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An Investigation on University Students' Online Information Search Strategies and Relationships with Some Educational Variables*

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ABSTRACT: The purpose of this study was to determine graduate and undergraduate students' online information search strategies (OISS) and their relationships with some educational variables. For this purpose, survey method was used. Participants of this research were 1006 undergraduate and graduate students from Turkey who filled the online survey. For measuring students' OISS, "Online Information Search Strategies Inventory" was utilized. Results showed that students level of OISS development were intermediate. Students reported most confident in "control" strategy which included skills for manipulating the online applications. Moreover, the results indicated that students were least confident about developing a skill to avoid disorientation. The causes of disorientation even though students knew how to use Internet for searching, were investigated by examining the interactions between strategies. The findings revealed that disorientation was mostly linked to problem solving. Additionally, it was concluded that students, who were confident in metacognitive information search behavior, were also confident in other information search skills. Considering GPA, the study results showed that students with high GPA tended to have better OISS than those who had low GPA. It was also found that OISS changed with education level, major and required online information search for school work. Limitations and future studies were discussed.

Keywords: Online information search strategies, disorientation in online environments, level of education, grade point average

1. INTRODUCTION

It can be said that the Internet has become the first preferred medium as a source of information, especially in areas where access is provided. Studies showed that the internet use enriches the educational processes, offers rich experiences to the teachers and students, and has positive effects on academic self-efficacy and achievement (Akkoyunlu & Yılmaz, 2005; Jackson, von Eye, & Biocca, 2003; Jackson, von Eye, Biocca, Barbatsis, Zhao, & Fitzgerald, 2006; Tsikalas, Lee, & Newkirk, 2007; Zhu, Chen, Chen, & Chern, 2011). On the other hand, the Internet has an aspect that makes it difficult to use it for improving learning outcomes in educational processes. The Internet can be used in a wide variety of environments therefore it is an available environment for manipulating any kind of information. Today there are countless Web sites of all kinds. Over 4 billion Internet users (Internet World Stats, 2018) can upload any information to the Internet. Accessing information on the Internet, selecting the information needed, and obtaining reliable and qualified information is often a challenging process, as users can add, change, and share information. Even many years before the Web 2.0 stream, when the rapidly multiplying of information on the Internet started, Debowski (2001) and Marchionini (1995) emphasized that using an open environment such as the Internet to search for information is a challenging and complex process, especially for novice users. The most common problem in internet search is "disorientation". Dias, Gomes, and Correia (1999) and

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Tsai (2009) have pointed out that individuals often do not know what they are doing, where they are, or where to go when searching for information on the Internet and this causes disorientation. Another problem is that the necessary information can be obtained from this medium which contains as much information as to cause loss.

Users grapple with "information bombardment" during online search because of increasing amount of information in the environment (Hölscher & Strube, 2000). Users need to be able to access and decide whether the information they reach through this information bombardment is reliable. Kurt and Emiroğlu (2018) emphasized that it is important for the students to decide on the adequacy, reliability and relative quality of the acquired information, as well as the search and access of information on the Internet that they use as a primary source of information for their homework, projects and presentations. If they are not prepared to critically evaluate the online information, they are apt to be duped by false claims and misleading arguments (McGrew, Breakstone, Ortega, Smith, & Wineburg, 2018). Search strategies come to users help.

Strategies that individuals use to conduct an effective and efficient online search have a critical importance (Aşkar & Mazman, 2013; Çoklar, Yaman, & Yurdakul, 2017; Hill, 1999; Hill & Hannafin 1997; Tsai, 2009; Tsai & Tsai, 2003; Tu, Shih, & Tsai, 2008). Considering that the level of development and use of online information search strategies (OISS) influences effort, time and efficiency of the search process, which in turn impacts users learning performance, it is meaningful to study this. In this framework, this study investigated students' OISS and their relations with some educational variables.

1.1. Theoretical framework

Gagne (1985) stated that information search strategies, like cognitive strategies, are techniques and processes designed to help and manage a process. Information search strategies involve the purposeful and systematic management of all variables that can influence the information search. OISS can be defined as the way of purposefully and systematically managing all the variables that can be used when searching for information in the online environment.

Hill (1999) emphasized that the search for information on the Internet is a process that is far more complex and confusing than the search in traditional e-information systems. While e-information systems leave the user in a passive state after receiving keywords to provide the desired information, the user participates. Internet search all along the process. Advanced search engines help users in various ways to find what they search, but in the semi-structured environment like internet users have to work for finding needed information. For example, when people use advanced search engines, they have to generate related keywords for query, then compare results to what they wanted. If the search engine does not provide the needed information, the search process becomes even more complex. In this case, people need to review their queries by modifying, adding and/or removing new keywords, and possibly changing their search strategies (Chevalier, Dommes, & Marquié, 2015).

