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Effects of Undergraduate Student Computer Competence on Usage of Library Electronic Collections

Ming-der Wu[1], Ssu-Tsen Yeh[2]

Abstract

University libraries have been increasing their electronic collections for decades. While it was found that students prefer electronic resources than printed materials, studies indicated that many electronic titles were left unused. This study is intended to investigate whether students possess the capabilities to use those collections. The following questions will be addressed: Do students use library electronic collections frequently? Do they consider the collections important to their studies? Do they think they are familiar with the use of the collections? And, most importantly, do they possess the capabilities to use library electronic collections? And, are there variances among students in different fields and genders?

Questionnaire survey was conducted in this study. Participants were solicited from undergraduate students in the fields of Chinese Literature, Sociology, and Computer Science. A total of 443 students completed the questionnaires. Results indicated that most students agreed that library electronic resources were important to their studies, but they did not use the resources frequently. Not all students possessed equivalent computer competences to use library electronic resources. Gender, subject field, internet use are factors that correlate with competence variations. This study also found that students were not confident about their capabilities in using library electronic resources. Low correlation was found between students' levels of computer competences and their frequency, familiarity, and perceived importance of electronic resources.

Keywords: Computer Competences; Library Electronic Resources; Undergraduate Students; Library Instruction

1. Introduction

University libraries have been increasing their electronic collections for decades. Numerous studies have indicated that students prefer using resources in electronic format than those in printed format. However, studies have also shown that not all students were aware of the availability of electronic resources, and their usage was far less than expected. Among the students, graduate students used electronic resources more often and perceived the resources as more important to their studies than undergraduate students. The report of OCLC (2006) indicated that 89% of U.S. undergraduate students preferred to begin their information search with search engines,

[1,2] Department of Library and Information Science, National Taiwan University, Taipei, Taiwan
* Corresponding Author: Ming-der Wu, Email: mdwu@ntu.edu.tw

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and only 2% began with a library Web site. Rowlands, Nicholas, Jamali, and Huntington (2007) found that undergraduates and university staff used e-books on campus less than graduate students.

The OCLC survey (2002) indicated that students encountered difficulty accessing remote library databases and searching the library Web site. Tenopir (2003) reported that "students bring Web searching habits to their use of electronic scholarly materials and seem to have difficulty adapting to different types of information resources, interfaces, or search systems." Even when more user-friendly interfaces are employed in current databases, students still need some level of competence to use the resources successfully, such as connecting to the library Web site from an off-campus site, or logging in from a wireless laptop on campus. Some databases require students to install prescribed software. Students may need to download some documents for further use or may wish to be alerted and receive updated information. Students should undoubtedly possess some level of computer competences to use electronic resources effectively.

This study investigates whether undergraduate students possess the capabilities to use library electronic collections and addresses the following questions: Do students frequently use library electronic collections? Do they consider the collections important to their studies? Are they familiar with the use of the collections? Most important, do they possess the capabilities to use library electronic collections? Finally, do variances exist between students of different genders and from different subject fields?

2. Literature Review

Although university libraries have expanded their electronic collections, many studies have indicated that other than the library, the Internet is the major source for undergraduate students searching for information. For example, a survey of Pew Internet and the American Life Project (2002) revealed that nearly three-quarters of college students indicated that they use the Internet more than the library for information searching. Van Scoyoc and Cason (2006) reported that undergraduate students rely on the Internet rather than library resources for their research needs. Although undergraduate students are currently familiar with Internet use, they are not sufficiently fluent with information and communication technology, and are less fluent than their perception (Hilberg & Meiselwitz, 2008; Maughan, 2001). Salisbury and Ellis (2003) mentioned that professors might believe students to be computer literate, but most students cannot demonstrate foundational skills

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for information research.

