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Are students thinking critically while seeking for information?

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ABSTRACT
Critical thinking (CT) is a meta cognitive process, a considerable issue and a desirable outcome for higher education in the 21st century. CT is more noticeable when information users want to seek relevant information in an appropriate time and reasonable approach. Nowadays, CT is an equipment to be qualified in each dimension of life today, and also it can be an ability during the information seeking process (ISP). The aim of this paper is to find the level of CT of postgraduate students in the University of Malaya as well as investigating the Usage of CT when they seek for information. The study has adopted a quantitative research design. Watson-Glaser critical thinking appraisal- UK (WGCTA-UK) edition was used to find the level of CT of postgraduate students. Moreover, another survey was prepared by the authors to find whether postgraduate students use CT in ISP or not. Printed questionnaires are distributed among postgraduate students randomly as a pilot test, 45 out of 50 responded to the surveys comprehensively. This study uses the theory that "a critical thinker is able to seek information more precise and accurate than a person without critical thinking". The findings from the study revealed that those postgraduate students had the highest score in "recognition of assumptions" and the lowest score in "inference". Furthermore, 71% of subjects are below average and average areas of CT. The result also shows that when students seek information, they use several CT skills and dispositions such as their inference, recognition of assumption, deduction and evaluation of arguments. This is the first attempt to show that postgraduate students use their critical thinking skills (CTS) and dispositions (CTD) when they seek information.

Keywords: Critical thinking; Information seeking behavior; Information seeking process;

INTRODUCTION

In the 21st century, students must not only be highly knowledgeable, but must also be equipped with soft skills, which include critical thinking skills, (CTS) and problem-solving skills as well as the 4Cs – communication, collaboration, critical thinking (CT), and creativity (Ledward and Hirata 2011). These skills will prepare them for post-secondary education, employment, and to become competent members of society. The Common Core State Standards also mentioned that CT is one of the vital cross-disciplinary skills for education and in the workplace (Lai 2011). There are several definitions for CT depending on different viewpoints of researchers. Ennis (1991) defined CT as "reasonable, reflective thinking that is focused on deciding what to believe or do". On the other hand, constant Internet coverage and several types of information are key factors to emerge the seeking appropriate information among users and researchers. Appyling CTS during information seeking is important because they provide the means

for students to question assumptions, analyze arguments, and evaluate the quality of information inside and outside of their chosen fields (Bensley and Spero 2014).

Many researches related to CT have been carried out. For instance, in the research which was conducted by Bensley and Spero (2014) direct infusion as one of the instructional approaches to cultivate CT is studied. Problem-based learning as a teaching strategy has the potential to develop CTS, therefore, it is used increasingly to develop CTS among higher-education students, including nursing students (Kek and Huijser 2011). Although, there are many studies about cultivating CT through instructional methods with emphasis on the information age and decision making about suitable information to solve a problem, there is no study about the effects of critical thinking of information seeking behavior (ISB). For that reason, the main purpose of this study is to demonstrate a statement by Ennis (1989), that claims those who think critically are able to seek information that is not only of quality but is also accurate.

According to Wilson (1999) many information behavior models exist in LIS research. However,Kuhlthau (1991) 's model is relevant in this context because she has developed an information literacy program that relates the information seeking process of users in the process of learning and problem solving when they are carrying out a project (Kuhlthau 2002). Users use a variety of sources of information to learn about a particular subject, complex problem or extensive issue. Users often have difficulty in the early phases of information seeking. This can be particularly noticeable with students' who have been assigned a research paper, (Kuhlthau 1991)

In this paper, we explain that postgraduate students should use their critical thinking skills while seeking information. Although higher-education institutes emphasize the importance of having graduate students with high quality in soft skills and critical-thinking skills, the results of the WGCTA - UK edition show that respondents do not have enough critical thinking. A second survey carried out to investigate in each stage of the information seeking process, what critical-thinking skills and dispositions are used by respondents. The results show that when students seek information, they use several CT skills and dispositions such as their inference, recognition of assumption, deduction and evaluation of arguments. This is the first attempt to show that postgraduate students do use their critical-thinking skills and dispositions when they seek information.

The rest of the paper is organized as follows: literature review which includes critical thinking and information seeking behavior; the method section which is divided into three parts: sample, materials and instrument; and this is followed by data analysis. In the next section labeled as finding, we explained the demographic analysis, level of critical thinking of postgraduate students, and the presence of critical thinking skills in students' information seeking process (ISP). Finally, in the discussion and conclusion section, the key points of this paper are summarized.