1.1.1. The user related factors affecting online information search

Individual characteristics determine people’s information search strategies and processes. Gender, education, experience, self-efficacy, system knowledge, and cognitive structures were noted as major factors impacting online information search (Hill, 1999; Hill & Hannafin, 1997; Tsai, 2009; Tsai & Tsai, 2003). According to Hill and Hannafin (1997), students with a low level of metacognitive awareness tended to think linearly in places where they were directed. The learners with high level of metacognitive awareness had divergent thinking and multifaceted point of view. While learners with a low self-efficacy level did not feel comfortable with their ability to use the system, learners with high self- efficacy were

comfortable with the system and were eager to try new systems. Learners with low on system knowledge and experience could be experienced computer users, but probability of their use of a particular system to search for information is scarce. Learners with extensive system knowledge and experience not only use the system's tool according to their design, but also use them in different ways, While the learners with limited subject knowledge are at a level of novice or simple understanding of the area, learners with a sufficient knowledge are at a high level of understanding and act according to their expertise.

The conditions of the environment influence the cognitive processes. These conditions also change and control skills to be used in the environment (Fischer, 1980). When the search environment is online, the individual develops search skills according to the characteristics of the online environment. In this context, the perception of orientation corresponds to the awareness of position within the system, the necessary strategies and actions. While learners with a low level of orientation awareness experience the "disorientation in hyperspace ", learners with high orientation awareness are cognizant of where they are in the search process, how they got there, and how they could go to their previous positions in the system (Hill & Hannafin, 1997). Hill (1999) stated that the level of user control (low-high) causes significant changes. The sense of orientation adaptation encompasses the ability to orient the environment and allows the user to perform controlled search in the system. By this means, the user can develop various search strategies. In the case of inadequacy of the orientation skill, users frequently encounter with the disorientation problem (Dias, Gomes, & Correia, 1999; Tsai, 2009). Frequent disorientation during a search may cause dissatisfaction with the search process, discourage research, and reduce the belief in success (Beasley & Waugh, 1995).

Education influences how people see and understand the environment they are in. It is expected that students who are educated in different fields and have different education levels, would have distinct information search behaviors, because the level of search skills would be different (Whitmire, 2002). Wang (2006) stated that field of study have decisive effects on students' views on information providing services, the level of use of these services, and on their information seeking behaviors.

1.1.2. Determining and Measuring OISS

There have been plenty studies done in order to determine the OISS according to certain features. While some studies investigated these strategies to in the frame of recognizing and orienting the system, others considered that metacognitive knowledge was also effective in the process of searching online information, and when they determined the strategies, they acted in this direction. In other words, some studies focused on the way in which information was acquired online regardless of the nature of the information (Navarro-Prieto, Scaife, & Rogers, 1999), some focused on evaluating information, regardless of the way in which it was acquired (Tsai, 2004), while others considered both acquiring the information and evaluating its nature (Thatcher, 2006; Tsai & Tsai, 2004).

Navarro-Prieto, Scaife and Rogers (1999) examined individuals' online information search strategies based on the behavior of the individuals during the search and the information they give verbally in a total of three dimensions: a) top-down strategy, b) bottom-up strategy, c) mixed strategy. They examined online information search strategies in terms of their ability to control the system and no high-level knowledge searching skills were discussed. In another study, Tsai (2004) examined the strategies and interpretation standards of individuals on the Web. According to Tsai, information seeking strategies and interpreting standards of individuals are both linked and shaped by the epistemological beliefs of the individual because they both contain the nature of knowledge and value judgments. During the interviews with the participants, Tsai took opinions about how they use strategies to search for information from the Internet and how they use standards when evaluating their knowledge. According to the study,

the process of searching for information online is a process that involves searching and evaluating information. Tsai described online search strategies as an explicit component and evaluation standards as implicit components. Under the explicit component, two online information search strategies, elaboration and match, are defined. These are strategies that users use when searching for information online, and these two strategies are functionally opposite strategies. Under the implicit component there are two evaluation standards, which are defined as accuracy standards and usability standards, and two sub-factors below them. According to the definitions made by Tsai (2004), it is observed that the individual's system control and disorientation in the environment is not taken into consideration and the information searching process is more focused on metacognitive processes.

Tsai and Tsai (2003) conducted a study on determining the strategies that were being used in the process, based on user behaviors - shaped by information search stages in Hill's theoretical framework (1999). In this study, participants were asked to think aloud when they were searching for information. Researchers identified OISS as the end result of protocol analysis and observation of motor skills. In this study, online search strategies covered three areas of skill: behavioral, procedural and metacognitive. The "behavioral domain" consisted of control and disorientation strategies, and involved the behavior of individuals towards their basic navigation and manipulation on the Internet. The focus of behavioral domain strategies was the ability to manage the system by adapting to the information system. The "procedural domain", which included trial & error and problem-solving strategies, reflected users' general approach to search for content on the Internet. The focal point of the procedural domain strategies was the ability of the user's desirably solving and completing the process when user encountered any problem in the process. The "metacognitive domain" reflected the users' self-control and high-level search behavior, including purposeful thinking, select main ideas and evaluation strategies. Metacognitive domain strategies were higher-level strategies than the others, and they focused on consciously evaluating and managing search behavior and the output.

Toward this conceptual framework of Tsai and Tsai (2003), Tsai (2009) developed a valid and highly reliable measurement tool that measures individuals' OISS with well-designed items. In this study we used this tool since it is valid, reliable and appropriate to collect data from large samples.