Information literacy is a basic skill of survival in the information age. The report of the American Library Association (1989) indicated, "To be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information." Information technology competences, embodied in the broader term "information literacy" refer to individual capabilities of using "computers, software applications, databases, and other technologies" to achieve a variety of goals (Association of College & Research Libraries [ACRL], 2005). Intellectual capabilities, information technology concepts, and information technology skills are the components of fluency with information technology. Setting up a personal computer, using basic operating system features, and connecting a computer to a network are important skills among information technology tasks (National Research Council, 1999). McDonald (2004) indicated that the current challenge for universities is to ensure that their students meet a minimum level of computer competency when using new and constantly changing information technology. Because of the increasing electronic collections of university libraries, student computer competency is an important factor affecting student capability to use the collections successfully. McDowell (2002) indicated that university teachers believe that undergraduate students should possess information technology skills with information use in the academic library context.

A number of studies have investigated the relationship between information or computer competences and information searching skills. Majid and Abazova (1999) found a positive correlation between the level of computer literacy and usage of library OPAC. Faculty members with good and excellent computer skills inclined to use OPAC more than those with poor computer skills. Ren (1999) reported that executives with higher computer self-efficacy searched the Internet more frequently than those with lower computer self-efficacy. The study by Callinan (2005) revealed that undergraduates had difficulty finding course-related materials because they were unfamiliar with library computer systems. Gross and Latham (2009) found that undergraduate students self-reported they were computer information proficient, but their knowledge and information searching skills were insufficient. Investigating the information retrieval patterns of surgeons, Shelstad and Clevenger (1996) reported computer illiteracy as one of the major barriers. Lim, Hsiung, and Hales (2006) mentioned the importance of computer literacy

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for physicians in using online resources and indicated that physician competence does not always keep up with technology. A questionnaire survey by Cole and Kelsey (2004) revealed that nurses and midwives in undergraduate courses were deficient in computer use and lacked the skills to search library catalogs and databases.

Many studies have documented gender differences in computer competency. Females demonstrated less computer-related confidence than males did (Miura, 1987; Abbis, 2008). A questionnaire survey by Ford, Miller, and Mosa (2001) found gender to be a major predictor of Internet use and attitudes. Female students experienced more difficulty finding information on the Internet, and felt less competent and comfortable using the Internet. They used the Internet less frequently than male students and used fewer Internet applications. The study by Jackson, Ervin, Gardner, and Schmitt (2001) revealed no gender difference in the frequency of Internet use, but female undergraduate students displayed more computer anxiety and less computer self-efficacy. Tella and Mutula (2008) found that male undergraduate students in Botswana were more experienced and used computers more than their female counterparts. The authors also indicated that students with higher computer literacy were more inclined to use the library. Odell, Korgen, Schumacher, and Delucchi (2000) found that male college students spent significantly more hours on the Internet and indicated gender differences on purposes of use. Li and Kirkup (2005) compared the Internet use of college students in China and the United Kingdom and found that male students in both countries were more self-confident in their computer skills than female students were. More female students reported difficulties in their information search than male students did. Baro and Fyneman (2009) reported that male undergraduate students are more digitally literate and aware and use library resources more than female students. In addition to the gender factor, Kwon and Song (2011) indicated that personal traits affected student information competence. For example, students who were more methodological and organized tended to be more competent and critical in evaluating information they retrieved. Compared to the gender factor, studies investigating whether the subject background of students affects their computer or information literacy are few. The study of Odell et al. (2000) showed that students majoring in business, math, and hard sciences spent more hours on the Internet than did students majoring in education, communications, humanities, and social science. Tella (2009) found that the specific discipline of undergraduate students affects their information seeking behavior.

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3. Research Method

A questionnaire survey was conducted at National Taiwan University (NTU). The authors chose undergraduate students from the departments of Chinese Literature, Sociology, and Computer Science to be the participants of this study. These departments were chosen because they belong to the fields of humanities, social science, and technology. This study assumed that Literature students were less skilled in computer competence, Computer Science students were most skilled, and Social Science students were in between.

With the consent from instructors, students filled in the questionnaires in class of the required courses of the three departments. Web questionnaires were emailed to Social Sciences and Computer Science seniors who did not have required courses. Participants included students from freshmen to seniors. A total of 443 valid questionnaires were collected.

