University Students' Internet Attitudes and Internet Self-Efficacy: A Study at Three Universities in Taiwan

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ABSTRACT

This study was conducted to explore university students' attitudes and self-efficacy toward the Internet. Moreover, the relationships between their attitudes and self-efficacy toward the Internet were also investigated. The sample of this study included 1,313 students, coming from three universities in Taiwan. It was found that male students expressed significantly more positive attitudes than females on their "perceived control" of the Internet. The male students also revealed better Internet self-efficacy than their female counterparts. Moreover, students having more on-line hours per week, in general, displayed more positive Internet attitudes and Internet self-efficacy. In addition, students' grade level also played an important role in their Internet attitudes; graduate students tended to possess more positive Internet attitudes. More importantly, students' Internet attitudes were highly correlated with their Internet self-efficacy. The results in this study seemed to reveal that students' attitudes toward the Internet could be viewed as one of the important indicators for predicting their Internet self-efficacy. It is also suggested that some training programs or courses may be helpful in improving university students' attitudes and self-efficacy toward the Internet.

INTRODUCTION

IN THE LAST TWO DECADES, rapid developments in information technology, such as the Internet, have made considerable and dramatic impact on contemporary educational practice.[1–3] For example, the Web-based learning where educators integrate the Internet into instructional practice can not only provide learners with distant, interactive, broad, individualized and inquiry-oriented learning activities, but also promote their knowledge construction and meaningful learning.[4,5] As the Internet is broadly used for educational purposes, learners may have more rich experiences of utilizing the Internet. However, while students have increasingly more opportunities to utilize the Internet to enhance their learning outcomes, studies about the nature of learners' Web use have not kept pace with their usage of the Internet.[6] As a re-

sult, the nature of students' Web use, such as their perceptions, attitudes and self-efficacy toward the Internet, should be highlighted by educational researchers.

Undoubtedly, appropriate attitude toward the Internet is a prerequisite for successful Internet-based instruction. Previous studies have revealed that the attitude toward a new technology plays an important role in its acceptance and usage.[7] For example, students' attitudes toward the Internet may influence their motivation and interests toward learning to use the Internet, or vice versa.[8] Over the past decade, researchers have largely explored learners' attitudes toward computers.[7,9,10] However, comparatively fewer studies have been conducted to investigate students' attitudes toward the Internet.[11–13] Therefore, one of the major purposes of the present study was to assess university students' Internet attitudes.

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Moreover, gender differences in computer-related issues are always important issues for educators. Relevant studies have indicated that male students, in general, have more positive computer-related attitudes. For instance, male students perceived lower computer anxiety, and more positive attitudes toward computer than female students.[14,15] However, still not many studies investigated learners' gender differences in Internet-related issues.[11,16] Hence, gender differences on university students' Internet attitudes were also explored in this study.

"Self-efficacy" refers to an individual learner's beliefs and expectations in his/her capability to perform in a task; and self-efficacy influences people's choice of activities, how much effort they will expend, and how long they will sustain effort in dealing with stressful situations.[17,18] In the past, self-efficacy has been an important issue in educational research. For example, teachers' self-efficacy, affecting their teaching performance and students' learning, has been a topic of much research for approximately 25 years.[19,20] Also, students' self-efficacy, which can be used to effectively predict their academic performance, has also been largely investigated.[21] While students may have increasing opportunities to learn by utilizing the Internet in Web-based instruction, their self-efficacy regarding the Internet, which may have profound impact on their learning outcomes, should become an important research topic for educators and researchers.

The Internet self-efficacy indicates Web users' self-perceived confidence and expectations of using the Internet. It has been proposed that learners with high efficacy expectations may have a greater chance of success in computer and Internet-related tasks.[22,23] Consequently, students' self-efficacy in utilizing technology-related (such as computer and the Internet) tasks has received growing attention among educational researchers.[23–27] Among these relevant studies, students' computer self-efficacy has been investigated, but Internet self-efficacy is a relatively new issue for researchers. Hence, the current study also investigated students' Internet self-efficacy and its gender differences.

