

New Digital Divide?_Self-reported Information Literacy of Postgraduates at a University in Southern China

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Abstract—Digital divide has been heatedly discussed in business, politics, economics, and so on. However, viewpoints from educational perspective are urgently needed since the digital divide in education is considered both the miniature and one of the most crucial causes of that in society. Information literacy emerged as a new concern for quality use of technologies besides the original aspects of digital divide: access and usage. This paper attempted to identify whether there are any differences among postgraduate students from a university in southern China in terms of four sub categories of information literacy respectively: information consciousness, information ethics, information knowledge, and information ability by adopting self-reported questionnaires. Results showed no significant differences considering both between females and males, and between senior postgraduates and junior postgraduates ; However, the overall low information literacy scores indicated improvement is wanted, especially in consideration of information knowledge, which was the weakest and causing a information literacy divide at inter-individual level; Analysis of both separate and mean ranking of students' four information literacy categories suggested that in order to promote a sustainable higher information literacy level, we must enhance each subfield. Finally, based on this study, limitations and suggestion were also provided.

Index Terms—Information literacy, digital divide, e-learning, educational technology.

I. INTRODUCTION

Ever after the middle of 1990s when the term “digital divide” was first used in an official publication by US Department of Commerce’s National Telecommunications and Information Administration, the phenomenon of inequality in digitalization had caught a wide attention and then heatedly debated by politicians, socialists, and economists. Its original meaning is to describe the inequality of technology access or the differences between people who have information technology and those who do not have (Attewell, 2001). Then more and more concern was given to those who have access but are non-users (Mancinelli, 2008), the other cases that still there were some people who do not wish to use (Carpentier, 2003), those who could not make full potentials of the technology after getting it, and those who do not possess sophisticated digital skills to use them (J. v. Dijk & Hacker, 2003). According to Mancinelli (Mancinelli, 2008)’s summary, the three facets of digital divide and three levels of analysis are: access, usage and quality of use.

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Although implementation of programs for digital access in education had been carried out immediately when the benefits of technologies on learning and teaching get wide acceptance, the correspondent researches did not adequately follow, for example, few studies mentioned the information literacy as a perspective of addressing the quality use of information technology among students. Most of the broadly discussed issues about digital divide are from social-economic perspective, “contribution from education studies to digital divide research is scare...Educational views of digital divide... are urgently needed (J. A. G. M. v. Dijk, 2006)”.

Meanwhile, information literacy itself, as a new concept, has attracted more and more attention by all countries. It is an essential ability in information age, and also an important indication of the comprehensive quality of personal assessment. The United States education technology 4th annual CEO report explicitly pointed out, “The 21st century's ability quality” should include five aspects, one of which is information literacy. Information literacy reflects how people recognize the importance of information is, and how people use and evaluate information, etc. Information literacy has become not only a scholarly research topic but also the key character for the quality of how people cope with the information society changes.

The information highway brings us hundreds of opportunities, while at the same time, challenges co-exists. The infinite expansion of Internet information causes information overload and errant information. This is largely hindering the efficiency of user to obtain information. People who get into the information network will have to draw on advantages and disadvantages. When it comes to college students, concerns were raised: could college students effectively make use of information? How about their information discovering consciousness? How about their ability of applying information? How about their information ethics and performance? These are directly reflecting college students’ information literacy level. We need to inspect the situation and then to promote their development.

II. BACKGROUND

The concept of information literacy evolves from literature retrieval skills. In 1974, American information industry association President Paul Zurkowski first proposed in terms of the information literacy. He defined information literacy as “it is the information technology and skills for people to solve problems”.

A. The definition of information literacy

Association of College & Research Libraries (ACRL,

2001) noted that Information literacy encompasses more than good information-seeking behavior. It incorporates the abilities to recognize when information is needed and then to phrase questions designed to gather the needed information. It includes evaluating and then using information appropriately and ethically once it is retrieved from any media, including electronic, human or print sources.