The questionnaire comprised six parts. Part 1 included student background (department, study level, gender, and internet use). Part 2 included student usage, perceptions, and familiarity of library electronic collections. Part 3 to 6 included student computer competence related to use of the library electronic collections. The authors analyzed library instruction manuals and database manuals to compile a list of computer competences needed to effectively use electronic collections. Information search competences (intellectual competences) such as query formulation, search strategy construction, and results screening were not included in the categories. The authors believed that other types of research methods (e.g., think-aloud technique) would be more suitable to investigate students those types of competences. Therefore, only technical competences related to Internet and computer use were selected. The skill set was further examined by reference librarians to ensure its content validity. Computer competences were divided into four categories in this study: Internet connection, software installation, document management, and current awareness. Students were asked to rate their capabilities on those competences from scores 1 to 5 (1 = *strongly disagree*, 2 = *disagree*, 3 = *undecided*, 4 = *agree*, 5 = *strongly agree*). A validity test was conducted and Cronbach's alpha was .881.

4. Data Analysis

4.1 Student backgrounds

Among the 443 respondents, 200 (45.15%) were Computer Science students, 169 (38.15%) were Literature students, and 74 (16.70%) were Sociology students. There were 95 (21.44%) freshmen, 140 (31.60%) sophomores, 130 (29.35%) juniors, and 78 (17.61%) seniors. Female students (51.47%) numbered slightly

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more than male students (48.53%). Table 1 outlines students' backgrounds.

4.2 Daily use of the Internet

Table 2 shows that most students typically spent over two hours daily on the Internet. However, significant differences were found among students of different backgrounds by employing Chi-square test. Male students spent more hours daily than female students did (χ^2 = 40.009, p = .000). More than half of male students (51.16%) spent over five hours daily on the Internet compared to only 22.37% of female students. Table 2 indicates that Computer Science students spent more hours daily on the Internet than Literature students and Sociology students did (χ^2 = 97.641, p = .000). Over 60% of Computer Science students spent over five hours daily on the Internet compared to only 16% of students in the other two subject fields. The results indicate that some Literature students did not heavily depend on the Internet. Approximately one-quarter of Literature students spent less than two hours daily.

Table 1. Students' Backgrounds

	Male	Female	No. of student
Subject			
Literature	36 (16.74%)	133 (58.33%)	169 (38.15%)
Sociology	14 (6.61%)	60 (26.32%)	74 (16.70%)
Computer Science	165 (76.75%)	35 (15.35%)	200 (45.15%)
Total	215 (48.53%)	228 (51.47%)	443(100%)

Table 2. How Many Hours Do You Spend on the Internet Daily?

	below 2 hrs.	2-4hrs.	over 5 hrs.	No. of student
Subject				
Literature	45 (26.63%)	96 (56.80%)	28 (16.57%)	169
Sociology	14 (18.92%)	48 (64.86%)	12 (16.22%)	74
Computer Science	14 (7.00%)	65 (32.50%)	121 (60.50%)	200
Gender				
male	25 (11.63%)	80 (37.21%)	110 (51.16%)	215
female	48 (21.05%)	129 (56.58%)	51 (22.37%)	228
Total	73 (16.48%)	209 (47.18%)	161 (36.34%)	443

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4.3 Use of library electronic collections

Although the NTU Library has been increasing its electronic collections, undergraduate students did not use the resources very often. Table 3 shows that less than one-third of students (30.69%) reported frequently using library electronic resources. T test reveals significant difference between male and female students (t= -4.371, p = .000). Female students used library electronic resources more often than male students. Significant differences were also found among students of different subject fields (F= 28.074, df= 2, p = .000) by employing ANOVA test. A post hoc test showed that Computer Science students used library electronic resources less often than Literature students and Sociology students did.

