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The Passive Usage of ICT by Japanese Undergraduate Students

Mayumi Kubota

Kansai University, Japan

The primary purpose of this study is to investigate Japanese undergraduate students' attitudes towards various information communication technologies (ICTs) in order to construct an effective learning environment at a Japanese university. To achieve this purpose, a questionnaire survey was administered at six different universities at the beginning of the first semester of 2011. Data for 855 subjects were collected. After examining the demographic information of the data, factor analysis was conducted to analyze students' use of the Internet in relation to their studies. Six factors were extracted: "convenience," "utilization," "encyclopedia," "primary sources," "consideration," and "the negative sense of usage." Based on these factors, a t-test was conducted with gender and a path analysis was conducted in order to identify interrelationships among the six factors. After discussion of the results, four approaches are suggested to enhance ICT use by freshmen for academic study.

Keywords: ICT, Consideration, Freshmen, Learning, Questionnaire

Study Background and Purpose

The primary purpose of this study is to investigate Japanese undergraduate students' attitudes towards using various information communication technologies (ICTs) in light of Prensky's (2001) notion of *Digital Natives* and *Digital Immigrants*. Prensky holds that, because of generational gaps, students and teachers can be categorized as either native or immigrant in their technological abilities. Proponents of this theory maintain that if "immigrant" instructors can effectively grasp their "native" students' approaches toward

new technologies, higher education teaching methods can be adjusted accordingly to use their abilities effectively and enhance academic understanding. Hence, many studies have examined students' use of technologies, such as Kennedy, Judd, Churchward, and Gray (2008), who surveyed more than 2000 incoming first-year Australian university students in 2006 and found that the first year students' patterns of access to, use of and preference for a range of other technologies beside computer, emails and mobile phones show considerable variation. A diverse usage of technologies by the first-year students in Australian university was also found in the study by Corrin, Lockyer and Bennet (2010).

Hosein, Ramanau, and Jones (2010) conducted a longitudinal survey in England examining the time spent on 'living' and 'learning' technologies by 369 first-year university students, the frequency that specific learning technologies were used, and participants' competencies with each tool. The researchers found that age was not a simple predictor of technological use, and concluded that "the theory that there is a distinct difference in the ICT competence of Net Generation aged students with technology does not seem to hold when it comes to using learning technologies" (p.416).

Therefore, it remains unclear how students should best use the wide range of technologies available to them for academic learning. Additionally, the use of these technologies in educational sectors varies according to educational systems, school cultures, and technological environments. The 2012 Programme for International Student Assessment (PISA) conducted by the Organization for Economic Cooperation and Development (OECD) revealed in its evaluation of 15-year-old students' mathematics, science, reading, and problem-solving skills that only 8.0% of Japanese students reviewed their homework using a computer, the lowest among the 65 (34 OECD and 31 non OECD) countries surveyed. Comparatively, results for Korea, Shanghai-China, Indonesia, the United States, and Finland were 38.8%, 43.0%, 86.7%, 45.4%, and 27.0% respectively (the OECD average is 46.2%).

Hashimoto (2011) warns that the definition of a digital native is unclear, and often based upon an assumption that such individuals access the Internet primarily using personal computers. In Japan, however, a unique mobile phone culture exists and computers are not necessarily perceived as devices used to access to the Internet; consequently, Hashimoto, Okutsu, Nagao, and Shono (2010) coined the term *neo-digital native* (NDN). While digital natives

are individuals from Japan born around 1976, NDNs were born between 1986 and 1996.

Hashimoto et al. (2010) identified a series of distinct technological behaviors among Japanese people born in 1976, 1986, and 1996 (herein referred to as the ’76, ’86, and ’96 generations respectively). NDNs characteristically use video for daily communication among friends. Furthermore, they value immediacy, frequently visit blogs, and use social networking services (SNS). Accordingly, NDNs value being constantly connected, which allows them to immediately respond to e-mails; thus, in some sense, being connected affords these individuals a feeling of security. NDNs are mobile oriented, and have been exposed to mobile phones, music players, and games since their inception. Members of the ’86 and ’96 generations write sentences easily with mobile phones, and verify the layout using a computer; in contrast, individuals from the ‘76 generation depend primarily on a computer when writing (Hashimoto et al., 2010). Therefore, one must consider these phenomena when conducting a survey of freshmen undergraduates in Japan.