In the 1990s, due to changes in the environment of information and the rapid development of network, some research institutions and scholars worked out some new concepts on information literacy. Doyle (1994) defined information literacy as "the ability to evaluation and using information from different sources of information acquisition". Information literacy was also viewed as a new humanism science: Knowing how to use computer and access information extends to critical thinking (Shapiro & Hughes, 1996).

In 2003, at the international information literacy conference, information literacy was defined as "the ability to solve problems by effectively production and communicate information". Information literacy is announced as basic human rights. It was noted that information literacy is becoming an important factor in the whole society in promoting the development of the global human policy. Information literacy is a prerequisite of information society. If there is no information literacy, information society will never reach its full potential.

B. Standards of information literacy

In 2000, the American Association of College & Research Libraries (ACRL) established "higher education information literacy competency standards", It includes five criteria, 22 standards and 86 standard effects index (ACRL, 2000).

- 1) Determine the extent of information needed
- 2) Access the needed information effectively and efficiently
- 3) Evaluate information and its sources critically
- 4) Incorporate selected information into one's knowledge base
- 5) Use information effectively to accomplish a specific purpose
- 6) Understand the economic, legal, and social issues surrounding the use of information, and access and use information ethically and legally

While in China, from the angle of cultivating students' information literacy, Sang (2006) put forward the six standards of students' information literacy:

- 1) The efficient information ability
- 2) Skilled, critically evaluation information ability
- 3) To effectively absorb, storage, the ability to extract information
- 4) Using multimedia information, creative expression form of using information
- 5) The ability of controlling information independently and effective learning and communication ability
- 6) Learning, cultivating and improving the information age of moral and civic emotions, legal consciousness and social responsibility

Sang (2006) further pointed out that information literacy is a higher order cognitive skill; with the critical thinking and

problem solving ability, students will learn how to learn. "In the new century, the pedagogy is no longer only inducting numerous facts, but also information retrieval, evaluation, and ability of using information". People with high information literacy do not only know how to learn, but also have consciousness, habits, ability of life-long learning. Information literacy is not only a goal at certain stage; it must be a lifelong goal of each member in a society and basic survival ability in such information age.

C. Content of information literacy in the literature

Based on the literature, it comes to the conclusion that information literacy should contain four categories: information consciousness, information ethics, information knowledge, and information ability:

- 1) Information consciousness refers to people's understanding and communication of information in perspectives of its social importance, value, the function and effect. It is about people's sensitivity for information, the attention paid, the attitude and the processing method chosen to the information. It also refers to the judge, and catch useful information.
- 2) Information ethics is used to identify the relationship between information, user and user's behavior of processing information
- 3) Information knowledge include the basic knowledge about information technology and the history, working principle, structure, component, related law and ethics of information system.
- 4) Information ability includes the ability to use the information system, information ability, information comprehension ability, information processing capability, and information skills.

Information consciousness, information knowledge and information skills and information ethics form an interactive and mutual dependent unity. Information consciousness plays the leading role, information knowledge and information skills are the core of information literacy, and information ethics is the healthy and wholesome premise for the development of information literacy.

D. Research questions

Information literacy survey could reflect the current situation of university students' information literacy level, and then respective cultivation strategies could be provided. Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources (He & Li, 2009). For postgraduate students majored in educational technology, information literacy is much more important than other students.

However, few researches focused on the information literacy level and its possible divide among postgraduate students who majored in educational technology, especially from the classified four distinct categories. This paper aims to get to understand the following questions:

- 1) What are the general and the detailed pictures of postgraduate students' information literacy level?
- 2) Is there information literacy divide among postgraduate student? Between male students and female students?

- Between junior postgraduate and senior postgraduate?
- 3) Are there correlations among the four sub categories of information literacy?
 - 4) Are there any potential strategies to improve postgraduate students' information literacy level?