4.4 Perceptions on library electronic resources

Table 4 indicates that 59.36% of students agreed that library electronic resources were important to their studies, and 12.41% disagreed. T test reveals significant difference was found between male and female students (t= -3.298, p = .001). Female students perceived that library electronic resources were more important to their studies than male students did. Significant differences were also found among students of different subject fields (F= 28.341, df= 2, p = .000) by employing ANOVA test. A post hoc test showed that Computer Science students perceived library electronic resources to be less important than Literature and Sociology students did.

4.5 Familiarity of library electronic resources

Table 5 indicates that approximately one-quarter of students (25.28%) agreed that they were familiar with the use of library electronic resources, 45.15% neither agreed nor disagreed,

Table 3. Do You Frequently Use Library Electronic Resources?

	strongly disagree	disagree	undecided	agree	strongly agree	No. of student
Subject						
Literature	7 (4.14%)	36 (21.30%)	62 (36.69%)	47 (27.81%)	17 (10.06%)	169
Sociology	7 (9.46%)	13 (17.57%)	13 (17.57%)	30 (40.54%)	11 (14.86%)	74
Computer Science	39 (19.50%)	63 (31.50%)	67 (33.50%)	25 (12.50%)	6 (3.00%)	200
Gender						
male	38 (17.67%)	63 (29.30%)	63 (29.30%)	37 (17.21%)	14 (6.51%)	215
female	15 (6.58%)	49 (21.49%)	79 (34.65%)	65 (28.51%)	20 (8.77%)	228
Total	53 (11.96%)	112 (25.28%)	142 (32.05%)	102 (23.02%)	34 (7.67%)	443

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Table 4. Do You Agree that Electronic Resources are Important to Your Studies?

	strongly disagree	disagree	undecided	agree	strongly agree	No. of student
Subject						
Literature	0 (0.00%)	13 (7.69%)	28(16.57%)	78(46.15%)	50(29.59%)	169
Sociology	2 (2.70%)	2 (2.70%)	21(28.38%)	28(37.84%)	21(28.38%)	74
Computer Science	11 (5.50%)	27(13.50%)	76(38.00%)	69(34.50%)	17 (8.50%)	200
Gender						
male	9 (4.19%)	27(12.56%)	66(30.70%)	78(36.28%)	35(16.28%)	215
female	4 (1.75%)	15 (6.58%)	59(25.88%)	97(42.54%)	53(23.25%)	228
Total	13 (2.93%)	42 (9.48%)	125(28.22%)	175(39.50%)	88(19.86%)	443

Table 5. Do You Agree that You are Familiar with the Use of Library Electronic Resources?

	strongly disagree	disagree	undecided	agree	strongly agree	No. of student
Subject						
Literature	10 (5.92%)	26(15.38%)	71(42.01%)	52(30.77%)	10 (5.92%)	169
Sociology	4 (5.41%)	10(13.51%)	40(54.05%)	16(21.62%)	4 (5.41%)	74
Computer Science	20(10.00%)	61(30.50%)	89(44.50%)	24(12.00%)	6 (3.00%)	200
Gender						
male	19 (8.84%)	55(25.58%)	96(44.65%)	35(16.28%)	10 (4.65%)	215
female	15 (6.58%)	42(18.42%)	104(45.61%)	57(25.00%)	10 (4.39%)	228
Total	34 (7.67%)	97(21.90%)	200(45.15%)	92(20.77%)	20 (4.51%)	443

and 29.57% disagreed. T test reveals that there was significant difference was found between male and female students (t = -2.199, p = .028). Female students were more familiar with electronic resources than male students were. Significant variances were also found among students of different subject fields (F= 13.421, df= 2, p = .000) by employing ANOVA test. A post hoc test showed that Computer Science students were less familiar with library electronic resources than Literature and Sociology students were.

4.6 Confidence in computer competences

Table 6 shows that students were not very confident that they could master the competences needed to use library electronic resources. All mean scores in four categories

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were below 4 (on a 1 to 5 scale). Among the competences, students had more confidence in document management, and less confidence in current awareness (for details, see Appendix).

