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Effects of online college student's Internet self-efficacy on learning motivation and performance

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This study investigates how Internet self-efficacy helps students to transform motivation into learning action, and its influence on learning performance. In this study, the effects of Internet self-efficacy on motivation and the learning performance of online college students were examined using social cognitive theory. The subjects of this study were 87 college students participating in an online course. We applied quantitative analysis to elucidate the relationship between student-perceived Internet self-efficacy and learning performance. The effects of Internet self-efficacy on student motivation and learning performance were evaluated through the analysis of variance. Students with high Internet self-efficacy outperformed those with low Internet self-efficacy on the final exam and were more confident in their ability to complete an online course. Significant gender differences were noted, in which males had a higher degree of Internet self-efficacy and confidence than females; whereas, females had higher scores of online discussion participation and the final exam than males. Regarding the learning motivation, the influence of Internet self-efficacy of males on the dimensions of relevance and confidence in the attention, relevance, confidence, satisfaction motivation model were stronger than females. Therefore, educators are encouraged to identify the psychological characteristics of online learners to provide suitable support for their learning.

Keywords: ARCS model; college students; Internet self-efficacy; online learning

Introduction

Most college students are proficient in the use of computers and skilled at navigating the Internet. The new generation of students typically uses online learning as a method of acquiring knowledge. Learning performance is influenced by factors such as the perception of students regarding their ability to perform particular tasks or achieve certain goals, their motivation to explore, and their desire for knowledge (Bandura, 1997). Educators would benefit from understanding the internal psychological status of online learners to better facilitate learning. Sankaran and Tung (2001) found that learning motivation influences learning and Keller (1987)

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proposed the attention, relevance, confidence, satisfaction (ARCS) model, focusing on enhancing the motivation of learners. The ARCS model includes four elements: attention, relevance, confidence and satisfaction. Liu, Lin, and Chang (2010) found that ARCS models are beneficial to the improvement of learner motivation. In social cognitive theory, Bandura (1986) proposed the idea of self-efficacy, indicating that one's self-efficacy influences his/her performance. Song and Keller (1999) investigated the relationship between self-efficacy and motivation, and found that self-efficacy also influences the motivation of learners. The Internet has been widely applied as a learning tool, fully integrated within a wider learning context. Under these circumstances, the concept of Internet self-efficacy was proposed and it has been found that high Internet self-efficacy has a positive influence on one's expectation concerning learning performance in online contexts (Compeau & Higgins, 1995). This study investigates the influence of Internet self-efficacy on the motivation of students with regard to the ARCS model, by investigating the learning performance of college students in an online asynchronous course. The aim of this study was to determine how Internet self-efficacy helps students to transform motivation into learning action and its effect on learning performance.

Literature review

Internet self-efficacy and motivation

Bandura (1997) demonstrated that self-efficacy is typically demonstrated in learning domains. Self-efficacy influences learning performance, the judgement of one's ability to complete tasks successfully, and how one reacts within a learning environment. Additionally, self-efficacy is a belief in one's ability to complete a task and/or learning goal; that is, learner motivation is driven by self-efficacy through cognition, affection and selection. A belief in one's ability to complete a task pushes a learner to assume the actions required to attain goals (Gist & Mitchell, 1992; Stajkovic & Luthans, 1998; Woolfolk, 2001). In other words, self-efficacy will influence the choice of whether engage in tasks, the effort expended in performing it and the persistence shown in accomplishing it (Bandura, 1997; Bouffard-Bouchard, 1990).

Learning motivation is based on the beliefs in one's capabilities and the evaluations of the learning environment. The evaluation of ability and learning environment helps students to select a learning task and learning environment that are best suited to their abilities (Wood & Bandura, 1989). Students seeking to learn online require skills in information technology and computer self-efficacy (Compeau & Higgins, 1995). Barbeite and Weiss (2004) demonstrated that computer self-efficacy can be used to predict student computer use and whether they will learn well in computer-based courses. Potosky (2002) indicated that a high degree of self-efficacy transforms into increased motivation to learn. When students are interested in using computers, their computer self-efficacy can be enhanced by training courses.