III. PROCEDURE

The respondents of this investigation, majored in educational technology in a University in southern China, are postgraduate students who registered either in 2007 or in 2008. This University locates in a southern Chinese city and the city is ranked as one of the highly industrialized cities in China. However, higher education level in this city was viewed to be in its starting point and much effort was badly needed. The University in this study began to recruit educational technology postgraduate students in 2007 and there were only 16 postgraduate students in all in spring of 2009 when this study was carried out.

All of these students agreed to join this study and there were 9 students who were in their first year of postgraduate study and 7 students who were in their second year. There were 6 male students and 10 female students. Due to the situation in China that educational technology department is attached to education institute, where female students occupy the majority, the gender proportion of 6:10 could be considered to be reflecting the context.

Then a set of questions were designed to form a questionnaire, which contains four parts, addressing the four categories of information literacy respectively. The questionnaire contains 8 items for information consciousness, 8 items for information ethics, 10 for information knowledge, and 24 items for information ability. Answers for each question were based on Likert-type scale self-report: from score 1 to 5.

Data was collected by delivering 16 questionnaires online and all of them replied online in 2009. All of the questionnaires were viewed as valid questionnaire. When it came to the data analysis, Both SPSS and Excel were adopted.

IV. RESULTS AND DISCUSSION

A. The basic situation of respondents

TABLE I. THE BASIC SITUATION OF RESPONDENTS

category	value	number	Percentage (%)
gender	Male	6	37.5
	Female	10	62.5
grade	The 1st year postgraduates	9	56.25
	The 2nd year postgraduates	7	43.75

Analysis of table 1 data, we can see that male 37.5%, female 62.5%, and the first year of postgraduates 56.25%, the second year of postgraduates 43.75%.

Table one shows the proportion of males and females, which is 37.5% and 62.5% respectively; 56.25% are first year postgraduates while 43.75% are second year postgraduates.

B. The overall level of information literacy

As can be seen from Figure 1, the overall level of

information literacy was indicated:

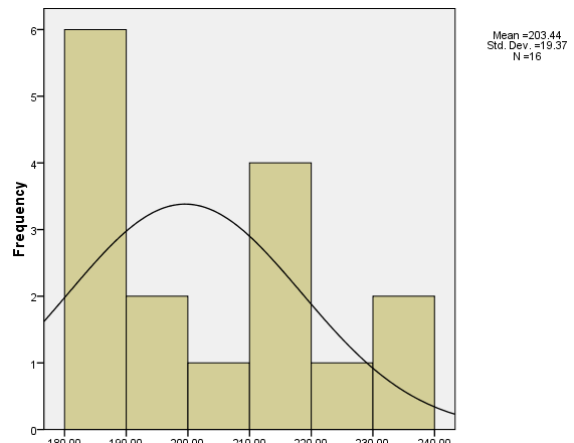


Figure 1. Indicates the overall level of information literacy

The total score of the questionnaire is 250. The average score of information literacy calculated scored 203.44 with a Median scored 200.00, and Standard deviation scored 19.37. The highest score is 238 and the lowest score is 183, indicating a comparatively low information literacy level. What's more, the frequency of each scale turned to be very diverse. For instance, 6 students got score between 180 to 190 and only 1 student got score between 200 to 210. This abnormal distribution should catch educators' attention. Especially, why such a big group of postgraduate students were holding the lowest information literacy level?

As later we looked deeper into the samples, we found that among the six students who marked the lowest, three girls and one boy were first year students, and two boys were second year students. However, the two students who ranked the top two in terms of overall score were two boys, first year students.

C. Four aspects: Information consciousness, information ethics, information knowledge, and information ability

Because there were different numbers of items for each sub category, the total score for each sub category were different too. For information consciousness, the total score is 40; for information ethics, it is 40; for information knowledge, it is 50; and for information ability, it is 120. The following are detailed description of the four sub categories respectively:

- 1) Average scores: 33.31, 32.75, 39.44, 97.94
- 2) The median: 34.00 32.50 39.50, 95.00
- 3) Standard deviation: 3.516 3.768, 3.444, 10.331
- 4) The highest points: 40, 39, 45, 117
- 5) The lowest points: 25, 26, 34, 86

As can be seen from the figures, difference in other aspects is relatively small except the information ability. While it is obvious that information ethics and information knowledge are slightly lower. And it needs to strengthen and improve at all levels.