LITERATURE REVIEW

(a) Critical thinking

Ennis (1987) provided a taxonomy for CT which includes dispositions and skills such as clarify the problem; identify the problem; formulate a question; gather information;

distinguish relevant from irrelevant information; make inference; deductive reasoning, recognize unwarranted claims; conduct advanced clarification; determine the strength of arguments; decide on answer, solution or course of action; and make a judgment. There are many studies based on the CT taxonomy, by Ennis (1987), to teach critical thinking (De Wever et al. 2006, Colucciello 1999, Webb 1994). ten Dam and Volman (2004) used the taxonomy and definition of critical thinking of Ennis (1989) to show that CT can be understood and taught as a set of general cognitive skills and dispositions. Tsui (2002) showed that there are several arguments on the basis of connection between CT and problem solving. Although these studies focused on the CT taxonomy and also the relationship with several factors such as learning styles (Colucciello 1999), reading (Aloqaili 2012), writing (Naber and Wyatt 2014), thinking styles (Lun, Fischer, and Ward 2010), and classroom interaction (Yiqi 2012), the importance of critical thinking in information seeking has not been considered.

(b) Information seeking process

Information seeking behavior is a process driven by humans' needs for information so that they can interact with the environment, emphasizing communication and the needs, characteristics, and actions of information seekers (Marchionini 1997). There are famous models for information seeking, such as behavioral model of ISB (Ellis, Cox, and Hall 1993), information seeking process (ISP) (Kuhlthau 1991), and problem-solving model (Wilson 1997). Prior research on ISB has focused on key factors, which influenced on information seeking and the relationship between ISB and disciplinary, demographic details such as education status and gender (Zhou 2014), positions (Al Qadire 2014) and information needs (Weiler 2005), personal traits (Malliari, Korobili, and Zapounidou 2011), and information literacy (Wahoush and Banfield 2014, Williamson and Asla 2009, Branch 2003).

The ISP presented by Kuhlthau (1991) includes six stages. In initiation, researchers recognize their needs for information to go to the second stage which is called selection. In selection, researchers identify and select the general topic to be investigated or the approach to be pursued. The third stage is an exploration that researchers investigate information on the general topic in order to extend personal understanding. In formulation which is the fourth stage of ISP, researchers form a focus from the information encountered to go to the next stage that is information collection, and researchers gather related information to the given topic. Finally, researchers complete the search and prepare to present or otherwise use the findings. Therefore, this stage is presented. Kuhlthau (1991) represented the user's sense-making process and incorporates three realms of human experience includes feelings, thoughts, and actions at each stage. Although her study was conducted in a traditional library environment, Kuhlthau's findings suggest that user cognitive, physical, and affective states are the driving force in any information seeking process.

Many LIS researchers have been inspired by Kuhlthau's research. For instance, Seldén (2004) points to the differences between bachelor students', doctoral students' and researchers' information needs and seeking; researchers may prefer to ask colleagues instead of seeking help from the librarians. According to Selden, the researchers are not motivated towards information literacy training programs as are the freshmen.

Hyldegård (2006) has also investigated how Kuhlthau's ISP-model may apply to the information behaviour of group members in an academic setting. She found differences between the individual information seeker in Kuhlthau's model and group members' information seeking behaviour. These differences turned out to be related to contextual, social and personal factors.

There were several studies on information seeking process and feelings such as uncertainty (Chowdhury, Gibb, and Landoni 2011, Wilson et al. 2002). Moreover, several researchers have studied the information seeking process from different views such as the dimension of tasks (Xie 2009), effects of information seeking process in collaborative task-based (Shah and González-Ibáñez 2010), and in virtual learning environment (Byron and Young 2000). Critical thinking is known as a meta cognitive process (Dwyer, Hogan, and Stewart 2014). Inspite of these studies, there is no work on the effect of critical-thinking skills and dispositions in information seeking behavior.

METHOD

The main objective of the study is to investigate whether postgraduate students think critically while they seek information or not and which CTS and CTD they use during the information seeking process. To address this research objective, the following research questions are postulated:
RQ1: What is the level of critical thinking of postgraduate students?
RQ2: Are the students thinking critically when seeking for information?