1.2. Purpose

The purpose of this study was to determine the OISS of students and to examine their relationships with some educational variables. Online information search requires cognitive and physical effort. Every individual who searches online utilize information search strategies that are managed by their own cognitive processes, whether they are aware or not. However, there are differences among people in terms of awareness of utilizing these strategies and/or the degree of having a conscious and consistent strategy set. These differences influence how far and how quickly users can navigate through the stages of online information search. In this respect, it is important to be aware of OISS and use of these skills during online information search, in terms of time spent and the efficiency of the search. The high efficiency of the search process increases the suitability of the information and its quality.

In that case, we can say; one of the conditions for the effective existence of individuals in the unlimited Internet world in terms of information diversity is related with having developed effective information search strategies. Developing students' effective information search strategies is one of the main responsibilities of education. This study also makes it possible to reach some answers on how well education fulfills this responsibility.

This study investigated students' OISS and their relations with the level of education, their major, the GPA (Grade Point Average), and amount of required online information search for their school work.

1.3. Research Questions

The research questions of this study were as follows:

1. How are distribution of students' online information search strategies levels?

2. Do students' online information search strategies differ significantly according to the level of education?

3. Do students' online information search strategies differ significantly according to the major?

4. Do students' online information search strategies differ significantly according to the GPA?

5. Do students' online information search strategies differ significantly according to the amount of required online information search for their school work?

2. METHOD

Survey method was used in this study. The purpose of surveys was to describe the characteristics of a population. In essence, what researchers wanted to find out was how members of a population distributed on one or more variables (Fraenkel & Wallen, 2009).

2.1. Participants

One thousand and six graduate and undergraduate students from various ages and private/public universities in Turkey in 2016 volunteered to fill the scale in the digital environment. Social media tools, individual messages and e-mails were used to reach the participants. Therefore, it can be said that participants were formed by random, but partly convenient sampling. According to Fraenkel and Wallen (2009) random sampling was the best choice for choosing a representative sample that sampling probability was equal and independent for each member in a community, and convenient sampling method could be used for selecting a sample that was easily accessible and suitable for research.

When groups were selected, the score of the one with the lowest GPA among the participants was subtracted from the score of the participant with the highest GPA and the middle point of the difference was used as a cut-off point. Thus, participants with GPA above 2,55 were allocated to high GPA group while others were allocated lo low GPA group. CEIT (Computer Education and Instructional Technology) students' training process is mainly about learning of information technologies and using them effectively and teaching them in learning environments. Their academic work often requires information from the Internet, so they experience more objective searches on the Internet than students in other education departments. Students who study in education department of Turkish, Mathematics, Science, Primary School, Early Childhood, Measurement and Evaluation, and Psychological Counseling and Guidance were considered in the "Other" category. These were majors that require less objective Internet experience than the CEIT. Distribution of major, education level, GPA, amount of required online information search were displayed in Table 1.

Table 1: Information related to the participants

Variables	Options	f	%
Level of education	Undergraduate	796	79.1
	Graduate	210	20.9
Major	CEIT	381	37.87
	Others	625	62.13
GPA	Under 2.55	266	26.4
	Above 2.55	740	73.6
Required online information search by school works	Low	156	15.5
	Intermediate	572	56.9
	High	277	27.5
Total:		1006	100

2.2. Measurement Tools

Two online tools were used in the survey data collection process. These tools were "Demographic Questionnaire" and "Online Information Search Strategy Inventory (OISSI)".

2.2.1. Demographic questionnaire

The demographic questionnaire consisted of four questions including participants' level of education, their major, GPA, and the required online information search their school works.

2.2.2. Online information searching strategy inventory (OISSI)

Developed by Tsai (2009) and adapted to Turkish by Aşkar and Mazman (2013), the OISSI was used to identify individuals' OISS. The inventory examines OISS' in three domains: behavioral, procedural, and metacognitive.

Behavioral domain includes "control" and "disorientation" strategies, while procedural domain consists of "trial & error" and "problem solving" strategies, and metacognitive domain encompasses "purposeful thinking", "select main ideas" and "evaluation" strategies. Inventory consists of 3 domains, 7 sub factors and 25 items in total. It measures each item by a 6-likert scale, ranging from ''not like me at all" to ''very much like me". The lowest possible score to be obtained from inventory is 25 and the highest score is 150. The high scores indicate that the relevant sub-factors, domain and total measured strategies are developed/mature. OISSI includes five reverse coded items namely: 1, 2, 14, 20 and 25.

A confirmatory factor analysis was conducted to verify whether the factors defined at the OISSI could be verified for the data of this study. The 25-item and 7 sub-factor were examined with Lisrel 8.7 program.

The analyses confirmed the seven factorial structure of the scale. $\chi 2$ value was found to be 1547.1, and the degree of freedom was found to be 252. $\chi 2$ / sd ratio was 6.139 ($p < .05$). There were a wide variety of studies on fit indexes used in confirmatory factor analysis, but since these indexes did not always produce consistent results, there have been disagreements about the best fit index, so it has been emphasized to report at least 3 or 4 indexes (Schermelleh-Engel, Moosbrugger, & Müller, 2003). The results of the goodness of fit indexes obtained from the confirmatory factor analysis of the OISSI conducted by this study were given in Table 2.