Mobile-oriented culture is closely related to users’ daily lives. For example, women aged 13 to 69 use mobile mail more frequently than men, although both genders access websites on mobile phones with equal regularity (Hashimoto, 2011). Moreover, 87% of female high school students use mobile phones daily compared to 77% of male students. It is also interesting to note that 11% of female high school students use personal computers daily, compared to 21% of male students (Nihei, Shiraishi, & Terui, 2008). Thus, gender is among the important indicators of first-year Japanese undergraduates’ technological behavior.

In 2003, the subject ‘Information Study’ became mandatory in upper-secondary schools; however, not all high school students were able to register for the subject ‘Information Study’ because of a shortage of qualified teachers (Sawada, 2008). Furthermore, the knowledge possessed by university students regarding ICT and the skills required for its use varies. While transitioning from upper secondary to higher education is key to developing effective learning environments at Japanese universities, few studies exist that specifically focus on contemporary freshmen attitudes towards the use of ICT. By focusing on freshmen, we will gain an understanding of the support systems needed to ease their transition into the academic world.

The purpose of this study is to investigate Japanese undergraduates' attitudes towards ICT use, with special emphasis on freshmen. A questionnaire survey was administered at six different Japanese universities upon commencing the first semester in 2011. Data from 863 students were collected, and the preliminary findings were presented in an earlier study (Kubota, 2013). This paper elaborates on those results and examines the interrelationships among them to propose future directions for freshmen to use ICT in their active learning. I begin by presenting the basic findings of previous studies that are relevant to this purpose. Next, results of the analyses conducted specifically for the current study are presented. Finally, several suggestions are made for the future use of ICT in learning.

Research Methods

This study poses the following research questions: 1) Are there any common characteristics among freshmen in terms of their ICT use? 2) How do freshmen use the Internet in relation to their studies? 3) Does this use differ by gender? To answer these questions, a questionnaire survey was administered comprising three sections: 1) items concerning participants' backgrounds, such as gender and whether they studied the subject 'Information Study' in high school (k=13); 2) inquiries regarding their use of web community sites (k=10); and 3) questioning pertaining to respondents' network use in relation to their studies (k=20). A 4-point Likert-type scale with response options ranging from strongly agree to strongly disagree are used in Section 3.

Regarding the use of web community sites, a chi-square test was performed to determine if there were any gender differences in addition to ones found in the previous study. Factor analysis of students' ratings for questions in Section 3 was conducted to reveal participants' ICT use characteristics, and t-tests were conducted on the factor scores to expose gender differences. Lastly, confirmatory factor analysis was conducted to identify interrelationships among factors.

Results and Discussion

Demographic Information

Of 855 students, 743 were freshmen and 112 were at least sophomores (excluding three missing values). Thus, the computer use of 743 freshmen was analyzed in this paper. Among them, 269 (36.2%) and 474 (63.8%) were male and female respectively; and 71.9%, 26.6%, and 0.4% attended public, private, and international schools respectively. Sixty nine point six percent of the students had studied the subject 'Information Study' during their high school years; the percentages of students who studied the subject 'Information Study A,' 'Information Study B,' and 'Information Study C' were 52.2%, 9.5%, and 8.0% respectively. Thus, it can be concluded that most participants possessed basic knowledge of computer-mediated communication systems, although skills and practices such as slide creation for PowerPoint presentations and authoring personal web pages was prioritized over developing the academic use of ICT.

Regarding the availability and possession of personal computers (PCs) among freshmen, 95.4% had access to a PC, 66.8% possessed their own, and 33.2% shared a system. Although 66.8% of the freshmen owned PCs, 68.5% of the machines were purchased within a one-month period. The percentages of students who possessed a PC for six months, a year, two years, three years, or more than three years was 9.1%, 3.7%, 3.1%, 4.5%, and 11.1% respectively (excluding 258 missing values). Additionally, all students except three owned mobile phones; however, only 20.8% (n=154) were using smartphones at the time of data collection in April 2011.

According to Motomura (2013), between 2009 and 2011, the number of Chinese (n=100), Korean (n=99), and Japanese (n=266) junior high school students who owned computers was 61.4%, 99%, and 42.5% respectively. The same study also solicited junior high school students' perspectives concerning ICT in relation to their own experiences, finding that 'Utilizing ICT for jobs in the information industry' was statistically low for Japanese students, and statistically high for Chinese students. Moreover, 'the general use of ICT in hobbies and daily life' was statistically low for Chinese students. Thus, students' perspectives towards ICT and their behaviors reflect the IT environment of each country.