This study employed a quantitative method using survey questionnaires. Two sets of a questionnaire survey were distributed among postgraduate students in a Research Center of University of Malaya (UM).

(a) Sample

This is a pilot study of a larger scale research work. Therefore a total of 50 questionnaires were distributed among postgraduate students in the Research Center of UM. Postgraduate students in the Research Center of UM include Master's, PhD's and Research Assistants. They study in different majors such as Engineering, Education, Medicine, Computer Science, Science, Business, and Economics. From about 11484 postgraduate students, 330 students were selected as target population to answer the questions. In the pilot test, 50 postgraduate students were selected and only 45 students responded to the survey.

(b) Materials and instruments

Watson-Glaser critical thinking appraisal - UK edition (WGCTA-UK) (Watson and Glaser 2002) was used to answer the first research question. It has five items with separate scenarios that students should decide about them and conclude. These items are inference, recognition of assumptions, deduction, interpretation, and evaluation of arguments.

To address the second research question, the other survey was prepared to find whether postgraduate students think critically when they seek information using CT and ISP. According to the ISP model by Kuhlthau (2004), this information seeking process is

in five processes. The following stages presented Kuhlthau's ISP-model with her proposals for information literacy education in each phase. Common patterns of thinking, feeling and acting are found in each stage: initiation, selection/exploration, formulation, information collection, and presentation. To investigate the relationship between CTS and CTD in the five processes of information seeking, 10 CTS and CTD are asked from respondents. The questionnaire is divided into 5 sections based on 5 stages of the ISP, and at each stage of the ISP; the CTS and CTD were asked from respondents in 5-Likert scale. Figure 1 is the preliminary model to show the correlation between CTD, CTS and ISP. These 10 CTS and CTD are on the basis of the taxonomy of critical thinking, which was presented by Ennis (1987) that they are clarifying a problem, identify or formulate the question, gather information, distinguish relevant from irrelevant information, make an inference, deductive reasoning and recognize unwarranted claims; conduct advanced clarification, determines the strength of arguments, decides on answer, solution or course of action, and makes a judgment.

(c) Data analysis

In order to answer the first research question, Watson-Glaser critical thinking appraisal-UK edition (WGCTA-UK) was used (Watson and Glaser 2002). It includes five items with separate scenarios that students should decide about them and conclude. These items are inference, recognition of assumptions, deduction, interpretation, and evaluation of arguments (Table 1).

To address the second research question, the other survey was prepared to find whether postgraduate students think critically when they seek information by using CT and ISP. According to the ISP model by Kuhlthau (2004), this information seeking process is in five processes (Table 1). The following stages presented Kuhlthau's ISP-model with her proposals for information literacy education in each phase. Common patterns of thinking, feeling and acting are found in each stage: initiation, selection/exploration, formulation, information collection, and presentation.

Table 1: The measurements

Critical thinking	**Mean**	**S.D.**
Inference	1.34	0.938
Recognition of assumption	2.56	1.14
Deduction	1.58	0.882
Interpretation	1.80	0.901
Evaluation of arguments	1.59	0.774
Information seeking process		
Initiation	2.52	0.639
Selection/exploration	2.88	0.751
Formulation	2.65	0.784
Information collection	2.54	0.786
Presentation	2.55	0.928