T test was used to analyze the variation of computer competences between male and female students, resulting in male students showing a significantly higher confidence in competences in all four categories than female students. Mean scores were as follows: Internet connection (male= 3.52, female= 2.90, t= 6.196, p= .000), software installation (male= 3.47, female= 3.26, t= 2.179, p= .030), document management (male= 4.12, female= 3.74, t= 6.478, p= .000), and current awareness (male= 3.35, female= 2.88, t= 5.954, p= .000) (see Figure 1).

ANOVA and post hoc analyses were used to test the variation of computer competences among students of different subject fields. The results reveal that Computer Science students

Table 6. Student Confidence in Computer Competences

Computer competences	Mean score	*sd*
Internet connection	3.20	1.10
Software installation	3.36	1.01
Document management	3.92	.64
Current awareness	3.10	.87

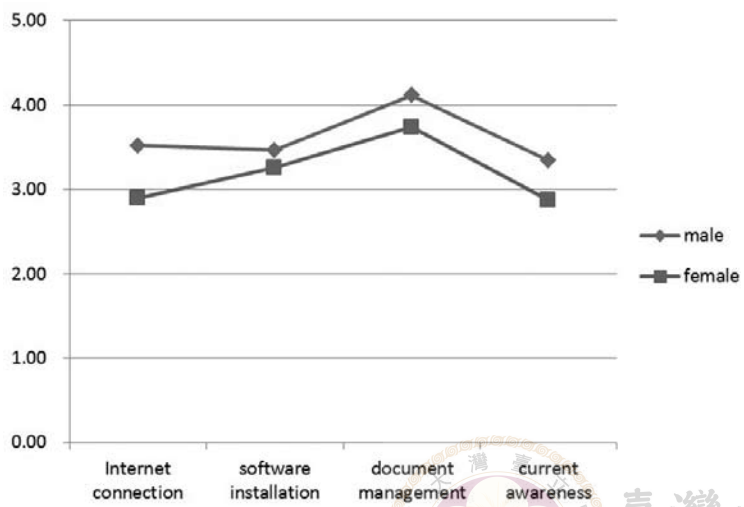


Figure 1. Student Genders and Computer Competences

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showed significantly higher confidence in their competences in all four categories than Literature students and Sociology students did. Mean scores were as follows: Internet connection (Computer Science=3.62, Literature=2.80, Sociology=3.00, F= 30.453, df= 2, p= .000), software installation (Computer Science=3.56, Literature=3.28, Sociology=2.99, F=9.704, df=2, p= .000), document management (Computer Science=4.19, Literature=3.69, Sociology=3.74, F= 36.433, df=2, p= .000), and current awareness (Computer Science=3.44, Literature=2.82, Sociology=2.88, F= 31.293, df= 2, p= .000) (see Figure 2).

ANOVA and post hoc analyses were also used to test the variation of computer competences among students with different Internet use frequencies. The result shows that students who spent longer hours daily on the Internet had significantly higher confidence in their computer competences in all four categories than those who spent fewer hours. Mean scores were as follows: Internet connection (over 5 hours=3.55, 2 to 4 hours=3.06, less than 2 hours=2.82, F= 14.819, df= 2, p= .000), software installation (over 5 hours=3.63, 2 to 4 hours=3.26, less than 2 hours=3.05, F= 10.305, df= 2, p= .000), document management (over 5 hours=4.16, 2 to 4 hours=3.79, less than 2 hours=3.77, F= 18.636, df= 2, p= .000), and current awareness (over 5 hours=3.39, 2 to 4 hours=2.94, less than 2 hours=2.92, F=15.064, df= 2, p= .000) (see Figure 3).