Twenty nine point one percent of the undergraduates surveyed had experience interacting with individuals outside of Japan using the Internet, although only 8.6% used teleconferencing. In short, the author discovered the following concerning this demographic:

1) It includes more females than males
2) Sixty nine point six percent of the students registered for the subject 'Information Study' in high school
3) Sixty eight point five percent of the students (n=332) purchased PCs approximately a month prior to their freshmen year
4) Less than 30% had prior experience interacting with non-Japanese online
5) Although most freshmen owned mobile phones, only 20.8% used smartphones as of April 2011

According to the Ministry of Internal Affairs and Communications (2013), smartphone ownership increased rapidly from 9.7% in 2010 to 49.5% in 2012. Therefore, the data should be interpreted according to when it was collected in 2011 while noting that the circumstances surrounding personal media use are changing rapidly. Despite this limitation, the data show that university freshmen can be more active users of ICT for academic purposes.

Usage of Web Community Sites

In Kubota (2013), the use of ten web community sites by freshmen was examined and categorized by frequency (e.g., almost daily, three to four times weekly, once or twice weekly, less than once a month, never used, only for viewing/reading). The ten types of sites included: blogs (Decolog etc), microblogs (Twitter etc), prof (Zenryaku Prof (profile site in Japanese) etc), Q & A sites (Yahoo Chiebukuro etc), anonymous bulletin boards (2channel etc), video sites (YouTube, NikoNiko Movie sites etc), live broadcasting (NikoNiko, LiveBroadcasting, Ustream etc), SNS (mixi, Facebook, GREE etc), online game (Monster Hunter, Final Fantasy etc), and virtual worlds (Ameba Pigg).

The findings reveled that, as of 2011, the most frequently used web community sites by freshmen were SNS (56.9%). As mentioned above, sites in this category included mixi, GREE, and Facebook. In Japan, Facebook became popular in January 2011 following the theatrical release of "The Social Network." Hence, at the time of the survey (April 2011), Facebook had

not achieved the popularity it had in western countries, with most Japanese preferring to use mixi instead.

Video sites were the second most frequently visited (41.2%), followed by **blogs** (40.9%). Consequently, the percentage for "never used" and "only for viewing/reading" was quite high in this data. For example, the percentage of respondents who only viewed/read **video sites, Q & A sites,** and **blogs** was 54%, 47.5%, and 41.2% respectively. According to the Ministry of Internal Affairs and Communications (2013), the highest usage of SNS was about 60% by individuals between 20 to 29 years old (n=4573). Thus, data in this study is almost average.

A chi-square test was performed to determine if a relationship existed between gender and the active or passive use of various web sites. Active use entails visiting sites almost daily to less than once a month; passive use involves visiting sites only to view content. By conducting a chi-square test across the ten types of sites, it was found that gender is statistically related to the active and passive use of blogs ($\chi^2(1, N=599)=26.828$, p=.000) and online games ($\chi^2(1, N=160)=10.416$, p=.001). In other words, female and male students use blogs and online games differently in terms of active and passive way of usages. As mentioned previously, blogs are among the most frequently used site types with the highest percentage of users who only view/read its material. Thus, it is clear that these usage styles differ by gender.

Factor Analysis and T-test Results

Factor analysis was conducted to determine the latent variables for the Internet use in relation to academic study. Table 1 shows the factor loading following promax rotation. After the rotation, six factors were extracted. The first factor comprises four items (**white paper**, **public sites**, **news sites**, **net than bookshelf**), and was thus labeled **primary sources** (**primsources**). The second factor comprises three items (**copyright**, **quotation**, **two sites**) and was subsequently named **ethical use**. The third factor comprises three items (**Wikipedia**, **Q&A**, **dictionary**) and was thus labeled **encyclopedia**. The fourth factor comprises four items (**indispensable**, **first net**, **get online help**, **digital information**); therefore, the fourth factor was named **convenience**. The fifth factor comprises three items (**many choices**, **ambiguous sources**, **inconvenient**) and was labeled **negative sense of use**. Finally, the sixth factor comprises three items (**ask friend first**, **search engine**, **inquire deeply**) and

was titled **utilization**. Bold words used in the question items indicate the names of variables that appear in the following analysis.

The six factors extracted from the data (**primary sources**, **ethical use**, **encyclopedia**, **convenience**, **negative sense of use**, **utilization**) did not correlate strongly according to the factor analysis. Thus, in order to grasp the interrelationships among the six factors, a path analysis based on covariance structure analysis (AMOS) was conducted (see Section 4).

