesis that there is relationship between gender and uncertainty was approved. By

attention to the average of obtained uncertainty scores, the females had better performance in the presentation stage.

Table 3: Relationship between gender and average of uncertainty scores in information search stages

Kuhlthau model stages	Female average	Male average	P-value
Initiation	22.17	22.10	0.84
Selection	26.21	25.36	0.09
Exploration	24.83	24.29	0.37
Formulation	29.87	30.53	0.15
Collection	21.93	22.10	0.56
Presentation	26.61	26.93	0.005

The next factor is to study the relationship between education level and the average of uncertainty scores in the Kuhlthau model. 222 participants were studying in M.Sc. degree and 41 participants were studying in Ph.D. degree. In the selection stage, there was significant relationship between educational level and the average of users' uncertainty scores. This mean that the students' education level was effective on the uncertainty feeling in this stage. By attention to the average of uncertainty scores in M.Sc. students compared with Ph.D. students (Table 4), so Ph.D. students had been better in the selection of research title and had higher certainty about their selected titles. The education level had positive effect more on the participants' performance in selecting research title.

Table 4: Relationship between education level and average of uncertainty scores in information search stages

Kuhlthau model stages	M.Sc. average	Ph.D. average	P-value
Initiation	22.20	21.92	0.46
Selection	26.25	24.97	0.019
Exploration	24.91	23.74	0.067
Formulation	29.98	30.07	0.84
Collection	21.88	22.41	0.108
Presentation	25.75	26.46	0.165

The average age of students studying in graduate levels of KUMS was 27 years. Pearson correlation coefficient used to study the relationship between age and uncertainty.

Table 5: Relationship between age and average of uncertainty scores in information search stages

	Initiation	Selection	Exploration	Formulation	Collection	Presentation
Pearson coefficient	-0.02	-0.14	-0.19	-0.01	0.11	0.15
P-value	0.7	0.02	0.002	0.84	0.07	0.01

There was an inverse significant relationship between selection stage and age. On the other hand, age had effects on the selection stage. This mean that the participants' performance decrease with increase in age in the selection stage.

Table 6: Relationship between experience and average of uncertainty scores in information search stages

Stages of Kuhlthau model	The number of articles	Average	Standard deviation	P-value
Start	Without articles	21.87	2.36	0.059
	1-3 articles	22.29	2.04	
	4-6 articles	23.31	1.85	
	More than 6 articles	22.71	2.52	
Selection	Without articles	26.41	3.03	0.048
	1-3 articles	25.94	3.35	
	4-6 articles	24.25	3	
	More than 6 articles	25.37	2.06	
Exploration	Without articles	26.41	3.03	0.006
	1-3 articles	25.94	3.35	
	4-6 articles	24.25	3	
	More than 6 articles	25.37	2.06	
Formulation	Without articles	30	2.84	0.25
	1-3 articles	29.69	2.8	
	4-6 articles	31.18	3.74	
	More than 6 articles	30.42	2.17	
Collecting	Without articles	21.98	1.85	0.99
	1-3 articles	21.92	1.94	
	4-6 articles	22	2.19	
	More than 6 articles	22	1.66	
Presentation	Without articles	25.69	2.79	0.01
	1-3 articles	25.55	2.89	
	4-6 articles	27.81	3.97	
	More than 6 articles	27.14	2.95	

There was an inverse significant relationship between the exploration stage and age. This mean that age has a positive effect on exploration stage. On the other hand, in the exploration stage, the participants' performance decreased with age increasing.

By attention to $p<\alpha=0.05$ in the selection stage, the significant relationship between experience and uncertainty is approved. The experience help students to select their titles with higher certainty and self-confidence.

By attention to $p<\alpha=0.05$ in the follow up stage, the significant relationship between experience and uncertainty is approved. The students with previous experience in writing articles or research

activities had lower uncertainty in this stage of study.

By attention to $p<\alpha=0.05$ in the presentation stage, the significant relationship between experience and uncertainty is approved. The experiences help students to practice in calm, peace of mind and certainty in the time of research presentation.

DISCUSSION

The results indicate that the students have uncertainty when start searching their needed information. The study of Narmenji and Nowkarizi on users' feelings indicated that contrary to Kuhlthau model, the participants feel confidence at the beginning of study [36].