In addition, "the relationships between computer attitudes and computer self-efficacy," "the relationships between computer attitudes and Internet self-efficacy," and "the relationships between Internet attitudes and computer self-efficacy" have been examined in several pervious studies.[27–29] It has been found that students' computer attitudes are positively correlated with their computer self-efficacy.[29] Also, learners with greater computer self-efficacy may have more positive attitudes toward the Internet; and male students tend to have greater computer self-efficacy and more positive attitudes toward the Internet than female students.[28] In addition, learners with more positive attitudes toward computers tend to display better Internet self-efficacy than their counterparts.[27] However, the relationships between students' Internet attitudes and their Internet self-efficacy were not investigated by these relevant studies. Therefore, the relationships between university students' Internet attitudes and their Internet self-efficacy were examined in this study.

In sum, by gathering questionnaire responses from 1,313 students in three universities in Taiwan, the present study addressed the following questions:

1. What are the university students' Internet attitudes?
2. Is there any gender difference in university students' Internet attitudes? How?
3. What is the Internet self-efficacy expressed by the students?
4. Is there any gender difference in university students' Internet self-efficacy? How?
5. What are the relationships (if any) between university students' Internet attitudes and their Internet self-efficacy? How?

METHODS

Sample

The sample of this study included 1,313 university students with different Internet experiences (consisting of 860 males and 453 females) in Taiwan. They were either undergraduate or graduate students (including 893 college students and 420 graduate students), coming from three famous national universities in Taiwan. Among the 893 college students, 320 were freshmen and sophomores, while the rest of them ($n = 573$) were juniors and seniors. As these universities are science or technology-oriented, there were much more male students than female students in the sample.

Instrument

To assess students' Internet attitudes and their Internet self-efficacy, two instruments were implemented in this study. The sample subjects' attitudes toward the Internet were assessed by the Internet Attitudes Survey (IAS), while the Internet Self-efficacy Survey (ISS) was used to measure their Internet self-efficacy.

The Internet Attitudes Survey (IAS) implemented in this study was revised from the original one developed in the previous study.[16] In the original version, the IAS consisted of 18 questionnaire items with four scales, including "perceived usefulness," "affection," "perceived control," and "behavior" (consisting of, respectively, 5, 5, 5, and 3 items).[16] The current study slightly modified the original version of IAS, and the fourth scale of IAS was extended to five items. Consequently, the IAS administered in this study included four scales, with five items per scale initially. The items of these scales were presented in a six-point Likert scale, ranging from "strongly agree," "agree," "somewhat agree," "somewhat disagree," "disagree," to "strongly disagree." The use of such a 1–6-Likert scale not only avoided totally neutral responses, but also differentiated students' variations of agreement in greater detail. The four scales used were as follows:

1. *Perceived usefulness scale*: assessing students' perceptions about the positive impacts of the Internet on individuals and society. A sample item of this scale is "The Internet makes a great contribution to human life."
2. *Affection scale*: measuring students' feeling and anxiety for using the Internet. A sample item of this scale is "The Internet makes me feel uncomfortable."
3. *Perceived control scale*: investigating students' confidence about the independent control of the usage of the Internet. A sample item of this scale is "I can use the Internet independently, without the assistance of others."
4. *Behavior scale*: assessing students' perceived actual practice and frequency of using the Internet. A sample item of this scale is "I spend much time on using the Internet."

The Internet Self-Efficacy Survey (ISS), employed in this study, was modified from previous studies.[11,23] The ISS implemented in this study included two scales, consisting of five and four items respectively. The items of the two scales were presented with bipolar strongly confident/strongly unconfident statements in a six-point Likert mode. The two scales were as follows:

1. *General self-efficacy scale*: measuring students' self-efficacy in general, such as using Internet-related tools. A sample item of this scale is "I am good at searching information on the Internet."
2. *Communicative self-efficacy scale*: assessing students' confidence and expectation of Internet-

based communication or interaction. A sample item of this scale is "I think I can talk to others in online chatrooms."