Table 1. *Factor analysis of the questions in section 3*

Item	Factors					
	1	2	3	4	5	6
I often use the **white paper** on the Internet.	**0.876**	0.009	0.059	-0.022	-0.012	0.034
I often use **public sites** such as the Ministry of Education, Science and Culture.	**0.811**	0.097	-0.125	0.009	-0.024	0.055
I often use **news sites.**	**0.753**	0.055	0.071	0.005	-0.123	-0.071
At the library, I use Inter**net** search engine rather **than** going to the **bookshelves**	**0.354**	0.122	-0.216	0.282	0.036	0.063
I care about **copyright**.	0.08	**0.819**	0.097	-0.128	0.123	-0.078
I care about use of **quotations** and try not to make any mistakes.	0.086	**0.799**	0.134	-0.172	0.079	-0.002
I compare the data from more than **two sites** when I write a report.	0.007	**0.559**	-0.161	0.294	-0.089	0.057
Wikipedia is convenient.	-0.075	0.068	**0.831**	-0.03	0.034	-0.12
Q & A sites(Yahoo Chiebukuro etc) is convenient.	-0.019	-0.037	**0.754**	-0.055	0.135	0.058
A **dictionary** on the Internet is useful.	0.075	0.124	**0.623**	0.06	-0.175	-0.03
Using Internet is **indispensable**.	0.027	-0.132	-0.07	**0.765**	0.101	-0.048
I will **first** search the Inter**net** whenever I have a problem with my report.	-0.016	-0.024	-0.014	**0.731**	-0.06	-0.136
It is fine to **get online help** when I need to solve the assigned problem.	0.207	-0.355	0.162	**0.457**	0.341	-0.105
Digital information is valuable because it is easy to modify and process.	0.038	0.167	0.169	**0.416**	0.103	-0.024
It is cumbersome to search for information because of too **many choices**.	-0.165	0.082	-0.022	0.14	**0.866**	0.123
It is not easy to use the information because the **source** is **ambiguous**.	-0.089	0.391	-0.061	0.167	**0.695**	-0.049
It is **inconvenient** to use Internet when I study.	0.163	-0.145	0.108	-0.244	**0.615**	0.137
I will **first ask** my **friend** whenever I have a problem with my report.	0.038	-0.051	-0.092	-0.216	0.225	**0.92**
An Internet **search engine** is convenient.	-0.042	0.083	0.196	0.266	-0.208	**0.388**
I can **inquire deeply** with Internet..	-0.046	-0.018	0.269	0.33	-0.128	**0.342**
Factors	1	2	3	4	5	6
1	1	0.223	0.026	0.219	0.331	-0.049
2		1	0.019	0.225	0.014	0.089
3			1	0.375	-0.141	0.243
4				1	-0.145	0.222
5					1	-0.147
6						1

Table 2 shows the t-test results by gender for the six factors elucidated from factor analysis in Section 3 (male=269; female=474).

Table 2. *Gender differences*

		Male		Female	t-value
Factor 1	primary source	.0646	(1.0596)	-.0366 (.9637)	1.329
Factor 2	ethical use	-.1563	(1.0715)	.0887 (.9467)	-3.123**
Factor 3	encyclopedia	.1939	(1.0106)	-.1100 (.9779)	4.023***
Factor 4	convenience	-.0693	(1.1046)	.0393(.9343)	1.361
Factor 5	negative sense of use	-.1187	(1.0466)	.0674 (.9671)	-2.447*
Factor 6	utilization	-.1618	(1.0718)	.0918 (.9457)	-3.233**

*p<0.05, ** p<0.01, *** p<0.001, ( ) standard deviation

According to the t-test results, the female t-values for **ethical use**, **negative sense of use**, and **utilization** are significantly higher than males', while the male t-value for **encyclopedia** is higher than for females. Based on these results, it can be surmised that female students use ICT more cautiously and methodically than their male counterparts; this is because female students use ICT more for research, and believe that **search engines** are convenient. However, they also **ask their friends** upon encountering problems with their reports rather than consulting the **Internet first**. Since the female students use ICT actively in their research, they are mindful of **copyright** issues and the use of **quotations**. These behaviors cause female students to have **negative sense of use**, since there are **too many choices** and **ambiguous sources** online. In contrast, male students believe that encyclopedias such as **Wikipedia** are convenient. Therefore, these differences in gender should be considered in order to enhance the use of ICT for academic purposes.