Pearson product-moment correlation analysis was conducted to test the relationships

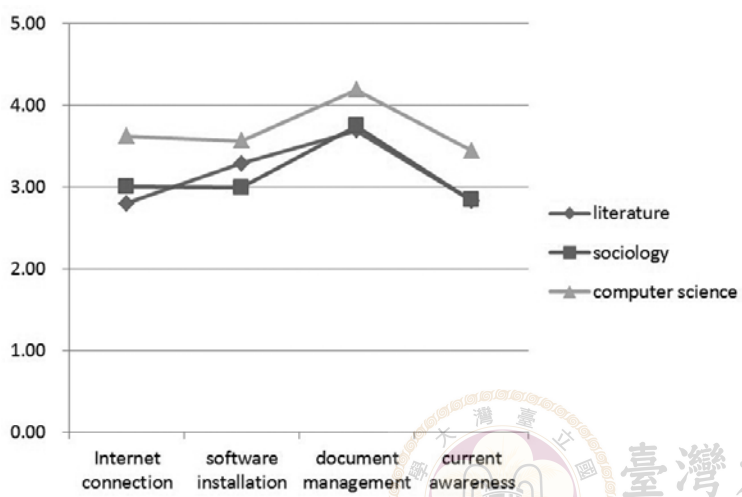


Figure 2. Student Subject Fields and Computer Competences

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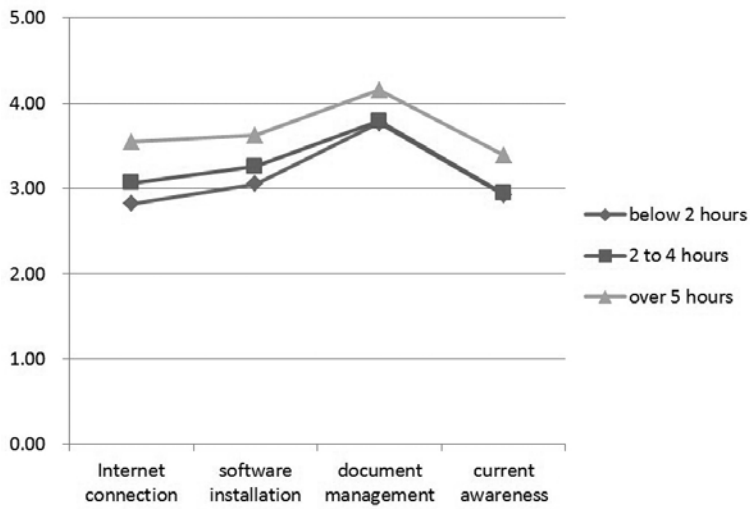


Figure 3. Student Internet Use and Computer Competences

between student computer competences and their perception, usage and familiarity of library electronic resources. The results reveal low correlation between computer competences and perception on electronic resources in all four categories. Correlation coefficients were as follows: Internet connection (r =.10, p = .033), software installation (r = .13, p = .006), document management (r = .06, p = .207), and current awareness (r = .03, p = .494). Low correlation was also found between computer competences and frequency of electronic resources use in all four categories. Correlation coefficients were as follows: Internet connection (r= .143, p= .003), software installation (r= .176, p= .000), document management (r= .111, p= .020), and current awareness (r= .097, p= .041). Low correlation was further found between computer competences and familiarity of electronic resources use in all four categories. Correlation coefficients were as follows: Internet connection (r= .214, p= .000), software installation (r= .214, p= .000), document management (r= .229, p= .000), and current awareness (r= .182, p= .000). The results indicate that students with higher confidence in their computer competences did not necessarily perceive library electronic resources to be more valuable than those students with lower confidence did; and vice versa. Student computer competences did not necessarily correlate with their usage and familiarity of the electronic resources either.

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5. Discussions and Conclusions

Findings of this study show that not all undergraduate students possess equivalent computer competences to use library electronic resources. Gender, subject field, and internet use are factors that correlate with competence variations. Male students possessed higher capabilities than female students did, possibly because of variation in their Internet use. Because male students spent longer hours daily on the Internet than did female students, they were more capable of mastering competences necessary to use library electronic resources. Several previous studies have indicated that males are more computer literate and have more computer and Internet experience than female students have. The findings of this study may be evidence that, even in library environments, the stereotype of gender difference on computer skills still exists. This study found that Computer Science students spent longer hours daily on the Internet than did Literature and Sociology students, resulting in their increased confidence to master competences necessary to use library electronic resources than students of other subject fields. Computer Science students also more heavily depend on the Internet and computer, and therefore are more computer literate because of their subject backgrounds.