Statistical analysis

To clarify the structures of the two constructs in this study (i.e., Internet attitudes and Internet self-efficacy), exploratory analyses were conducted on the data. A series of t-tests were used to make gender comparisons on the construct scales. The role of Internet experiences and student grade levels on these scales were examined by ANOVA F-tests. In addition, a series of correlation analyses were also conducted to examine the relationships between these two constructs (i.e., Internet attitudes and Internet self-efficacy).

RESULTS

Factor analysis

To clarify the structure of students' Internet attitudes, the principle component analysis was utilized as the extraction method, with the rotation method of varimax with Kasier normalization. An item would be retained, if the factor loading of the item was larger than 0.5 in the relevant scale and smaller than 0.5 in the non-relevant scale. The results of factor analyses revealed that students' responses in the Internet Attitudes Survey (IAS) were grouped into four factors, which were "perceived usefulness scales," "affection scale," "perceived control scale," and "behavior scale." The initial 20 items were reduced to 19, and there were, respectively, 5, 5, 5, and 4 items in the four scales of IAS. The factor loadings for retained items are presented in Table 1. The four scales were exactly the same as the original version,[16] and they accounted for 59.81% of variance totally.

The reliability (alpha) coefficients for the four scales respectively were 0.78, 0.83, 0.78, and 0.80, and the overall alpha was 0.86. Moreover, in this study, the alpha in the fourth scale of IAS (alpha = 0.80) was much higher than that reported in the original version (alpha = 0.49).[16] Therefore, these scales were deemed to be sufficiently reliable for assessing students' Internet attitudes.

Similarly, exploratory analysis was adopted to clarify the structure of the Internet self-efficacy. By the method mentioned above, students' responses in the Internet Self-efficacy Survey (ISS) were grouped into two factors: "general self-efficacy" and "communicative self-efficacy." There were five

TABLE 1. ROTATED FACTOR LOADINGS AND CRONBACH'S α VALUES FOR THE FOUR SCALES OF INTERNET ATTITUDE SURVEY ($N = 1313$)

Item	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1: Perceive usefulness, α = 0.78				
Perceive use 1	0.650			
Perceive use 2	0.717			
Perceive use 3	0.718			
Perceive use 4	0.707			
Perceive use 5	0.701			
Factor 2: Affection, α = 0.83				
Affection 1		0.750		
Affection 2		0.810		
Affection 3		0.806		
Affection 4		0.669		
Affection 5		0.651		
Factor 3: Perceived control, α = 0.78				
Perceived con 1			0.650	
Perceived con 2			0.565	
Perceived con 3			0.771	
Perceived con 4			0.765	
Perceived con 5			0.771	
Factor 4: Behavior, α = 0.80				
Behavior 1				0.542
Behavior 2				0.830
Behavior 3				0.774
Behavior 4				0.765
Percentage of variance	31.39	11.54	10.09	6.79

Overall α = 0.86. Total variance explained is 59.81%.

TABLE 2. ROTATED FACTOR LOADINGS AND CRONBACH'S α VALUES FOR THE TWO SCALES OF INTERNET SELF-EFFICACY SURVEY ($N = 1313$)

	Factor 1	Factor 2
Factor 1: General self-efficacy, α = 0.90		
General 1	0.830	
General 2	0.794	
General 3	0.762	
General 4	0.779	
General 5	0.748	
Factor 2: Communicative self-efficacy, α = 0.85		
Communicative 1		0.787
Communicative 2		0.768
Communicative 3		0.582
Communicative 4		0.840
Percentage of variance	61.21	9.80

Overall α = 0.91. Total variance explained is 71%.

and four items in these two scales respectively. The factor loadings for the items of these two scales are shown in Table 2, and in total, 71% variance was explained by these two scales. In addition, the alpha coefficients for these two scales were 0.90 and 0.85, respectively, and for the entire ISS questionnaire was 0.91, indicating that these scales were considered as adequately reliable for surveying students' Internet self-efficacy.