Previous studies have investigated the motivation of students in traditional learning and online learning contexts (Artino, 2007; ChanLin, 2009; Keller, 1999; Liu & Lin, 2010; Small, 2000) and noted that motivation is a key factor to enhance the learning outcome. Moreover, the Keller's ARCS model which has been applied in business and academia is focusing on how to enhance learning motivation from four different dimensions – attention, relevance, confidence and satisfaction. Atkinson

and Kydd (1997) found that the willingness of students to learn, learning satisfaction and attention increase self-oriented learning motivation. Furthermore, Beffa-Negrini, Cohen, and Miller (2002) employed the ARCS model in the development of a strategy for the promotion of student motivation by means of an online nutrition and health course. Liu et al. (2010) employed the ARCS model to design a robotics course and found that their design was capable of improving student self-efficacy and satisfaction with the course. Additionally, Means, Jonassen, and Dwyer (1997) demonstrated that student learning performance is related to self-efficacy and the belief that one has the ability to comprehend course material. Analytical results obtained by antecedent studies (Lane, Lane, & Kyprianou, 2004; Pajares, 1996; Schunk, 1991) demonstrated that the self-efficacy of learners is correlated to learning performance. Therefore, according to the above-reviewed literature, we argue that the Internet self-efficacy of students influences motivation to learn.

Internet self-efficacy and learning performance

Social cognitive theory suggests that the learning ability and beliefs of students influence learning performance, and self-efficacy can be used to predict learning performance (Bandura, 1986, 1997; Lane et al., 2004; Zimmerman, 1997). Thus, students with a higher degree of self-efficacy demonstrate better learning performance (Thompson, Meriac, & Cope, 2002; Tsai & Tsai, 2003; Wang & Newlin, 2002; Wang & Wu, 2008). Due to the various characteristics associated with online learning environments, the learning performance of students can be influenced by student-perceived Internet self-efficacy (Compeau, Higgins, & Huff, 1999; İşman & Çelikli, 2009; Moos & Azevedo, 2009). It is commonly believed that online learning performance can be improved if students are confident in their ability to learn computer skills or if they are willing to spend time learning such skills. Students' perceptions of Internet self-efficacy and their ability to perform learning tasks influence their learning performance (Salanova, Grau, Cifre, & Llorens, 2000). Teo (2009) found that teachers' self-efficacy influences how technology is being used in their classes. Wang and Newlin (2002) indicated that self-efficacy is closely related to a learner's desire to take online courses, thereby influencing learning performance. Liaw (2002) showed that the Internet self-efficacy of college students influences learning performance, and as Internet self-efficacy increases, motivation to use the Internet increases, as does learning performance. Tsai and Tsai (2003) also indicate that students with higher Internet self-efficacy perform better than those with low Internet self-efficacy in the web-based learning task. Nevertheless, Hasan (2003) argued that computer self-efficacy may change when encountering learning difficulties. Aşkar and Davenport (2009) reported that the computer skills of students influence self-efficacy in programming. All of the above-surveyed articles provide evidence that learning performance is strongly influenced by self-efficacy. However, some studies have found that self-efficacy cannot predict students' online learning outcomes (Bell, 2007; Xie, Debacker, & Perguson, 2006). This implies a further study to explore the depth of this issue is required.