D. Correlation analysis of four aspects

Then we continued to analyze the possible correlations between four aspects, results were showed in the figure 6:

The data show that all the four categories are significantly correlated with each other. It is implied that efforts should be paid to these sub categories simultaneously. The four aspects

of information literacy has a very close connection, four aspects supplement each other and none of them can be neglected. To improve the overall level of information literacy, we should improve the four aspects simultaneously.

The linear relationship between information knowledge and information ability in figure 7 significantly verifies their close and positive connection, which means that the more information knowledge one student got, the higher information capability would he or she gets.

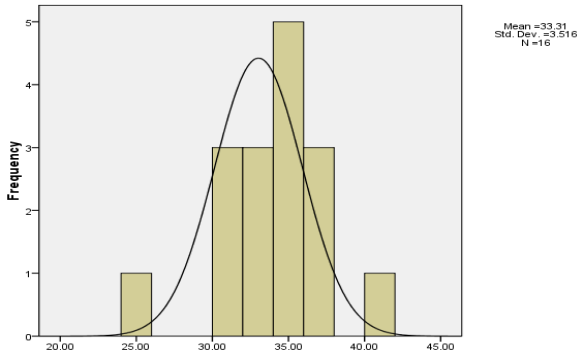


Figure 2. Information consciousness

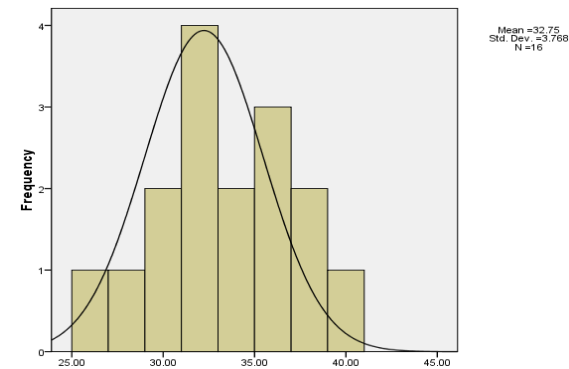


Figure 3. information ethics

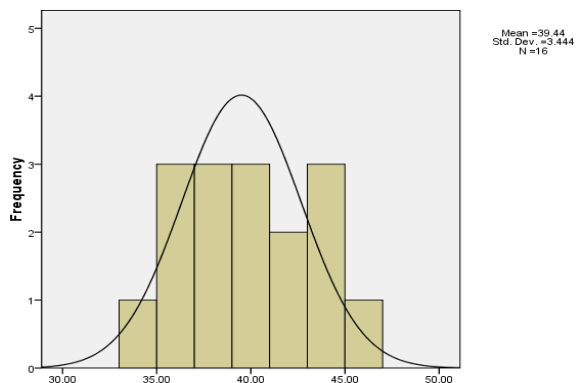


Figure 4. information knowledge

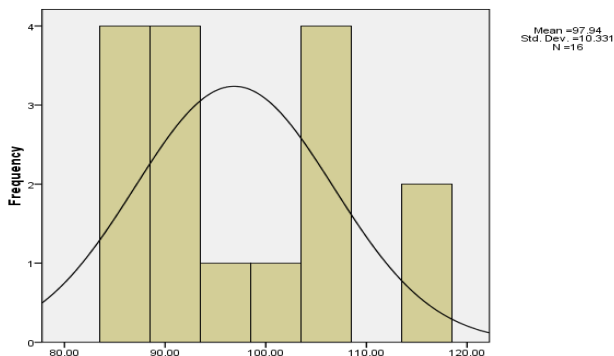


Figure 5. information ability

		information consciousness	information ethics	information knowledge	information ability
information consciousness	Pearson Correlation	1	.565*	.544*	.804**
	Sig. (2-tailed)		.023	.029	.000
	N	16	16	16	16
information ethics	Pearson Correlation	.565*	1	.733**	.834**
	Sig. (2-tailed)	.023		.001	.000
	N	16	16	16	16
information knowledge	Pearson Correlation	.544*	.733**	1	.836**
	Sig. (2-tailed)	.029	.001		.000
	N	16	16	16	16
information ability	Pearson Correlation	.804**	.834**	.836**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	16	16	16	16

*. Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Figure 6. Correlation analysis of four aspects

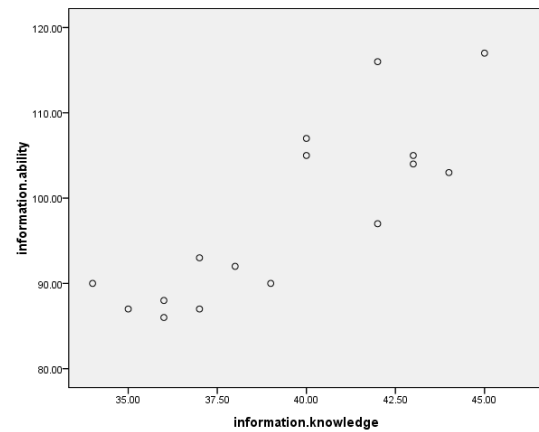


Figure 7. information knowledge and information ability

	gender	N	Mean	Std. Deviation	Std. Error Mean
information consciousness	1	6	34.5000	3.56371	1.45488
	2	10	32.6000	3.47051	1.09747
information ethics	1	6	32.0000	4.85798	1.98326
	2	10	33.2000	3.15524	.99778
information knowledge	1	6	39.0000	4.56070	1.86190
	2	10	39.7000	2.83039	.89505
information ability	1	6	99.1667	13.87684	5.66520
	2	10	97.2000	8.32399	2.63228

Figure 8. Group Statistics

E. Gender and information literacy