Students' scores on the scales

Table 3 shows students' average scores and standard deviations on the scales of the IAS. Students attained similar high scores on the perceived usefulness scale (an average of 5.07 per item), the behavior scale (an average of 5.06 per item), and the affection scale (an average of 5.04 per item) in the 1–6-Likert measurement. Although students scored relatively lower in the perceived control scale (an average of 4.49 per item), the average score was still higher than the mean of 1–6-Likert scale (i.e., 3.5). The results indicated that students, in general,

	Mean	SD
Internet attitude		
Perceived usefulness	5.07	0.61
Affection	5.04	0.70
Perceived control	4.49	0.74
Behavior	5.06	0.72
Internet self-efficacy		
General self-efficacy	5.54	0.60
Communicative self-efficacy	5.19	0.85

displayed positive attitudes regarding the usefulness of using the Internet, the control of using the Internet, and they also have positive affection when using the Internet. In addition, they also showed frequent behavior of using the Internet.

Table 3 also presents students' average scores and standard deviations on the scales of the ISS. Students had high scores on two ISS scales, but students, on average, attained higher scores on the general self-efficacy scale (an average of 5.54 per item) than those on the communicative self-efficacy scale (an average of 5.19 per item). The results implied that university students in this study tended to display high confidence and expectation of using the Internet for general and communicative purposes. Furthermore, they might show higher confidence and expectation of using the Internet for general purposes than those for communicative purposes.

Gender differences on Internet attitudes and Internet self-efficacy

The gender differences on IAS responses were examined, presented in Table 4. The results showed that these two gender groups of students only showed statistical differences on the "perceived control' scale" ($p < 0.001$), indicating that the male students, on average, scored higher on this scale than the female students did. It implied that male students expressed stronger beliefs regarding the independent control of the usage of Internet than female students. However, it has been reported that high school students of different genders showed significant differences on their scores on the "affection," "perceived control," and "behavior' scales" ($p < 0.05$) in the previous study.[16] The findings in this study were somewhat different from those of the previous study. Unlike high school students, university students of different genders did not show significant differences in their feelings, anxiety and perceived usefulness when using the Internet; and no significant differences were found between these two groups of students in their actual practice and frequency of using the Internet as well.

Furthermore, the differences between male and female students' scores on the two scales of the ISS were also explored. Table 4 revealed that these two groups of students had significant differences on both the "general self-efficacy" scale and the "communicative self-efficacy" scale ($p < 0.05$), and male students attained higher scores on both scales than female students. The results indicated the male students in this study expressed significantly higher confidence and expectation of using the Internet for

TABLE 4.   GENDER COMPARISONS ON THE SCALES OF THE INTERNET ATTITUDE SURVEY
AND THE INTERNET SELF-EFFICACY SURVEY

	Male (mean, SD)	Female (mean, SD)	t value
Internet attitude			
Perceived usefulness	5.10 (0.64)	5.05 (0.55)	0.74 (n.s.)
Affection	5.02 (0.72)	5.08 (0.65)	−1.45 (n.s.)
Perceived control	4.58 (0.74)	4.30 (0.71)	6.61***
Behavior	5.07 (0.74)	5.03 (0.68)	0.88 (n.s.)
Internet self-efficacy			
General self-efficacy	5.56 (0.59)	5.50 (0.61)	1.99*
Communicative self-efficacy	5.23 (0.83)	5.12 (0.87)	2.35*

*$p < 0.05$.
***$p < 0.001$.

both general and communicative purposes than did the female students.

Role of Internet experiences on Internet attitudes and Internet self-efficacy

In this study, the interplay between students' Internet attitudes and their Internet experiences was also investigated. The amount of the participant's on-line hours in average per week was defined as his/her Internet experience. In this study, the students were divided into five groups of different Internet experiences: <14 h, 14–21 h, 21–28 h, 28–35 h, and finally >35 h. Then, the analyses between different Internet experience groups and their Internet attitudes were conducted, and the results are presented in Table 5.