Path Analysis

A path analysis based on covariance structure analysis (AMOS) was conducted to better understand interrelationships among the six factors. It was hypothesized that the students used the Internet because of **convenience**, which can be explained by several features, such as **ethical use**, **encyclopedia**, **utilization**, and **primary sources**. Figure 1 shows the final results of the path analysis. All relationships among the 19 observed variables and six construct variables were statistically significant, at the level of 0.1%. The hypothesized model showed a good fit with the given data: GFI (Goodness of Fit Index) = 0.908, AGFI (Adjusted Goodness of Fit Index) = 0.881, CFI (Comparative Fit

Index) = 0.817, and RMSEA (Root mean Square Error of Approximation) = 0.069 (Toyoda, 2007). According to Toyoda (2007), if RMSEA is less than 0.05 the model is a good fit, however if it is more than 0.1, it is not; between 0.05 and 0.1 is denoted a "gray zone," and requires more careful interpretation. Therefore, it can be said that the model goodness of fit results in this study are quite satisfactory, although more careful interpretations are needed.

Latent variable, **convenience**, comprise variables such as **indispensable** (β=0.51, ρ<0.001); **use net first** (β=0.52, ρ<0.001); **digital information** (β=0.49, ρ<0.001); and **get online help** (β=0.37, ρ<0.001) strongly affect **utilization** (β=0.70, ρ<0.001) and **encyclopedia** (β=0.62, ρ<0.001), while **convenience** has a moderate effect on **primesources** (β=0.34, ρ<0.001) and **ethical use** (β=0.22, ρ<0.001). On the other hand, latent variable, **convenience**, had no statistically significant direct effect on **negative sense of use**, which was consequently removed from the model. Path analysis results instead suggested that **convenience** had an effect on **ethical use** (β=0.22, ρ<0.001), which, in turn had an effect on **negative sense of use** (β=0.41, ρ<0.001). In other words, **ethical use**, which comprises **copyright** (β=0.83, ρ<0.001), **quotation** (β=0.72, ρ<0.001), and **two sites** (β=0.40, ρ<0.001), mediated the effect of **convenience** on **negative sense of use**, which comprises variables such as **too many choices** (β=0.58 ρ<0.001), **ambiguous sources** (β=0.80, ρ<0.001), and **inconvenient** (β=0.34, ρ<0.001).