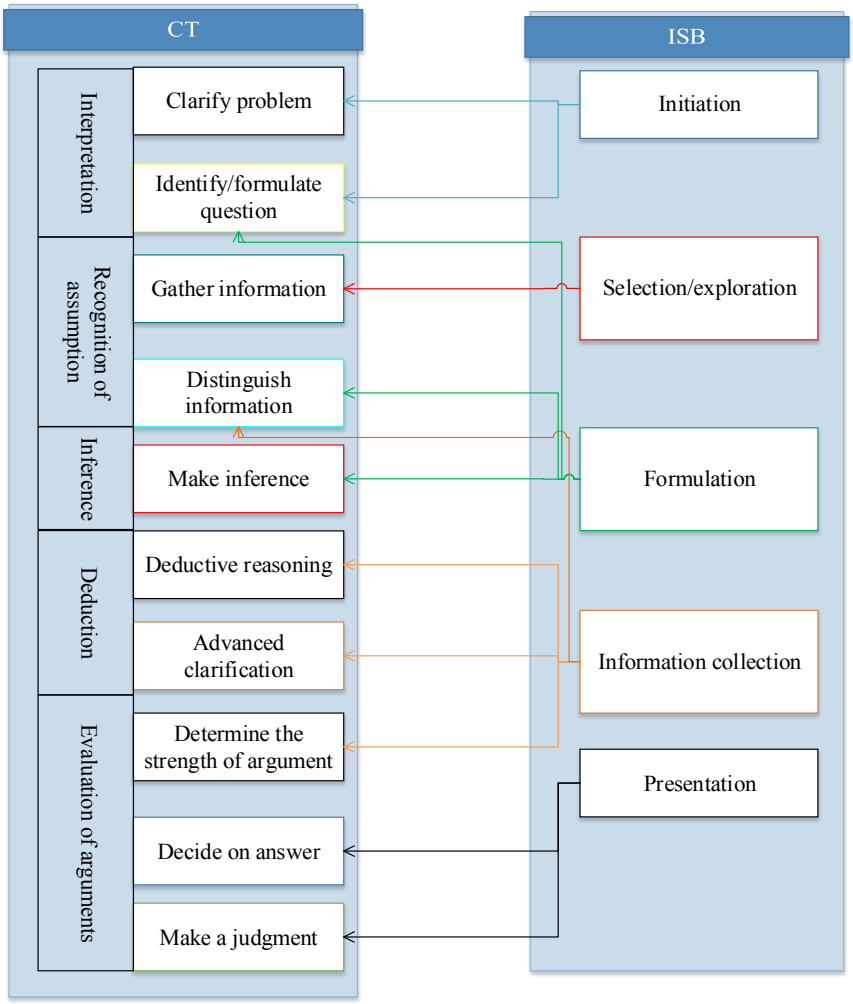

Figure 1: The relationship between critical thinking and information seeking process

FINDINGS

(a) Demographic Analysis

The printed questionnaires were distributed among 50 postgraduate students and only 45 answered them. They study in different majors and 11 of them are Master students and 34 are PhD candidates. Their ages ranged from 20 to 43 years old and 33 respondents are male, and the rests of them are female. The demographic details of respondents are presented in table 2.

(b) Level of critical thinking of postgraduate students

The total score in WGCTA-UK edition is 17; for this group that 41 of them answered the survey, the range was from 5 to 14, Mean= 9.37, and Standard Deviation= 2.083. According to the user's guide of WGCTA, 9 respondents are below average area of critical thinking and 23 respondents are also in the average level (Watson and Glaser 2012). Therefore, more than 71% of respondents suffer from lack of critical thinking as it can be seen in Table 3.

Table 2: Demographic details of respondents

Characteristics (n=45)		**Frequency**	**Percentage**
Degree	Master's	11	24.4%
	PhD	34	75.6%
Field	Computer science	31	68.9%
	Education	1	2.2%
	Engineering	9	20.0%
	Medicine	1	2.2%
	Science	3	6.7%
Gender	Male	33	73.3%
	Female	12	26.7%
Age	20-25	5	11.1%
	26-30	12	26.7%
	31-35	19	42.2%
	36-40	5	11.1%
	Over 41	4	8.9%

Table 3: Level of critical thinking of respondents

Below average 0%-40%	**Average 40%-60%**	**Above average 60%-100%**
9	23	13
20.00%	51.11%	28.88%

According to the score of participants in each item of the WGCTA-UK and the overall mean score of them, it is shown that the lowest score of respondents is in the inference (1.34) and the highest score is in recognition of assumption (2.56). Table 4 shows the critical thinking scores.

Table 4: Critical thinking score of respondents

Critical thinking	**Overall mean score**	**Std.**
Inference	1.34	0.938
Recognition of assumptions	2.56	1.14
Deduction	1.58	0.882
Interpretation	1.80	0.901
Evaluation of arguments	1.59	0.774

The WGCTA-UK results show that the level of critical thinking of postgraduate students is low, and also it is considerable when they answered the survey on the relationship between critical thinking and information seeking process. Furthermore, it is shown that participants who have below average score in critical thinking are more problematic in inference (weak point) while participants with a high score in critical thinking are good in recognition of assumption (strong point).

(c) The presence of Critical thinking skills in students' ISP

The survey of the presence of CTS in student's ISP includes 50 questions with 5-point scale ranging from "always" to "never". It was distributed among 50 postgraduate students and finally 45 of them answered the questions.