Table 2: Models index values with acceptable and good fit index values

Fit İndexes	Model Value	Acceptable Fit	Good fit
RMSEA	.07	$.05 < RMSEA \leq .08$	$0 \leq RMSEA \leq .05$
NNFI	.97	$.90 \leq NNFI \leq .95$	$.95 \leq NNFI \leq 1.00$
NFI	.97	$.95 \leq NFI < .97$	$97 \leq NFI \leq 1.00$
CFI	.98	$.95 \leq CFI < .97$	$.97 \leq CFI \leq 1.00$
SRMR	.06	$.05 < SRMR \leq .10$	$0 \leq SRMR \leq .05$
AGFI	.86	$.85 \leq AGFI < .90$	$.90 \leq AGFI \leq 1.00$

It was seen that at least four of the values obtained from the model were acceptable or had excellent compatibility when compared to the good fit values and acceptable fit values (Schermelleh-Engel, Moosbrugger, & Müller, 2003) given in Table 2.

The internal consistency coefficient (Cronbach alpha) of the scale was .93, the internal consistency coefficients of subscales: control, disorientation, trial & error, problem solving, purposeful thinking, selecting main ideas and evaluating were .84, .84, .74, .42, .83, .84 and .83, respectively. On the original scale (Tsai, 2009), these scores were found to be .74, .88, .82, .64, .79, .75 and .79, respectively and the internal consistency coefficient of the scale was .91.

2.2.2.1. Interaction between sub-factors of OISSI

A correlation analysis was performed to determine the relationships between subscales of the OISSI to help better understand the results. The results of the correlation analysis given in Table 3 showed that there was a significant positive correlation at .01 between all the subscales of the scale.

Table 3: Correlations between sub-factors of OISSI

Strategies	Correlations						
	Control	**Disorientation**	**Trial & error**	**P. Solving**	**P. Thinking**	**Select main ideas**	**Evaluation**
Control	1	.16**	.73**	.67**	.74**	.74**	.82**
Disorientation		1	.13**	.44**	.08**	.10**	.14**
Trial & error			1	.59**	.70**	.71**	.72**
Problem Solving				1	.66**	.61**	.69**
P. Thinking					1	.77**	.79**
Select main ideas						1	.75**
Evaluation							1

** p<.01

In order to understand which strategies are most effecting the disorientation strategy, which is the ability to overcome the most frequently encountered problem in searching online information according to the literature, the prediction of the disorientation strategy by other strategies was examined. A linear regression analysis was performed for this purpose and the obtained data are given in Table 4.

Table 4: Linear Regression Coefficients Predicting Disorientation

	B	**SE**	**β**	**Adjusted R^2**	**F**
Control	-.046	.073	-.033	.265	61.441
Trial & Error	.040	.079	.022		
Problem Solving	1.501	.083	.713***		
P. Thinking	-.384	.074	-.265***		
Select main ideas	-.097	.089	-0.53		
Evaluation	-.126	.80	-.089		

***p<0.001

Table 4 shows that the problem solving strategy significantly and positively predicts disorientation strategy while the purposeful thinking strategy negatively predicts it. The effects by the rest of the strategies are not statistically meaningful.

2.3. Data analysis

The data was collected online and the Google Forms service was used to collect the data. The scales were then applied via social networking platforms, where both undergraduate and graduate students were located, as well as through individual messages and emails. 1006 questionnaires were taken into the study.

If the degree of skewness and kurtosis of the data is in the range of +1.5 to -1.5, the distribution is considered normal (Tabachnick & Fidell, 2013). Prior to the analysis of the data, normality tests were performed and the skewness coefficient of the data was found to be -0.38 and kurtosis coefficient was found to be -0.47. Since this value was within the acceptance range, it was assumed that the distribution was normal and data analysis was started. Descriptive statistics were used for the analysis of the data. In addition to these, correlation analysis was used to determine relations among sub-factors; independent t-test was used for second, third and fourth research questions. One-way analysis of variance (ANOVA) and post-Hoc Scheffe test were used for the fifth research question.

3. FINDINGS

3.1. Distribution of Students' OISS

Table 5: Descriptive values of students' OISS

	N	Number of items	Min	Max	M	SS	Item average
OISS Total Score	1006	25	37	150	107.48	23.97	4.30
Behavioral	1006	8	10	48	32.26	8.90	4.03
Procedural	1006	6	8	36	26.10	6.16	4.35
Metacognitive	1006	11	11	66	49.12	12.01	4.47
Behavioral							
Control	1006	4	4	24	18.26	4.88	4.57
Disorientation	1006	4	4	24	14.00	6.72	3.50
Procedural							
Trial & error	1006	3	3	18	13.45	3.72	4.48
Problem solving	1006	3	3	18	12.65	3.19	4.22
Metacognitive							
Purposeful Thinking	1006	4	4	24	17.70	4.63	4.43
Select main ideas	1006	3	3	18	13.65	3.64	4.55
Evaluation	1006	4	4	24	17.78	4.75	4.45

Considering the lowest possible obtainable score from the scale could be 25, and the highest could be 150, it can be said that students were moderate since the average scores was 107.48. Behavioral strategies are essential skills to provide basic Internet browsing and system manipulation; the students' scores showed that their skill level was moderate. Procedural strategies reflect the ability to develop and change search approaches on the Internet when necessary. The moderate level of scores indicated that students reported having average level of these skills. Metacognitive strategies enable demonstrating self-control and high-level information search behavior during the online information search process. The scores indicated that, like behavioral and procedural strategies, students reported having moderate level of skills in metacognitive strategies.