According to the data that we collected, average information literacy score of girls is 202.70, slightly lower than that of boys (204.67). Detailed data followed in figure 8 and table 2.

The P value is larger than 0.05 in four aspects, indicating that the influence of information literacy on gender is statistically not significant. Therefore, female postgraduates are not testified to be weaker than their male counterparts in terms of information literacy.

V. INFORMATION LITERACY DIVIDE

Then we go on to see the possible information literacy divide among postgraduate students. Firstly, all the average total scores are interpreted into proportions of correctness. Secondly, comparisons are made in figure 9.

It is pleased to see the students' high in information consciousness, information ethics, and information ability. However, information knowledge is so insufficient to

support the entire development of information literacy. Since we have verified that more information knowledge would lead to better information ability, it is believed that if educators pay more attention to the cultivation of information knowledge, the aim for the enhancement of students' information literacy might be more effectively achieved.

From separate and total ranking table, it is very easy to find out that the students whose total scores ranked the top two were also the two students who did well in every separate aspects of information literacy. This alarms one of the strategies to improve students' information literacy: we must

TABLE II. INDEPENDENT SAMPLES TEST

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
information consciousness	Equal variances assumed	.000	.990	1.050	14	.311	1.900	1.80950	-1.98099	5.78099
	Equal variances not assumed			1.043	10.433	.321	1.900	1.82239	-2.13783	5.93783
information ethics	Equal variances assumed	1.007	.333	-6.03	14	.556	-1.20000	1.98854	-5.46499	3.06499
	Equal variances not assumed			-5.41	7.582	.604	-1.20000	2.22011	-6.36919	3.96919
information knowledge	Equal variances assumed	5.578	.033	-3.82	14	.708	-.70000	1.83147	-4.62811	3.22811
	Equal variances not assumed			-3.39	7.360	.744	-.70000	2.06586	-5.53701	4.13701
information ability	Equal variances assumed	3.956	.067	.358	14	.726	1.96667	5.49707	-9.82338	13.75671
	Equal variances not assumed			.315	7.205	.762	1.96667	6.24687	-12.71990	16.65323