(i) Critical thinking skills (Interpretation) in ISP (Initiation)

Initiation is the first stage of ISP in which a person becomes aware of lack of knowledge, information and understanding to solve a complex problem or accomplish a project. During this stage, information seekers felt uncertainty and their thoughts are vague, therefore, users attempted to clarify and identify the problem. According to the percentage of response rate, in the initiation stage of ISP, participants clarify and identify problem. As it is shown in Figure 1, the CTD and CTS of taxonomy of CT (Ennis 1987) can be similar to the WGCTA-UK edition which were replied by respondents. To clarify it, when subjects answered the questions about the interpretation skill in the WGCTA-UK edition, postgraduate students informed that they clarify problem (95.0%) and identify it (73.0%) and it shows that they used these skills and dispositions while they seek information.

(ii) Critical thinking skills (Recognition of assumption) in ISP (Selection/exploration)

Selection is the second stage of the ISP model, and it happens after identifying the task. In this stage, users feel optimism, but it is not constant and when users want to go to the exploration stage, they feel uncertain, doubtful and confused because users need to understand the problem and investigate it. Postgraduate students in selection/exploration step of ISP identify their problem (81.8%), distinguish relevant information from irrelevant information (72.8%), and gather information (92.8%) skills.

(iii) Critical thinking skills (Inference) in ISP (Formulation)

In formulation stage, uncertainty is diminished, and it is replaced by understanding and users formed a focus from the information encountered in exploration. In the formulation step of ISP, subjects showed that they identify a problem (79.5%), distinguish relevant information from irrelevant information (75.0%), and make inference skills (68.2%).

(iv) Critical thinking skills (Deduction) in ISP (Information collection)

Users in an information collection stage of the ISP had effective communication with the system; therefore, they were able to collect information about the topic systematically. Due to feeling confident and increased interest among users, they have the ability to distinguish relevant from irrelevant information (75.0%). Regarding the frequency and percentage of responses to the questions related to the information collection of ISP and CTS (deduction), subjects gathered information (81.8%), made inference (68.2%), used deductive reasoning (70.5%) and advanced clarification (77.3%) and determined the strength of arguments (63.6%).

(v) Critical thinking skills (Evaluation of arguments) in ISP (Presentation)

In the final stage of the ISP model, information seekers completed their search activities and their problems were solved. They had to reread and organized all notes about the given topic. Participants had shown that they used deductive reasoning (63.6%),

conducted advanced clarification (70.5%), determined the strength of arguments (70.5%), decided an answer (83.0%) and made judgment (90.0%) before they concluded and finalized their search activities.

Table 5: Frequency and Mean Value for CT in ISP

	ISP stage 1: Initiation						
	CT construct: Interpretation	**Always**	**Often**	**Usually**	**Sometimes**	**Never**	**Mean**
1	I clarify and interpret the meaning of the topic.	**60.0% (27)**	**0**	**35.0% (16)**	4.4% (2)	0	1.84
2	I can determine the existing information are related to the topic or not	**24.4% (11)**	**2.2% (1)**	**46.7% (21)**	24.4% (11)	2.2% (1)	2.78
	CT construct: Recognition of assumption						
3	I gather information	26.7% (12)	2.2% (1)	68.9% (31)	0	2.2% (1)	1.64
4	I distinguish relevant information from irrelevant information about the topic.	40.0% (18)	6.7% (3)	33.3% (15)	20.0% (9)	0	2.33
	CT construct: Inference						
5	I assess the information about the topic and identify to reach a reasonable conclusion.	35.6% (16)	11.1% (5)	28.9% (13)	22.2% (10)	2.2% (1)	2.44
	CT construct: Deduction						
6	I recognize the unwarranted information about the topic.	13.3% (6)	17.8% (8)	26.7% (12)	37.8% (17)	4.4% (2)	3.02
7	I define terms and judge definitions by using appropriate criteria.	22.2% (10)	6.7% (3)	35.6% (16)	28.9% (13)	6.7% (3)	2.91
	CT construct: Evaluation of arguments						
8	I determine the strength of arguments or information about the topic.	20.0% (9)	4.4% (2)	37.8% (17)	35.6% (16)	2.2% (1)	2.96
9	I decide to find the suitable answer	35.6% (16)	6.7% (3)	33.3% (15)	24.4% (11)	0	2.47
10	I make a judgment about the answer and draw a conclusion	24.4% (11)	11.1% (5)	33.3% (15)	24.4% (11)	6.7% (3)	2.78
				Average scale for initiation:			**2.51**
	ISP stage 2: Selection/exploration						
	CT construct: Interpretation	**Always**	**Often**	**Usually**	**Sometimes**	**Never**	**Mean**
11	I clarify and interpret the meaning of the topic.	**43.2% (19)**	**4.7% (2)**	**32.6% (14)**	14.0% (6)	7.0% (3)	2.36
12	I can determine the existing information are related to the topic or not	**29.5% (13)**	0	**52.3% (23)**	15.9% (7)	2.3% (1)	2.61
	CT construct: Recognition of assumption						
13	I gather information	**50.0% (22)**	0	**43.2% (19)**	6.8% (3)	0	2.07
14	I distinguish relevant information from irrelevant information about the topic.	**34.1% (15)**	**2.3% (1)**	**36.4% (16)**	25.0% (11)	2.3% (1)	2.59
	CT construct: Inference						