On the basis of second hypothesis, the users when select their considered title during information search process, feel optimistic and less likely feel uncertainty. The students' feelings were in accordance with Kuhlthau model. The study of Narmenji and Nowkarizi had similar results [36]. Hyldegard stated that the group members, in the starting stage, indicated the cognitive experience similar to that in information search process [15].
About the third hypothesis, in accordance with the expected feeling in the Kuhlthau model, the users had increasing uncertainty. Kuhlthau stated that, in the third stage, the users' feelings like confusion, uncertainty and doubt are continuously increasing [29]. Narmenji and Nowkarizi also drew similar conclusions in their review [36]
.
The results obtained from the fourth hypothesis were in accordance with Kuhlthau model. On the other hand, the users' uncertainty and doubt have decreased. Kuhlthau has stated that formulation is a turning point in the information search process. So that, in this stage, self-confidence increased, confusing decreased and interest intensified [29]. The Hyldegard results in this stage was in contrary with Kuhlthau model [15]. So that in the follow up stage, as Kuhlthau has stated it as a turning point, negative feelings have not been replaced with positive feelings like transparency. Narmenji and Nowkarizi indicated that users' certainty have increased compared to the first stage [36].

About the fifth hypothesis, the students' information search behavior was in accordance with Kuhlthau model, the users doubt and uncertainty decreased and their self-confidence increased continuously. Kuhlthau has stated about the users' feelings in this stage that self-confidence increase continuously and because of interest to the progress, uncertainty decrease [29]. The users have clear thoughts about their needs. Narmenji and Nowkarizi obtained similar results about users' feelings in the collecting stage [36].

The results of the sixth hypothesis indicated that the users, in accordance with Kuhlthau model, feel calm at the time of presentation. Hyldegard stated that uncertainty and hopelessness still feel by the group members at the end of project period [15]. Kuhlthau said that the sense of comfort is common along with the sense of satisfaction (Kuhlthau, 1991). The results of Narmenji and Nowkarizi is also similar to the Kuhlthau model [36].

The seventh hypothesis explore the relationship between uncertainty and demographic factors. The study indicated that gender don't have any effect on the starting, selection, follow up, formulation and collection stages. In the presentation stage, the gender was not effective on uncertainty. By attention to the obtained uncertainty scores, females had a better performance in the presentation of obtained information. Chowdhury stated that formulation of search term cause uncertainty in men higher than women. In other activities, women had higher uncertainty than men [9]. In another study, Chowdhury et al. concluded that the activities like stating the research question, decision making about the time of search and using founded cases were the main causes of uncertainty among women and men [37, 38]. Selection of information channels and suitable sources cause uncertainty more among women. Other studies stated that there is no relationship between uncertainty and gender [30,31].

CONCLUSION

The study indicated that students of KUMS feel uncertainty in different stages of information search process. To meet uncertainty problem in the starting stage, the students consulted with professors, informed people and librarians or search in the information resources.

In the selection stage, the students felt lower certainty and higher optimistic feelings. By increasing in age, the students' performance decreased. The students with previous experience in the research activities had lower uncertainty.

In the follow up stage, the obtained results were similar to the Kuhlthau model. The students' uncertainty has increased in facing with different information resources. The students' age was effective on the results of this stage. So that by age increasing, their performance decreased. The students with previous experience in the research activities search literature with higher certainty in this stage. Formulation stage, as a milestone in the Kuhlthau, repeated among the students of KUMS. The users' uncertainty decreased in this stage and replaced with certainty and optimism. The participants with different age groups and different experience levels in research activities and writing articles had same performance.

In the collecting stage, uncertainty has been decreased and confidence has been increased. When the participants make sure about accuracy and relevance of the gathered data, their interest increased in the subject under study. Such as previous stage, age and experience had no meaningful effect on participants' performance.
In the presentation stage, the results were similar to the Kuhlthau model. The students felt calm and certainty during presentation of gathered information. Higher experience helped to the better presentation. Increasing in age was also effective on performance reduction and increase in uncertainty.

Among Kuhlthau model stages, only gender had effects on the participants' presentation type. Women had higher confidence and lower certainty in this stage. The education level had positive effect only on the stage of title selection. The Ph.D. students had higher certainty and confidence than M.Sc. students in selecting their study title.

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Conflict of Interest
There is no conflict of interest to be declared.

Authors' contributions
All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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