Figure 9. Information literacy divide

TABLE III. SEPARATE AND TOTAL RANKING

	separate Ranking				total Ranking
	consciousness	ethics	knowledge	ability	
A	7	8	4	7	8
B	5	12	11	10	15
C	1	4	1	1	1
D	2	1	4	2	2
E	5	11	9	11	11
F	8	9	10	12	13
G	7	10	7	9	10
H	4	3	5	4	5
I	4	5	3	4	4
J	3	2	3	5	3
K	5	7	2	6	7
L	8	10	8	12	14
M	6	6	8	8	9
N	3	5	5	3	6
O	8	9	9	13	12
P	9	9	6	10	15

keep in mind that each aspect should be in pace with the others. Still, there are students with higher score in some aspects but much lower in other aspects. For example, Student "K" ranked second in information knowledge but ranked seventh in total score. This unbalanced development of information literacy would definitely hinder students from developing all-roundly. Educators must also emphasize the importance of improving students' information literacy as a systematic process.

VI. CONCLUSION AND PROSPECT

From separate and total ranking table, it is very easy to find out that the students whose total scores ranked the top two were also the two students who did well in every separate aspects of information literacy. This alarms one of the strategies to improve students' information literacy: we must keep in mind that each aspect should be in pace with the others. Still, there are students with higher score in some aspects but much lower in other aspects. For example, Student "K" ranked second in information knowledge but ranked seventh in total score. This unbalanced development of information literacy would definitely hinder students from developing all-roundly. Educators must also emphasize the importance of improving students' information literacy as a through the above analysis, we can find that there are no significant gender differences or grade differences existing in postgraduate students in terms of information literacy. However the relatively low scores indicate that improvement should be made for each sub categories of information literacy, including information consciousness, information ethics, information knowledge, and information ability. Particularly, information knowledge cultivation must be paid more attention since it was verified to correlate with information ability and it is also the weakest one in the whole construct of information literacy. Only if the four aspects of information literacy are advanced side by side could our students achieve wholesome information literacy development. Based on these finding, this paper suggested that the following efforts can be made:

A. To improve the recognition of the importance of information literacy education

What's kind of thought, there will be what's kind of action.

Information literacy education could not be a new concept any longer and information literacy education should emancipate the mind, changing the traditional concept. Dun understands the information literacy education in the 21st century; the education of information literacy should be through the school education teaching process.

B. Integration Information literacy into curriculum

Information literacy could never be the learning objectives of one simple subject but the cumulative results of many subjects. Information literacy education must be integrated extensively into all sorts of subjects study. This can help students to better master skills of professional knowledge, promote self-study ability, to grasp the information retrieval, subtly processing, use and communication skills, thus gradually improve students' information literacy. For postgraduate students, the learning objectives must not be so restricted to one individual subject. And information literacy education must be combined with professional course in order to cultivate students' information literacy progressively.

C. To improve college teachers' information literacy level

In the information age, the rapid development of network education has already forced teachers to change their roles. New requirements have emerged and one of them is a higher level of information literacy. Teachers should not only master certain computer network operation skills, but also learn to use some teaching software's to assist their teaching in classroom. They also need to gradually adjust their teaching concepts to satisfy the new learning need of students in order to better equip themselves with significant skills and knowledge. They could also influence their students' information consciousness and ethics development by creating respective learning environment and designing useful learning activities.

D. To construction social environment for information literacy

As well as the fact that digital divide in education is a miniature of digital divide in society, the cultivation of students' information literacy is also closely related to the whole society. Educational technology and information literacy are connected by many means, among which one is the higher requirement for information literacy of students majored in educational technology. Joint effort by the society, school and family must be made to construct a good environment for students to develop their information literacy.

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