The ANOVA tests revealed that Internet experience played a statistically significant role on all of the IAS scales ($p < 0.001$). A series of Scheffe tests (post hoc tests) further indicated that students having more time of using the Internet, in general, tended to have statistically higher scores on all of the four scales of perceived usefulness, affection scale, perceived control, and behavior. Particularly, students' Internet experience (i.e., their hours of using the Internet) was highly related to their scores on the "behavior" scale, their perceived behavior of using the Internet ($F = 64.70$, $p < 0.001$),

and it was revealed that students with more Internet experiences tended to attain higher scores on the "behavior" scale. This finding also provided evidence for sufficient criterion-related validity of IAS administered in this study. Moreover, students, who had more Internet experiences, tended to express more positive feeling, lower anxiety and independent control toward the usage of Internet (i.e., affection and perceived control scales). It implies that learners' abundant Internet experience might help them feel more confident for controlling the Internet.

Table 5 also presents the comparison of Internet self-efficacy among students' Internet experience groups. The ANOVA tests showed that students' Internet experience also played a significant role on both scales of the ISS, that is, "general self-efficacy" and "communicative self-efficacy" ($p < 0.05$). Through a series of Scheffe tests, it was found that students who spent more time of using the Internet per week tended to attain higher scores on the both self-efficacy scales. Students' Internet experiences helped them enhance not only their general self-efficacy but also communicative self-efficacy toward the Internet. In particular, the Scheffe tests showed that students' Internet experiences were highly related to their communicative self-efficacy, as more significant differences were found among the Internet experience groups in this scale.

TABLE 5.   STUDENTS' INTERNET ATTITUDES AND INTERNET SELF-EFFICACY AMONG GROUPS OF DIFFERENT INTERNET EXPERIENCES

On-line hours per week	Perceived usefulness (mean, SD)	Affection (mean, SD)	Perceived control (mean, SD)	Behavior (mean, SD)	General self-efficacy (mean, SD)	Communicative self-efficacy (mean, SD)
(1) Less than 14 h (*n* = 260)	4.97 (0.60)	4.83 (0.65)	4.22 (0.73)	4.57 (0.69)	5.42 (0.59)	4.97 (0.88)
(2) 14–21 h (*n* = 287)	5.01 (0.56)	5.03 (0.64)	4.43 (0.72)	4.93 (0.63)	5.55 (0.56)	5.23 (0.84)
(3) 21–28 h (*n* = 192)	5.11 (0.53)	5.05 (0.67)	4.58 (0.68)	5.12 (0.53)	5.56 (0.59)	5.26 (0.81)
(4) 28–35 h (*n* = 237)	5.07 (0.67)	4.97 (0.81)	4.49 (0.76)	5.21 (0.67)	5.54 (0.59)	5.14 (0.87)
(5) More than 35 h (*n* = 337)	5.18 (0.63)	5.26 (0.66)	4.69 (0.73)	5.40 (0.69)	5.60 (0.63)	5.33 (0.80)
F (ANOVA)	5.51***	15.73***	16.92***	64.70***	3.31*	7.56***
Scheffe Test	(5) > (1) (5)>(2)	(5) > (2) > (1) (5)>(3) >(1) (5)>(4)	(5) > (2) > (1) (5)>(4) >(1) (3) > (1)	(5) > (2) > (1) (5)>(3) >(1) (5) > (4) > (1) (4) > (2)	(5) > (1)	(2) > (1) (3)>(1) (5) > (1)

*$p < 0.05$.
***$p < 0.001$.