15	I assess the information about the topic and identify to reach a reasonable conclusion.	25.0% (11)	0	56.8% (25)	11.1% (5)	6.8% (3)	2.75
	CT construct: Deduction						
16	I recognize the unwarranted information about the topic.	11.4% (5)	9.1% (4)	34.1% (15)	43.2% (19)	2.3% (1)	3.16
17	I define terms and judge definitions by using appropriate criteria.	31.8% (14)	4.5% (2)	36.4% (16)	22.7% (10)	4.5% (2)	2.64
	CT construct: Evaluation of arguments						
18	I determine the strength of arguments or information about the topic.	22.7% (10)	6.8% (3)	47.7% (21)	22.7% (10)	0	2.70
19	I decide to find the suitable answer	43.2% (19)	11.4% (5)	18.2% (8)	22.7% (10)	4.5% (2)	2.34
20	I make a judgment about the answer and draw a conclusion	25.0% (11)	6.8% (3)	38.6% (16)	25.0% (11)	6.8 (3)	2.82
				Average scale for selection/exploration:			**2.604**
				ISP stage 3: Formulation			
	CT construct: Interpretation	**Always**	**Often**	**Usually**	**Sometimes**	**Never**	**Mean**
21	I clarify and interpret the meaning of the topic.	34.1% (15)	2.3% (1)	15.9% (7)	27.3% (12)	20.5% (9)	2.98
22	I can determine the existing information are related to the topic or not	**31.8% (14)**	**4.5% (2)**	**43.2% (19)**	9.1% (4)	11.4% (5)	2.64
	CT construct: Recognition of assumption						
23	I gather information	41.95 (18)	2.3% (1)	27.9% (12)	20.9% (9)	7.0% (3)	2.55
24	I distinguish relevant information from irrelevant information about the topic.	**36.4% (16)**	**4.5% (2)**	**34.1% (15)**	20.5% (9)	4.5% (2)	2.52
	CT construct: Inference						
25	I assess the information about the topic and identify to reach a reasonable conclusion.	**25.0% (11)**	**0**	**43.2% (19)**	29.5% (13)	0	2.61
	CT construct: Deduction						
26	I recognize the unwarranted information about the topic.	22.7% (10)	9.1% (4)	31.8% (14)	34.1% (15)	2.3% (1)	2.84
27	I define terms and judge definitions by using appropriate criteria.	24.4% (11)	0	42.2% (19)	28.9% (19)	2.3% (1)	2.84
	CT construct: Evaluation of arguments						
28	I determine the strength of arguments or information about the topic.	25.0% (11)	4.5% (2)	47.7% (21)	22.7% (10)	0	2.68
29	I decide to find the suitable answer	40.9% (18)	4.5% (2)	31.8% (14)	18.2% (8)	4.5% (2)	2.41
30	I make a judgment about the answer and draw a conclusion	38.6% (17)	6.8% (3)	34.1% (15)	13.6% (6)	6.8% (3)	2.43
				Average scale for formulation:			**2.65**
				ISP stage 4: Information collection			
	CT construct: Interpretation	**Always**	**Often**	**Usually**	**Sometimes**	**Never**	**Mean**