However, this study found that student computer competences have low relationships with their usage and perception of library electronic resources. Although male students possessed higher computer competences, they used library electronic resources less frequently than female students did. Male students also valued library electronic resources as less important than female students did and were less familiar with the use of electronic resources. Similar results were found between Computer Science students and students in Literature and Sociology fields. Computer Science students spent longer hours on the Internet and possessed higher confidence in computer competences, but they used library electronic resources less frequently and perceived the resources to be less important than students in other two fields. These results may be explained by the factor of Internet use. Male students and Computer Science students spent longer hours on the Internet and possessed better computer competences than female students did. They might depend more heavily on the Internet and use it more often than females to search information for their study needs and may be more self-confident about finding what they want on the Internet instead of searching on the library Web site. Because of the nature of the subject field, Literature and Sociology students might rely more on library materials. In contrast, more computer science related materials, particularly those of new and updated

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information, are available from the Internet than from the library. Further studies concerning these issues may be needed. It should also be reminded that male Computer Science students were the predominant population of the male samples. We recommend that multiple-regression analyses be conducted in further studies to test the influence of multiple factors (e.g., discipline and gender).

This study found that students were not confident about their capabilities in using library electronic resources. Among the competences, they were more capable in managing documents, such as compressing and decompressing a document, exporting a document to a personal email address, or putting a document in "My Favorites." Students were familiar with these competences because these activities occurred in their daily computer or Internet use. The lowest score occurred in the current awareness category. Students did not know how to subscribe to "Alert" and e-news service, or join a discussion group. This may be because most undergraduate students are not research-oriented in their studies, and do not need to search for updated information frequently like graduate students or scholars do.

Librarians believe that students must be computer-literate to effectively use electronic resources, evidenced in the findings of this study. Undergraduate students did not use library electronic resources frequently and were not familiar with the use of resources. This may refer to their weakness in computer competence. Computer competence related to library resources can be categorized into intellectual competence and technical competence. Competences covered in this study were limited to technical ones. When offering instruction programs related to electronic resources, most university libraries only emphasize intellectual competence. Findings of this study may remind librarians not to overlook technical competence. Topics such as internet connection, software installation, and current awareness, etc. could be covered in library instruction programs. When there are new electronic resources being added to the library, students may need additional skills to use the resources effectively. We recommend that librarians update their instruction materials accordingly.

This study used a questionnaire survey to evaluate student computer competence. Students were asked to note whether they had confidence in given capabilities. Self-reported capabilities may differ from that in reality. Employing another methodology, such as observation, is recommended in further studies. Studies investigating graduate student computer competence are also recommended because they are major users of library electronic resources.

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Appendix. Student Computer Competences in Four Categories

Computer competences		
	mean	*sd*
Internet connection		
Ability to set proxy on computer from off-campus site	3.78	1.26
Ability to set VPN on computer from off-campus site	3.05	1.47
Ability to connect to library Web site from wireless equipment	2.77	1.35
Software installation		
Ability to register to use a database	3.52	1.10
Ability to install prescribed software to use a database	3.33	1.14
Ability to install new version of prescribed software	3.22	1.10
Document management		
Ability to compress and decompress a document	4.65	0.56
Ability to export and email documents from a database	4.55	0.64
Ability to put documents in “My favorites” for further use	4.41	0.85
Ability to enlarge or adjust resolution of a document	4.41	0.85
Ability to mark or note a PDF-type document	3.54	1.21
Ability to save a document on computer for further use	3.39	1.29
Ability to use bibliographic management tools (e.g., EndNote, RefWork)	2.50	1.17
Current awareness		
Ability to use RSS	3.93	1.03
Ability to use “Alert” service offered by databases	3.30	1.22
Ability to join discussion groups of interest	2.86	1.29
Ability to subscribe to e-news offered by databases	2.32	0.99

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