The control strategy from behavioral strategies is the ability to manipulate search applications on the Internet and the disorientation strategy points out the user's awareness of their own search orientation. The scores obtained from the control strategy were higher than the scores obtained from the strategy of disorientation. According to these scores, participants with undergraduate and graduate degrees often experienced disorientation in the system despite having moderate skills in system control.

The trial & error strategy of procedural strategies is the ability to show different search approaches, and the problem solving strategy is the skill and commitment to overcome problems or difficulties in the search process. Results showed that participants had higher scores on trial & error strategy than the problem solving.

Purposeful thinking strategy, from metacognitive strategies is the ability to manage self-monitoring and process intention in the search process, select main ideas strategy is the ability to identify the basic concepts of the information sought on the Internet and the evaluation strategy is necessary skills to organize and evaluate the information obtained from the Internet. Students' scores were close for all three strategies. It could mean that participants scored moderately competent in high-level information search behavior.

3.2. Differentiation of OISS according to "level of education"

Table 6: t-tests of students' OISS between education levels (Undergraduate= 796, Graduate=210, domains)

	Level	M	SD	t	p
Behavioral	**Under-Graduate**	29.47	7.67	-19.19	.00*
	Graduate	41.83	5.31		
Procedural	**Under-Graduate**	24.59	6.15	-10.19	.00*
	Graduate	30.18	5.03		
Metacognitive	**Under-Graduate**	46.88	12.87	-6.93	.01*
	Graduate	54.61	9.80		

* p<.05

Table 6 shows that academic degree level was an important variable in three domains of OISS (behavioral (t = -19.19), procedural (t = -10.19) metacognitive (t = -6.93)). There was a significant difference in favor of graduate students.

When Table 7 was examined, it was seen that in all sub factors of OISS there was a significant difference in favor of graduate students.

Table 7: t-tests of students' OISS between education levels (Undergraduate= 796, Graduate=210, sub-strategies)

		Level	M	SD	t	p
Behavioral	**Control**	**Under-Graduate**	17.48	4.92	-7.55	.00*
		Graduate	20.73	3.83		
	Disorientation	**Under-Graduate**	11.99	5.87	-19.94	.00*
		Graduate	21.10	3.06		
Procedural	**Trial & Error**	**Under-Graduate**	12.71	3.97	-7.48	.00*
		Graduate	15.25	2.92		
	Problem Solving	**Under-Graduate**	11.88	3.02	-10.86	.00*
		Graduate	14.93	2.73		
Metacognitive	**Purposeful Thinking**	**Under-Graduate**	16.90	5.11	-5.61	.00*
		Graduate	19.38	3.87		
	Select Main Ideas	**Under-Graduate**	12.96	3.97	-5.71	.00*
		Graduate	14.90	2.93		
	Evaluation	**Under-Graduate**	17.02	4.82	-7.75	.00*
		Graduate	20.33	3.90		

*p<.05

3.3. Differentiation of OISS according to "major"

Table 8: t-tests of students' OISS between majors (CEIT = 381, Other = 625, domains).

	Major	M	SD	t	p
Behavioral	**CEIT**	36.52	7.95	12.77	.00*
	Others	29.66	8.45		
Procedural	**CEIT**	27.91	5.65	7.67	.00*
	Others	24.99	6.20		
Metacognitive	**CEIT**	52.54	10.69	7.46	.00*
	Others	47.04	12.30		

* p<.05

Table 8 showed that the major was also an important variable for OISS (behavioral (t = 12.77), procedural (t = 7.67), metacognitive (t = 7.46)). There was a significant difference in

favor of CEIT (Computer Education and Instructional Technology) students, compare to students studying different majors (Turkish, mathematics, science, class, early childhood education, measurement and assessment and psychological counseling and guidance).

Table 9: t-tests of students' OISS between majors (CEIT = 381, Other = 625, sub-strategies).

		Major	M	SD	t	p
Behavioral	**Control**	**CEIT**	20.03	4.23	9.72	.00*
		Others	17.18	4.95		
	Disorientation	**CEIT**	16.49	6.38	9.58	.00*
		Others	12.48	6.47		
Procedural	**Trial & Error**	**CEIT**	14.07	3.39	4.31	.00*
		Others	13.07	3.87		
	Problem Solving	**CEIT**	13.84	2.94	9.69	.00*
		Others	11.92	3.13		
Metacognitive	**Purposeful Thinking**	**CEIT**	18.84	4.09	6.45	.00*
		Others	17.01	4.80		
	Select Main Ideas	**CEIT**	14.39	3.30	5.31	.00*
		Others	13.19	3.77		
	Evaluation	**CEIT**	19.30	4.13	8.55	.00*
		Others	16.85	4.87		

*p<.05

Table 9 showed that, in all sub factors of OISS were significantly different in favor of the CEIT students.