31	I clarify and interpret the meaning of the topic.	38.6% (17)	0	31.8% (14)	13.6% (6)	15.9% (7)	2.68
32	I can determine the existing information are related to the topic or not	36.4% (16)	6.8% (3)	31.8% (14)	18.2% (8)	6.8% (3)	2.52
	CT construct: Recognition of assumption						
33	I gather information	**40.9% (18)**	**2.3% (1)**	**38.6% (17)**	13.6% (6)	4.5% (2)	2.39
34	I distinguish relevant information from irrelevant information about the topic.	**36.8% (16)**	**6.8% (3)**	**31.4% (14)**	20.5% (9)	6.8% (3)	2.64
	CT construct: Inference						
35	I assess the information about the topic and identify to reach a reasonable conclusion.	**36.4% (16)**	**6.8% (3)**	**25.0% (11)**	31.8% (14)	0	2.52
	CT construct: Interpretation						
36	I recognize the unwarranted information about the topic.	**27.3% (12)**	**6.8% (3)**	**36.4% (16)**	25.0% (11)	4.5% (2)	2.73
37	I define terms and judge definitions by using appropriate criteria.	**31.8% (14)**	**9.1% (3)**	**36.4% (20)**	18.2% (6)	4.5% (2)	2.55
	CT construct: Evaluation of arguments						
38	I determine the strength of arguments or information about the topic.	**29.5% (13)**	**9.1% (4)**	**34.1% (15)**	22.7% (10)	4.5% (2)	2.64
39	I decide to find the suitable answer	20.5% (9)	2.3% (1)	31.8% (14)	45.5% (20)	0	2.27
40	I make a judgment about the answer and draw a conclusion	31.8% (14)	6.8% (3)	45.5% (20)	13.6% (6)	2.3% (1)	2.48
				Average scale for information collection:			**2.54**
	ISP stage 5: Presentation						
	CT construct: Interpretation	**Always**	**Often**	**Usually**	**Sometimes**	**Never**	**Mean**
41	I clarify and interpret the meaning of the topic.	38.6% (17)	2.3% (1)	18.2% (8)	11.4% (5)	29.5% (13)	2.91
42	I can determine the existing information are related to the topic or not	25.0% (11)	9.1% (4)	27.3% (12)	22.7% (10)	15.9% (7)	2.95
	CT construct: Recognition of assumption						
43	I gather information	31.8% (14)	2.3% (1)	27.3% (12)	18.2% (8)	20.5% (9)	2.93
44	I distinguish relevant information from irrelevant information about the topic.	27.3% (12)	9.1% (4)	27.3% (12)	25.0% (11)	11.4% (5)	2.84
	CT construct: Inference						
45	I assess the information about the topic and identify to reach a reasonable conclusion.	38.6% (17)	9.1% (4)	22.7% (10)	20.5% (9)	9.1% (4)	2.52
	CT construct: Interpretation						
46	I recognize the unwarranted information about the topic.	**29.5% (13)**	**13.6% (6)**	**20.5% (9)**	27.3% (12)	9.1% (4)	2.68
47	I define terms and judge definitions by using appropriate	**40.9% (18)**	**11.4% (5)**	**18.2% (8)**	25.0% (10)	4.5% 92)	2.43

	criteria.						
	CT construct: Evaluation of arguments						
48	I determine the strength of arguments or information about the topic.	**45.5% (20)**	**6.8% (3)**	**18.2% (8)**	25.0% (11)	4.5% (2)	2.36
49	I decide to find the suitable answer	**48.9% (21)**	**6.8% (3)**	**27.3% (12)**	13.6% (6)	2.3% (1)	2.11
50	I make a judgment about the answer and draw a conclusion	**61.4% (27)**	**6.8% (3)**	**22.7% (10)**	9.1% (4)	0	1.80
				Average scale for presentation:			**2.55**

DISCUSSION

This study attempted to find the level of CT by using the WGCTA-UK edition. The results revealed that about 71% of postgraduate students are in below and average level and 29% of them are high in critical thinking. It can be seen that postgraduate students suffer from lack of critical thinking and it influences their behavior while they seek information. For example, the weak point of respondents is in the inference, hence, respondents who have low and average score in critical thinking are weak to make inferences. On the other hand, the strong point of respondents in critical thinking is in "recognition of assumption" and it is apparent in respondents with high scores in critical thinking.