Internet self-efficacy and gender difference

Gender difference in education has been recognised as an important issue for research for a long time. Generally, males and females reacted differently regarding Internet

self-efficacy and attitudes toward computers (Peng, Tsai, & Wu, 2006). Liu and Chang (2010), who investigated how gender influences student blogging, found no significant difference between male and female students. A number of studies have indicated that males have a more positive attitude toward the Internet than females (Chen & Tsai, 2007; Wu & Tsai, 2006). However, Dabaj (2009) found that female students have a more positive attitude toward technology than male students. Previous research has reported that the males had more positive attitudes, more confidence, and more competencies than the females in using computers and participated more in technology-related work (Fountain, 2000). Federico (2001) stated that college students of both genders in various grades show different levels of learning performance in the web-based course. According to Mitra, LaFrance, and McCullough (2001), when studying computer-related subjects, males and females have different attitudes toward computer use. Sullivan (2001) noted there were significant differences among male and female college students' experiences in online learning environment, regarding the flexibility, face-to-face interaction, shy and quiet students, self-discipline, and self-motivation. Similarly, Young and McSporran (2001) found the gender differences in their study such as online material usage rate, confidence level, student motivation and learning strategies. They reported that male students felt confident, but need more discipline. Topkaya (2010), who investigated the computer self-efficacy of pre-service teachers, found that gender-based differences influence computer self-efficacy. Liu et al. (2010) demonstrated that effective course design and learning activities in a cooperative robotics course helped female students to improve their self-efficacy in operating robots. Durndell and Haag (2002) showed that males had a more positive attitude toward computer-based learning than females. That is, female students had a less positive attitude toward computer use, and used computers for a shorter duration than male students. Moreover, females demonstrated lower computer self-efficacy and higher anxiety than males (Durndell & Haag, 2002; Jackson, Ervin, Gardner, & Schmit, 2001). However, Busch's study (1995) revealed that no gender differences were found in computer attitudes or self-efficacy regarding simple computer tasks. Also, Price (2006) stated that online female students are confident independent learners who are academically engaged and may outperform their male counterparts online. In summary, when compared with male students, female students appear to report lower levels of self-efficacy in learning with computers. However, there were some inconsistencies among the previous studies; therefore, a comparison of Internet self-efficacy and learning performance with respect to gender difference was also conducted in this study.

Methods

Research questions

This study explores the following three research questions:

(1) Is there a significant difference between the influence of Internet self-efficacy on the motivation of college students?
(2) Is there a significant difference between the influence of Internet self-efficacy on the online learning performance of college students?
(3) Are there significant gender differences associated with Internet self-efficacy, motivation, and online learning performance?

Course design

Culture and Mental Health, a general education course, is an online elective held for only one semester in each academic year. Students who successfully complete the course requirements earn two credits. This course is a conventional blended learning course combining asynchronous online teaching with face-to-face instruction. However, face-to-face classes are only held when the teacher considers them necessary. The entire process meets the requirements of Taiwan's Ministry of Education. The WebCT learning system was adopted using functions such as bulletin boards, discussion forums, a group discussion area, assignments and personal learning portfolio (Liu, 2007). The teacher monitored learning progress by observing online learning activities using these functions.

Participants

The participants included 87 students enrolled in the Culture and Mental Health course at a university in northern Taiwan. However, only 80 students completed all questionnaires and requirements. Therefore, the data from 80 students (36 males and 44 females) were used for analysis. Table 1 shows the distribution of gender and academic year.

Instruments

Two questionnaires, the Online Computer Technology Survey (OCTS) and Course Interest Survey (CIS) (Keller, 1987), were used to collect quantitative data. The OCTS was developed by Chang (2000) and translated into Chinese by a research team for the assessment of the Internet self-efficacy of online learners and computer technology skills. The CIS, with 34 items, was developed by Keller (1987) to assess the motivation of learners with regard to online course. The CIS covers four dimensions – attention, relevance, confidence and satisfaction. Responses to both questionnaires were based on a five-point Likert scale, ranging from 1 for 'strongly disagree' to 5 for 'strongly agree'. The score of reliability analysis was .94 for the OCTS, and .83 for the CIS. Thus, both questionnaires were reliable. The OCTS was administered to students at the beginning of the semester to identify Internet self-efficacy. The CIS was administered to students at the end of the semester.