3.4. Differentiation of OISS according to "GPA"

Table 10: t-tests of students' OISS between GPA's (under 2.55 = 266, above 2.55 = 740, domains).

	Major	M	SD	t	p
Behavioral	**Under 2.55**	28.35	8.25	-6.87	.00*
	Above 2.55	33.66	8.71		
Procedural	**Under 2.55**	23.36	6.18	-8.74	.00*
	Above 2.55	27.08	5.86		
Metacognitive	**Under 2.55**	43.68	11.77	-8.95	.00*
	Above 2.55	51.08	11.49		

*p<.05

Table 10 showed that GPA was an important variable in terms of three domains of OISS (behavioral (t = -6.87), procedural (t = -8.74), metacognitive (t = -8.95)). There was a difference between students with low and high GPA. Students with high GPA (above 2.55) had better scores than student with low GPA (under 2.55) across all the sub-scales.

Table 11: t-tests of students' OISS between GPA's (under 2.55 = 266, above 2.55 = 740, sub-strategies)

		GPA	M	SD	t	p
Behavioral	**Control**	**Under 2.55**	16.06	5.02	-8.52	.00*
		Above 2.55	19.05	4.59		
	Disorientation	**Under 2.55**	12.29	5.77	-5.33	.00*
		Above 2.55	14.61	6.93		
Procedural	**Trial & Error**	**Under 2.55**	11.94	3.79	-7.72	.00*
		Above 2.55	13.99	3.55		
	Problem Solving	**Under 2.55**	11.43	3.09	-7.45	.00*
		Above 2.55	13.09	3.12		
Metacognitive	**Purposeful Thinking**	**Under 2.55**	15.64	4.56	-8.76	.00*
		Above 2.55	18.44	4.43		
	Select Main Ideas	**Under 2.55**	12.29	3.74	-7.00	.00*
		Above 2.55	14.13	3.49		
	Evaluation	**Under 2.55**	15.74	4.80	-8.41	.00*
		Above 2.55	18.51	5.52		

*p<.05

Findings of sub-factors are given in Table 11. The table demonstrated that compare to low GPA students; high GPA students obtained higher scores in all sub factors of OISS.

3.5. Differentiation of OISS according to "required online information search by academic works"

Table 12: ANOVA and Scheffe tests of students' OISS between information search requirement levels (domains).

	Major	n	M	SD	F	p	Scheffe
Behavioral	**Low**	156	26.35	7.37	137.70	.00*	L1<L2<L3*
	Intermediate	572	30.86	8.04			
	High	278	38.44	7.88			
Procedural	**Low**	156	21.63	6.22	101.12	.00*	L1<L2<L3*
	Intermediate	572	25.67	5.60			
	High	278	29.48	5.33			
Metacognitive	**Low**	156	41.54	12.47	75.37	.00*	L1<L2<L3*
	Intermediate	572	48.34	11.38			
	High	278	55.00	10.05			

*p<.05, MBeh = M Behavioral, MPrc = M Procedural, MMtc = M Metacognitive, L1 = Level 1 (Low), L2 = Level 2 (Intermediate), L3 = Level 3 (High).

The results of the analysis in Table 12 showed that OISS scores differed in all domains (behavioral F=137.70, p=.00, procedural F=101.12, p=.00, metacognitive F=75.37, p=.00). The average OISS score of students in majors requiring high-level online information search was significantly higher than the other students' in all domains (MBeh=38.44, MPrc=29.48, MMtc=55.00).

The OISS averages of students, who need to do intermediate level of online search (MBeh=30.86, MPrc=25.67, MMtc=48.34), were significantly higher than the students, who are required low level online information searches (MBeh=26.35, MPrc=21.63, MMtc=41.54).

Table 13: ANOVA and Scheffe tests of students' OISS between information search requirement levels (sub-strategies).

		Level	n	M	SD	F	p	Scheffe
Behavioral	**Control**	**Low**	156	14.95	5.14	83.42	.00*	L1<L2<L3*
		Intermediate	572	17.98	4.62			
		High	278	20.71	3.92			
	Disorientation	**Low**	156	11.40	5.59	71.02	.00*	L1<L2<L3*
		Intermediate	572	12.89	6.35			
		High	278	17.73	6.54			
Procedural	**Trial & Error**	**Low**	156	11.22	3.98	57.46	.00*	L1<L2<L3*
		Intermediate	572	13.32	3.55			
		High	278	14.97	3.20			
	Problem Solving	**Low**	156	10.41	2.97	106.53	.00*	L1<L2<L3*
		Intermediate	572	12.35	2.91			
		High	278	14.51	2.84			
Metacognitive	**Purposeful Thinking**	**Low**	156	15.19	4.88	49.45	.00*	L1<L2<L3*
		Intermediate	572	17.50	4.46			
		High	278	19.53	4.06			
	Selecting Main Ideas	**Low**	156	11.54	3.99	54.55	.00*	L1<L2<L3*
		Intermediate	572	13.50	3.51			
		High	278	15.13	3.02			
	Evaluation	**Low**	156	14.80	4.82	86.26	.00*	L1<L2<L3*
		Intermediate	572	17.34	4.49			
		High	278	20.35	3.92			

*p<.05, MCnt = M Control, MDis = M Disorientation, MT&E = M Trial & Error, MPrb = M Problem Solving, MPT = M Purposeful Thinking, MSMI = M Selecting Main Ideas, MEva = M Evaluation, L1 = Level 1 (Low), L2 = Level 2 (Intermediate), L3 = Level 3 (High).