The other question is whether postgraduate students use critical thinking while seeking information. The main goal of this study is to show the level of CT of postgraduate students and to find the usage of CT among subjects. Therefore, the study integrated concepts of CT from the taxonomy of critical thinking (Ennis 1987) and ISP (Kuhlthau 1991). In the ISP model, Users are using a variety of sources of information to learn about a particular subject, complex problem or extensive issue. Users often have difficulty in the early phases of information seeking. This can be particularly noticeable with students' who have been assigned a research paper, but it is not a characteristic of students' alone (Kuhlthau 1991). Moreover, the taxonomy of CT includes CTS and CTD as Ennis believe that critical thinking can be thought if the role of CTD besides CTS is considered (Ennis 1989) and it is one of the key reasons to study the usage rate of CT in ISP. The findings contribute to our understanding of the usage of CTS and CTD when respondents seek information.

Several researchers emphasized on critical thinking as a metacognitive process (Dwyer, Hogan, and Stewart 2014) and some studies on information seeking behavior in libraries (Ramirez et al. 2002, Kerins, Madden, and Fulton 2004) but there is no study about CT and ISP together. Our research is one of the first to explore the usage of CT during the information seeking process.

After conducting the research, we found that in each stage of ISP model, some CTS and CTD are used. In initiation stage, students clarify and identify a problem to find information needs and start searching activities. In selection/exploration stages of the ISP, subjects identify a problem, gather information and distinguish relevant from irrelevant information. In formulation stage, participants identify the problem,

distinguish relevant from irrelevant information and make inference to go to the next stage of ISP. During information collection step, students gather desired information and distinguish relevant from irrelevant information, then make inferences. Participants use their deductive reasoning skills; conduct advanced clarification and determines the strength of arguments. At the final stage of ISP, students use their deductive reasoning skills; conduct advanced clarification, and determines the strength of arguments. Finally, they use their mind whether to answer the question or solve the problem and make a judgment to complete search activities.

CONCLUSION

Being equipped with critical thinking skills is important because these skills play a vital role for students, and it allows students to question assumptions, analyze arguments, and evaluate the quality of information which they encounter in their fields (Bensley and Spero 2014). In addition, it creates an opportunity for students to be well-equipped with higher-order thinking skills and qualified as competent citizen. One of the main contributions of this study is to find out the level of critical thinking of postgraduate students, which indicates that they do from lack some critical thinking skills. The other contribution is to find the usage rate of using critical thinking in students' information seeking process. This study shows that people who demonstrate critical thinking are able to seek better and more accurate information mentioned by Ennis (1989).

In connection with library user education, Kuhlthau (2002) has developed a further step – assessing the process, which is the evaluation of the ISP. At this stage, identification of what cause difficulty, and determination of what could have been done differently to improve the process of learning as well as the final product is carried out. It is important that information literacy programs make users aware of focus, use of time, use of sources, and use of librarians. The quantity of information has increased, and it can, be difficult for users to have an overview of the most reasonable way to seek for information. As a consequence of this, many research libraries are offering information literacy programs on the use of information systems, and some libraries are trying to integrate students' project work into the information literacy curriculum by, for instance, focusing on problem-based learning (Egeland 2004, Poulsen 2002).

Our study is limited by several factors. First, the data of our study came from one university and one category– postgraduate students–, which may limit its generalizability. The use of one university causes potential range restrictions on the sample, and could actually yield relationships that appear weaker than they might be in a more diverse sample. Thus, the results we reported may only provide a conservative estimate of the usage rate under study. Second, we collected data in a short time, which limits our ability to draw definitive conclusions about causality. Third, postgraduate students were asked to write down their demographic information for data matching purposes, which may cause social desirability concerns.

Future research could proceed in a number of directions. First, our research focused on critical thinking as a metacognitive process and the information seeking process in which users seek their information and show their behavior and did not discuss strategies used in information seeking. Second, this research is about the use of some CT skills and

dispositions, and we did not consider all critical-thinking skills and dispositions separately, however, investigating all skills and dispositions can show the clear usage rate of critical-thinking skills and dispositions in information seeking. Finally, several researchers suggested different methods to cultivate critical thinking among students, but they did not pay attention to the role of critical thinking in information seeking and the correlation between critical thinking and information seeking. We are looking for finding the mutual effects of (Ennis 1989) critical thinking and information seeking to cultivate critical thinking by improving information seeking behavior of students.

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