Data collection

This study adopted quantitative analysis to elucidate the relationship between student-perceived Internet self-efficacy and motivation, and the relationship between

Table 1. Distribution of gender and grade level among participants.

Grade	Freshman	Sophomore	Junior	Senior	Total
Gender					
Male	1	15	10	10	36
Female	12	16	5	11	44
Subtotal	13	31	15	21	80

student-perceived Internet self-efficacy and learning performance. Gender differences related to these factors were also explored. To test the hypotheses, we collected several types of data. Data related to student-perceived Internet self-efficacy were acquired via an OCTS questionnaire. Data related to motivation were acquired via a CIS. Students were asked to engage in posting and reading the messages regarding the issues related to the course content. The length of each message posted was required to be more than 50 words. A message was considered as a valid discussion if it was about the concepts and/or issues related to the course content. Data related to the frequencies of participation in online discussions, and final exam scores were also obtained. The final exam was a written exam composed of 25 questions, of which 20 were multi-choice and five were short essay. Test questions (short essays) of the final exam were given in relation to the discussed issues about the course content in online discussions.

Results

This study used SPSS version 15.0 for ANOVA and *t*-test analyses. First, the mean score of Internet self-efficacy was used to classify students into a high self-efficacy group or low self-efficacy group. Learning motivation and learning performance were dependent variables. The impact of Internet self-efficacy on learning motivation and learning performance was then analysed.

Effect of Internet self-efficacy on motivation

The Internet self-efficacy scores of students were classified into two groups, high self-efficacy group and low self-efficacy group. Table 2 lists the mean self-efficacy value and its standard deviation for the two groups.

While conducting one-way ANOVA analysis, Internet self-efficacy was treated as an independent variable and the learning motivation measured by the dimensions of ARCS was dependent variables. The one-way ANOVA indicated significant differences between the confidence and relevance among the four dimensions of ARCS (Table 3). A comparison of the means of the two groups indicates that the

Table 2. Descriptive statistics on high and low Internet self-efficacy groups.

Group	*N*	Mean/SD
High Internet self-efficacy group	39	4.30 (.35)
Low Internet self-efficacy group	41	3.57 (.27)

Table 3. The effect of Internet self efficacy on motivation.

Dimensions		*N*	Mean (SD)	*F*
Confidence	High self-efficacy group	39	3.85 (.55)	6.09*
	Low self-efficacy group	41	3.61 (.31)	
Relevance	High self-efficacy group	39	3.61 (.44)	7.10**
	Low self-efficacy group	41	3.38 (.29)	

*$p < .05$, **$p < .01$.

high self-efficacy group had higher scores of confidence and relevance than the low self-efficacy group. This analytical result indicates that students with higher self-efficacy were more confident and felt that the course was more relevant than students with lower self-efficacy.

Effect of Internet self-efficacy on learning performance

One-way ANOVA was employed to analyse the difference in learning performance between the higher self-efficacy and lower self-efficacy groups. The results showed a significant difference in learning performance between the two groups (Table 4). A comparison of the mean scores of the two groups indicates that the high self-efficacy group obtained higher scores on the final exam than the low self-efficacy group. Thus, students with higher self-efficacy had better learning performances than students with lower self-efficacy.

Effects of gender difference on the Internet self-efficacy, confidence, online discussion participation and learning performance

One-way ANOVA analysis was used to examine the influences of gender difference on Internet self-efficacy, motivation, online discussion participation and learning performance.

Analytical results indicate that male and female students had significantly different perceptions of Internet self-efficacy ($F = 4.06$, $p < .05$), degree of confidence ($F = 5.84$, $p < .05$), online discussion participation ($F = 7.58$, $p < .01$), and learning performance ($F = 6.87$, $p < .01$). The female learners had significantly lower perceptions of Internet self-efficacy and confidence than the male learners. However, the female learners had significantly higher final exam scores and participated more in online discussions than the male learners (Table 5). The test questions (short essays)

Table 4.   The effect of Internet self efficacy on learning performance.