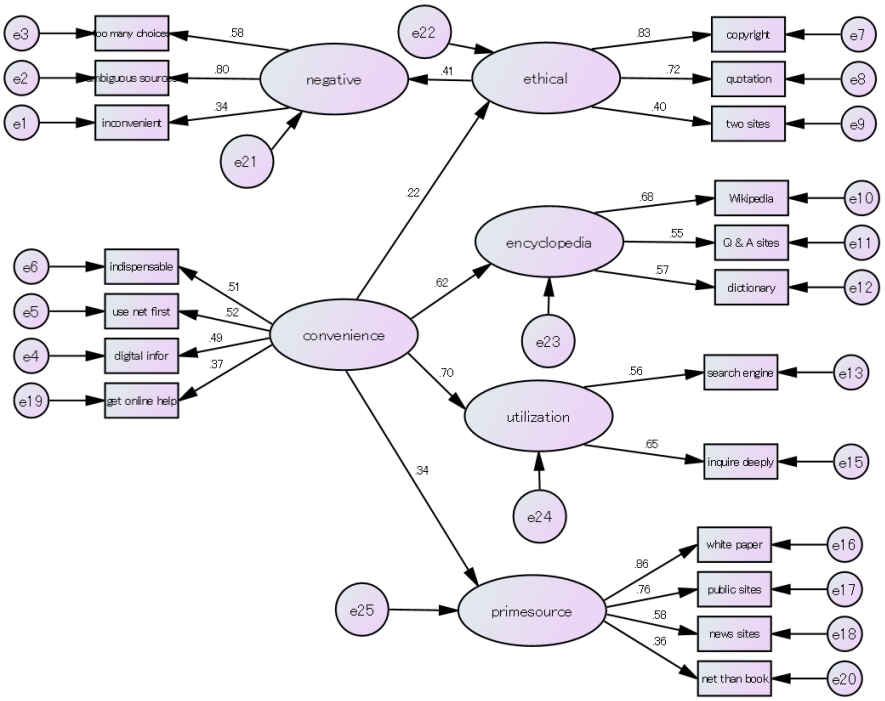

Figure 1. *Model of interrelations among six factors*

Discussion and Conclusion

Approximately 70% of the freshmen surveyed in this study recently purchased their own computers. Nevertheless, these students were accustomed to accessing the Internet in their daily lives, albeit perhaps more frequently through a mobile phone. Furthermore, mobile phones are not synonymous with smartphones in this study. Considering these circumstances, the students excel at using SNS and enjoy visiting **video sites** immensely. Therefore, the freshmen surveyed were essentially members of the neo-digital generation (NDG). However, the NDG is not necessarily composed of globally minded individuals who interact with other nationalities. Indeed, the data indicated that most NDG members had limited experience with teleconferencing and intercultural exchange.

Regarding the use of web sites, gender plays a critical role in using blogs and online games, either actively or passively. Additionally, female student behavior is statistically different from males in terms of **ethical use**, **negative**

sense of use, **utilization**, and **encyclopedia**. Therefore, greater attention should be afforded to gender differences.

The path analysis results indicated that, to promote an understanding among students that specifying sources is important, it is preferable to assign students tasks that require citations and/or comparisons—despite their apprehensiveness toward searching through multiple fields of information. Students cannot grasp the importance of copyright, use of quotations, and comparative analysis without confronting their negative feelings toward research. Moreover, it is important to use **primary sources** (i.e., various white papers and public sites belonging to the Ministry of Education, Culture, Sports, Science, and Technology etc) and a variety of news sources for educational purposes.

The results indicate that utilizing primary sources alone is insufficient when compared to Wikipedia and a search engine, although students may believe that primary sources are convenient.

This study focused on freshmen's attitudes and behaviors towards using ICT for academic purposes, placing emphasis on a smooth transition from the high school to university level. One characteristic of an NDG is that they can easily use new technologies. Thus, our strategies for using ICT for academic purposes are not designed to teach students how to use various ICT technologies, but to offer assignments that enhance critical thinking and problem-based learning. Kirkwood and Price (2006) assert that students in higher education should "develop and refine *information literacy* skills that go beyond basic searches" so that they understand that, "managed 'gateways' or 'portals' can provide access to appropriate and quality-assessed websites, possibly not accessible by other means" (p. 268). Furthermore, group work with both female and male participants will reinforce students' skills, since their ICT use differs, as this study highlighted earlier.

According to Hashimoto (2011), the '86 generation excels at writing sentences using a mobile phone, and can write at a speed equal to a '76 generation user with a computer. Mixi, the largest Japanese SNS, is accessed more frequently from a mobile phone than PC. This indicates that sentences written by NDNs are qualitatively different. Therefore, at the university level, assignments that require students to write several pages of logical themes could prove effective at enhancing information synthesis and writing skills for

academic purposes.

This study was limited by its inability to analyze demographic data other than gender. Our primary purpose was to investigate freshmen's attitudes towards using ICT, since there were no preexisting statistics specifically for this group. Statistics in prior studies were analyzed by age groups or generations. Thus, it was difficult to isolate freshmen attitudes specifically. As such, this data contributes to prior findings, although because it was collected from six universities whose students primarily study 'information' it cannot be feasibly analyzed by major or school.

Because of technological advancements, Internet access increases in ease and simplicity each year. Thus, it is becoming progressively more difficult to assess the state of undergraduate students surrounded by a wealth of personal media. Given the variety of functions provided by personal media and the advancement of ICT, communication among students and teachers is becoming more multilayered. As undergraduate students are exposed to university life, they begin to comprehend and use personal media in their daily affairs. Therefore, the use of ICT for educational purposes requires well-planned and intentional instruction.

Keeping these phenomena in mind, I suggest the following four approaches for the academic use of ICT. First, students should be intentionally taught where to find primary sources and how to use them for academic research. Second, female/male group work should be considered in which students collectively search for resources online and write an academic report. Third, SNS or video sites should be used in a more active manner for academic purposes (e.g., by creating a video for educational purposes students may develop concerned for ethical issues). Fourth, students should connect with various individuals online to discuss academic issues, and subsequently increase their cultural awareness. These approaches are especially important for freshmen, who must enhance their academic and global mindset in relation to their high school experiences.

University educators should bear in mind that Japanese freshmen are rather passive towards ICT use, thus, they should try to make them use ICT actively for the academic purposes by taking these four approaches. It is the author's hope that these approaches will prove beneficial in transitioning freshmen students from the high school to university level.

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