TABLE 6. STUDENTS' INTERNET ATTITUDES AND INTERNET SELF-EFFICACY AMONG GROUPS OF DIFFERENT GRADES

Grade	Perceived usefulness (mean, SD)	Affection (mean, SD)	Perceived control (mean, SD)	Behavior (mean, SD)	General self-efficacy (mean, SD)	Communicative self-efficacy (mean, SD)
(1) Freshmen & Sophomore	5.05 (0.69)	5.02 (0.64)	4.30 (0.80)	5.10 (0.75)	5.50 (0.66)	5.19 (0.86)
(2) Junior & senior	5.03 (0.58)	5.00 (0.73)	4.42 (0.73)	4.99 (0.72)	5.53 (0.58)	5.18 (0.84)
(3) Graduate	5.14 (0.57)	5.12 (0.69)	4.72 (0.65)	5.12 (0.68)	5.57 (0.57)	5.20 (0.85)
F (ANOVA)	4.41*	4.25*	33.77***	4.41*	1.47	0.10
Scheffe Test	(3) > (2)	(3) > (2)	(3) > (1) (3) > (2)	(3) > (2)		

*$p < 0.05$.
***$p < 0.001$.

Role of grade levels on Internet attitudes and Internet self-efficacy

In this study, the relationships between students' Internet attitudes and their grade levels were also explored. First, students were divided into three groups of different grade levels: the freshmen and sophomore ($n = 320$), the junior and senior ($n = 573$), and the graduate ($n = 420$). Then, a series of ANOVA test analyses were conducted to evaluate the possible interactions of grade level and Internet attitude (as well as Internet self-efficacy). The results of the analyses between different grade level groups and their Internet attitudes are presented in Table 6.

The ANOVA tests showed that grade level played a role on all the four scales of the IAS ($p < 0.05$). The follow-up Scheffe tests also revealed that graduate students' Internet attitudes were significantly better than those expressed by college students. Moreover, the results in Table 6 also indicated that students' grade level might not be related to their Internet self-efficacy.

Correlation between Internet attitude and Internet self-efficacy

According to Table 7, students' responses on each scale of the IAS were all significantly positively correlated with their responses on the "general self-

efficacy" scale of ISS ($r > 0.30$, $p < 0.001$). The results indicated that the students expressing more positive perceptions, less anxiety, better control, and frequent usage toward the Internet would display higher general self-efficacy regarding the Internet. Among these four scales, the students' responses on the "perceived control" scale had the highest correlation with their responses on the "general self-efficacy" scale ($r = 0.37$, $p < 0.001$), suggesting that students having more confidence about the independent control of using the Internet would show higher general self-efficacy regarding the Internet.

Also, the results in Table 7 indicated that students' responses on each scale of the IAS were all significantly correlated with their responses on the "communicative self-efficacy" scale of ISS ($p < 0.001$). In particular, their responses on the "behavior" scale were relatively highly correlated with that on the "communicative self-efficacy" scale ($r = 0.30$, $p < 0.001$). It seemed that students, using the Internet more frequently, might tend to attain better communicative self-efficacy regarding the Internet.

DISCUSSION

The IAS and the ISS administered in this study are deemed to be sufficiently reliable for assessing

TABLE 7. CORRELATION BETWEEN STUDENTS' INTERNET ATTITUDES AND THEIR INTERNET SELF-EFFICACY

	Perceived usefulness	Affection	Perceived control	Behavior
General self-efficacy	0.32***	0.36***	0.37***	0.35***
Communicative self-efficacy	0.24***	0.29***	0.29***	0.30***

***$p < 0.001$.

students' Internet attitudes and their Internet self-efficacy respectively. By means of these two instruments, the present study explored a group of Taiwan university students' Internet attitudes and Internet self-efficacy. It has been proposed that learners' attitudes toward the Internet may influence their motivation and interests toward learning to use the Internet,[8] which in turn affect their performance in Web-based learning environments. Moreover, individuals with high Internet self-efficacy may display better performance in Web-based learning tasks.[23] However, students in the present study scored relatively low on the "perceived control" scale of the IAS and the "communicative self-efficacy" scale of the ISS. These results probably suggest that educators should try to find some effective ways to improve students' independent control of using the Internet and their capacity of Internet-based communication and interaction in Internet-based environments. Previous studies have revealed the effects of training on Internet self-efficacy and computer user attitudes.[27] Therefore, it may be practicable for educators to enhance learners' attitudes and self-efficacy toward the Internet by utilizing similar training programs.