Table 13 demonstrated that the score of the students in departments, requiring high online search (MCnt=20.71, MDis=17.73, MT&E=14.97, MPrb=14.51, MPT=19.53, MSMI=15.13, MEva=20.35), was higher than the others.

The average score of the students studying in the areas requiring intermediate level information search (MCnt=17.98, MDis=12.89, MT&E=13.32, MPrb=12.35, MPT=17.50, MSMI=13.50, MEva=17.34) was found to be significantly higher than the average scores of the students studying in areas requiring low level information search (MCnt=14.95, MDis=11.40, MT&E=11.22, MPrb=10.41, MPT=15.19, MSMI=11.54, MEva=14.80).

4. DISCUSSION and RESULTS

4.1. Students' OISS

It seemed as a remarkable finding that the highest score was obtained from the control strategy, and the lowest score was obtained from the disorientation strategy, which were the sub-strategies of the same domain. This finding suggested that students could not avoid systemic disorientation, although they considered themselves adequate to know and manage the system. It has been argued by many researchers in different field that the weakest strategy of the users was disorientation (Marchionini, 1995; Dias, Gomes, & Correia, 1999; Tsai, 2009), and our findings also supported this. Information services (IS) have diversified and facilitated the information access process in many ways by offering a wide range of services. One can undoubtedly expect to see reflections of developments in information services on the OISS developed by users, because online information search does not require the scanning of many Web sites as they used to. Databases using the semantic network systems can automatically deliver documents with a high degree of relevance to the information sought, without the need for the user to repeat the search. However, this finding did not fulfill the expected results of the changing dynamics of the Internet.

The disorientation strategy had the strongest correlation with problem solving strategy. In addition, problem solving strategy was the only strategy that positively and significantly predicted disorientation. This indicated that when students were inadequate in solving system or information problems as they encounter during the online search for information, it causes them to be disorientated in the search process. Therefore, it can be said that the "disorientation" which is the most common problem of the online information search process is related to the problem solving skills of the users. While studies argue that disorientation is related to orientation skills, and that users with insufficient orientations skills often experience disorientation in the system (Dias, Gomes, & Correia, 1999; Tsai, 2009), our findings showed that users with high orientation skills also often experienced disorientation, and that disorientation was rather related with problem solving skills. This seemed to indicate that the changing structure and dynamics of the Internet were effecting OISS through problem solving skills.

Another important finding related to the relationship between sub-factors was that the evaluation strategy had the strongest relations with other strategies. Purposeful thinking and selecting main ideas strategies had strong relations with other strategies. Purposeful thinking, selecting main ideas and evaluating were metacognitive strategies and this finding pointed out that students with advanced metacognitive strategies also developed behavioral and procedural strategies at the same time.

The amount and variety of information on the Internet is rapidly increasing. This causes changes in the process of acquiring information from the Internet. Hence, it is necessary to clarify the aim more clearly (purposeful thinking strategy), to select relevant ones among the masses of information (select main ideas) and to evaluate the acquired information in more detail (evaluation strategy).

Tsai and Tsai (2003) stated that metacognitive strategies were the most critical variables in the success of the online search and learning process since they encompassed both the use of preliminary information about the information searched in the process and the ability of the self-awareness, self-regulation and self-monitoring of the information seeking process. Hannafin, Hill, and Land (1997) emphasized the regulatory influence of the metacognitive information search skills on skills that form the basis of online information search. Therefore it could be said that this finding had a critical importance. Even though it was not stated in theoretical background of the scale, there was a noticeable sign about a hierarchy between the strategies as looking into relations among the strategies. Hierarchy is an important concept. Drawing complex frameworks when building complex frameworks impacts understanding of the hierarchical structure (Uçak & Güzeldere, 2006). Van Gigch (1991) stated that hierarchy was effective on regulation, understanding, communication and learning. Therefore, determining the hierarchy between OISS can help to better understand this complex cognitive system. A better understanding of this can be a guide for individuals in developing effective OISS, as well as contribute to develop better information-providing services.

4.2. Role of education, major, GPA and the need of academic information seeking

Our findings showed that education was an important variable on OISS. Graduate students had better OISS than undergraduate students in terms of all domains and sub-factors. As the education increased, indirectly OISS also increased, so it could indicate that not only students could use the Internet more effectively for information but also they had a more efficient search process. Wu and Tsai (2007) also found that graduate students had more advanced strategies than undergraduates, that they attached more importance to assessing the quality of information and that they were inclined to question the accuracy of the information they acquire, from different sources. The findings showed the importance of the level of education on OISS and this seemed to draw attention to purposeful using of the Internet on developing search strategies.