Dimensions		N	Mean (SD)	F
Performance	High self-efficacy group	39	82.18 (5.83)	4.61*
	Low self-efficacy group	41	79.27 (6.28)	

*$p < .05$.

Table 5.   Effects of gender difference on Internet self-efficacy, confidence, online discussion participation, and learning performance.

Dimensions		N	Mean (SD)	F
Internet self-efficacy	Male	36	4.11 (.46)	4.06*
	Female	44	3.90 (.46)	
Confidence	Male	36	3.86 (.48)	5.84*
	Female	44	3.62 (.41)	
Participation in online discussions	Male	36	6.42 (5.67)	7.58**
	Female	44	10.48 (7.21)	
Final exam scores	Male	36	78.75 (7.01)	6.87**
	Female	44	82.27 (4.99)	

*$p < .05$, **$p < .01$.

of the final exam were given in relation to the discussed issues in online discussions and the female learners were more engaged in the participations of online discussions (posting and reading the messages) than the male learners. This could explain the reason why the female students had higher final exam scores than the male students even though their Internet self-efficacy and confidence were lower than male students.

Conclusion and discussion

Internet self-efficacy was also found to strongly influence confidence and relevance; that is, learners with higher Internet self-efficacy were more confident and found the course more relevant than those with lower Internet self-efficacy. In line with previous studies' finding (Joo, Bong, & Choi, 2000; Tsai & Tsai, 2003) that Internet self-efficacy plays a key role in the influence of learning performance, pre-test scores of students' perceptions of Internet self-efficacy influenced their final exam scores. Students with higher Internet self-efficacy performed better in the final exam than students with lower Internet self-efficacy. It is then recommended that teachers should be aware of the level of their students' Internet self-efficacy at the beginning of an online course and then provide some approaches/assistance for the low Internet self-efficacy students to support improvement so as to promote overall learning performance.

This study found significant differences between the male students and the female students in terms of online discussion participation, final exam scores, confidence and Internet self-efficacy in the post-test. Notably, the females participated more in online discussions than the males, and performed better in the final exam. This finding is in agreement with Gunn, McSporran, Macleod, and French's (2003) and Price's (2006) finding that female students posted and read more messages than their male counterparts in the online discussion board and female students also engaged more actively than male counterparts in online learning tasks.

These gender-based differences may indicate that males and females have different learning priorities. Learning online may allow male students to demonstrate their higher Internet self-efficacy and confidence; however, female students make an effort to perform better. Both male and female students display a gap between belief and action. On the one hand, the male students, with higher Internet self-efficacy, had inferior performance in the final exam but participated less in online discussions than female students. On the other hand, the female students, in addition to Internet self-efficacy, there must be some other factors, such as study effort, self-discipline and time management which would also influence the learning performance of female students. This leads to an interesting viewpoint that academic self-efficacy might be more important than Internet self-efficacy for female students (i.e. belief in the ability to complete the actual academic tasks is more important than belief in the ability to use the technologies for female students) (Thompson et al., 2002). As a result, male and female students may behave differently in several ways while attending online courses. This calls for a follow-up study addressing how academic self-efficacy and Internet self-efficacy would affect students' engagements in online courses.

Conclusions

There were two main results of this study; the first one is: it was proved that the Internet self-efficacy of learners is an important factor influencing learning

performance and motivation (ARCS dimensions: confidence and relevance); and these influences are stronger for male students than for female students.

The second result of this study shows that Internet self-efficacy had less influence on learning performance for the female students than for the male students; however, Internet self-efficacy did influence the confidence and learning performance of the male students. This calls for a follow-up study addressing how academic self-efficacy and Internet self-efficacy affect students' engagements in online courses. Future studies may also focus on the gaps between gender beliefs and practices regarding the completion of online courses.

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