This study also examined gender differences among university students on their attitudes and self-efficacy regarding the Internet. In a previous study,[16] high school students displayed gender differences on their affection, perceived control, and behavior of using the Internet, favoring males than females. However, the results derived from this study revealed that the female students did not show significant differences on their affection, perceived usefulness and behavior of using the Internet from males. They had gender difference only on their perceived control of the Internet. Many research reports (including the present study) have revealed that students with more Internet experiences tended to express more positive Internet attitudes.[16,30] Therefore, these findings might be due to the plausible fact that university students had more Internet experiences than high school students. It seems that the accumulated Internet experiences may be helpful in narrowing the gender difference. Moreover, the male students in this study also displayed higher Internet self-efficacy than the females. This finding was consistent with those in the previous studies concerning gender differences in computer self-efficacy and Internet self-efficacy.[27,28] Therefore, educators should, in particular, pay more attention to enhancing female students' perceived control and self-efficacy regarding the Internet.

Moreover, it was revealed that the graduate students, in general, showed more positive attitudes toward the Internet than the college students in this study. However, the grade differences were not found in university students' self-efficacy toward the Internet. That is, the graduate students did not show significantly better Internet self-efficacy than the college students.

In this study, the relationships between university students' Internet attitudes and their Internet self-efficacy were also examined. Educators and researchers have proposed that learners with high Internet efficacy expectations may have a greater chance of success in Internet-related tasks.[22,23] In other words, students' Internet self-efficacy can be viewed as one of the important indicators for predicting their performance in these tasks. The findings in this study revealed that university students' attitudes toward the Internet were significantly positively correlated with their Internet self-efficacy. It seemed to suggest that students' attitudes toward the Internet could be viewed as one of the important indicators for predicting their Internet self-efficacy. In particular, students, attaining better attitudes toward their independent control of using the Internet, may have higher general Internet self-efficacy.

As described previously, the female students in this study were found to have lower general Internet self-efficacy and less confidence about their independent control of using the Internet than the male students. It might be plausible that if female students' independent control of using the Internet is enhanced, their general self-efficacy may be also improved, or vice versa. In other words, these two aspects are likely mutually supported.

Based on the results in Table 5, learners' Internet experiences may help their perceived control of using the Internet. In addition, it was also revealed that students, who used the Internet more frequently, tended to attain better communicative self-efficacy regarding the Internet. Thus, students' actual Internet usage might help them develop adequate self-efficacy for Internet-based communication.

Nowadays, Internet-based instruction is frequently implemented in higher education. The findings in this study may provide some insights for educators regarding their Web-based instructional practice. As what has been revealed in previous studies, both students' Internet attitudes and their Internet self-efficacy may influence their performance in Web-based learning environments or tasks.[16,23,27] Hence, learners' appropriate attitudes

and adequate self-efficacy toward the Internet may be one critical prerequisite for the Internet-based instruction. Educators should try to enhance students' Internet attitudes and self-efficacy; it follows that they are expected to attain better learning outcomes in these learning environments or tasks. In particular, as students' attitudes toward the Internet and their Internet self-efficacy are highly related, some training programs or courses may be helpful to improve university students' Internet attitudes and self-efficacy at the same time.

Limitations

This study explored university students' Internet attitudes and their self-efficacy toward the Internet. However, due to the characteristics of the sample in this study, caution must be used when interpreting the results. First, the participants in this study came from three famous national universities in Taiwan. On average, they outperformed their counterparts in other universities of Taiwan in various aspects. Moreover, as the three universities in this study are science- or technology-oriented, most of the university students in this study majored in science or technology. Thus, the results derived from this study should be carefully interpreted.

In addition, with two questionnaires, the current study was undertaken by quantitative measures. The results in this study may not be sufficient to provide in-depth insights into students' Internet attitudes and self-efficacy toward the Internet. To this end, further study should be conducted utilizing a qualitative research approach.

ACKNOWLEDGMENTS

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