On the other hand, Khosrowjerdi and Iranshahi (2011) stated that there was no difference in the information seeking behavior among the groups in the study they conducted on the masters and doctoral students. Brand-Gruwel, Wopereis and Walwaren (2009) stated that high school, undergraduate and graduate students were using similar strategies when searching for information on the Internet, but high school students made more efforts to evaluate the information. Researchers stated that this may be due to the fact that the research tasks assigned to different groups were not the same. These differences between the findings of our study and the findings of the literature suggested that more research studies would need to be done.

The differences between online search strategies of students studying in different majors were examined. For this purpose, the online search strategies of CEIT students were compared to those in other majors. Findings revealed that CEIT students developed better strategies in terms of all domains and sub-factors compared to the students in other major. This can be seen as a consequence of the formal education on Internet users. In this respect, it can be said that the increasing level of education, which was discussed in the previous research question, is consistent with these results developing OISS. In another study, Kurt and Emiroglu (2018) compared OISS of CEIT students with Computer Engineering students. Their findings revealed that there was no significant difference between them. They also stated that content through which students from both majors could acquire these skills in different courses were available in the curricula. In general, findings indicated that field of study had an important influence on students' OISS and supported the findings of relevant studies carried out in the literature (Bates, 1996; Covi, 1999; Folster, 1995; Ge, 2010; Rouet, 2003; Smart, 2000; Tella, 2009; Whitmire, 2002). Tella (2009) determined that students' majors were in meaningful relationships with their information seeking behaviors.

There was a meaningful relationship between GPA, which is a demonstration of academic success, and OISS. Students with high GPA had more sophisticated OISS in all domains and all sub-factors than students with low GPA. This indicated that students with sufficient skills to have successful online information search had better learning experiences. This should be considered when organizing learning activities especially Web-based and Web-supported activities. Because students lacking information search strategies may face many difficulties for accessing qualified information, then they may obtain missing or incorrect information.

Our findings supported Tsai and Tsai (2003) who revealed that learning outcomes of students with advanced OISS were better than other students. It was expected that students with skills to access the required information were more successful. Students lacking sufficient information search skills may feel uncomfortable managing the system during the information search process, may be lost in the system, may not be able to use their preliminary information for their purpose, and therefore may not be able to access the information that they need for learning task. This would influence the learning output naturally. To help students in this regard, Hill and Hannafin (1997) suggested that students should be taught search tips and help them develop a functional mental structure for searching information in open-ended information systems. OISS, without doubt, include not only information acquisition, but also the ability to assess the reliability and authenticity of acquired information. Students who developed these cognitive skills would have a reasoned judgment about the usability potential of a Web site or content of interest. Therefore, students who are able to use appropriate evaluation skills and information search strategies in the process can reach more relevant content and learn better (Hoffman, Wu, Krajcik, & Soloway, 2003).

The needs which push users to search information online can be a reliable determinant of online search performance. Therefore, understanding users' needs to search information online is seen as a key for understanding their search behaviors as well as effective and efficient search experiences (Kim, 2009). The results of our study showed that individuals who needed more online information, thus searched more for online information, had more advanced information search strategies. This finding is indicative of the experience of searching online information, rather than the Internet experience. Because, the time spent on the Internet may not always be information-seeking.

Sırakaya and Çakır (2014) stated that students frequently searching online information had better control, trial & error and problem-solving strategies than students doing less frequent online search. They stated that students searching more information online are using more effective search strategies, trying different search approaches, and solving the problems that arise.

Like in Sırakaya and Çakır, in Tsai (2009), students who use the Internet more for the purpose of searching had better behavioral and procedural strategies. However, in both studies, the level of online information search did not differ in metacognitive strategies. Our results showed that the level of online information search made a difference in metacognitive strategies as well as behavioral and procedural strategies. Sırakaya and Çakır worked with undergraduate students and Tsai worked with high school students. In our study, we worked with graduate and undergraduate students. Differences in high school, undergraduate and graduate student dynamics may be explanatory of the differences between findings. As a matter of fact, our study also found that graduate students had more intensive online information search processes, so they needed to do more online information searches therefore their OISS were more advanced.

Formal education brings the knowledge gained from many aspects and organizes the search for online information with it. Since there were no standards for information evaluation at the time, Alba and Hutchinson (1987) studied people with low and high preliminary information and found that individuals with low preliminary information made broader

information searches than those with high preliminary information. Broader information search is a sign of the information search experience, which is more unstable with inefficient strategy use. At this point the consistency of research findings was seen as an important result.

4.3. Future studies

Several suggestions can be made for further studies in the light of the discussions and results sections. First, the participants of this study were faculty of education students, so there may be an educational emphasis on the participants' view of OISS. OISS of students studying in different departments may vary. For this reason, further studies can be conducted to examine OISS of students in different fields. In addition, the studies regarding association between OISS and level of education are limited and provided different results. Therefore, there is a need for further work on the subject. Further studies examining the impact of different levels of education on OISS can help illuminate this ambiguity. Lastly, our findings suggest that the problem solving strategy significantly and positively predicts disorientation strategy while the purposeful thinking strategy negatively predicts it. Disorientation is one of the most frequently encountered problems in online search. Further studies can elaborate the relation between these strategies.

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