Affective mechanisms linking Internet use to learning performance in high school students: A moderated mediation study

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Abstract

Although previous studies have concluded that Internet use can help students in learning and research, a number of empirical investigations have confirmed that Internet addiction or excessive Internet use has negative effect on students. Thus, if the Internet does not always benefit students, under which conditions can Internet use have positive effects? Since students' beliefs in their academic self-efficacy and their abilities to begin, continue, and complete their studies are as important as their academic successes and performances, this study hypothesizes that academic self-efficacy acts as a mediator for Internet use and academic performance. Based on Social cognitive theory, we argue that student academic performance will be mediated by academic self-efficacy with respect to Internet use. Two kinds of Internet use, general and professional, are considered to be antecedents of academic self-efficacy. Survey data from 212 twelfth-grade vocational high school students in Taiwan indicate that general Internet use has an indirect positive effect on student academic performance, which is also mediated through academic self-efficacy. In contrast, general Internet use has no significant direct impact on students learning performance. This study also shows that Internet anxiety moderates the relationship between academic self-efficacy and learning performance. In students with low Internet anxiety, the relationship is moderated, which results in enhanced learning performance.

Keywords: Internet use, Academic self-efficacy, Learning performance, Internet anxiety, Moderated mediation

1. Introduction

The Internet has become a place where many people perform basic activities everyday (Jackson, 1999; Jackson, Ervin, Gardner, & Schmitt, 2001). Data from the 2011 Individual/Household Digital Opportunity Survey (Research, Development, and Evaluation Commission [RDEC], Taiwan, 2011, 2012) in Taiwan not only show that the percentage of household computer ownership in Taiwan increased from 66.9% in 2002 to 87.9% in 2012, but they also show that Internet connectivity rose from 56.2% in 2002 to 83.7% in 2012. For households with students, the number is even greater, with computer-ownership increasing from 92.2% in 2006 to 97.5% in 2012. High computer ownership and household Internet connectivity rates have increased Internet use among students. Student Internet use includes activities related to schoolwork as well as more general activities. This situation has motivated several studies to examine the relationship between Internet use and academic performance. Zhu, Chen, Chen, and Chern (2011) suggested that a significant relationship exists between Internet information seeking and academic performance in high school students, thereby echoing the findings of Jackson, von Eye, Biocca, et al. (2006), who found a positive relationship between Internet use and academic performance among children. Cheung and Huang (2005) demonstrated that higher Internet use among university students leads to a better perception of learning performance. Gil-Flores, Torres-Gordillo, and Perera-Rodriguez (2012) also explored the relationship between the extracurricular experiences of students on the Internet and their performance in the Program for International Student Assessment by focusing on student competence in digital reading. Therefore, the above-mentioned Internet-based activities may have several positive influences on student learning performance.

Conversely, a number of studies have reported that Internet usage (Internet addiction, or excessive use) has either a negative influence or no significant influence on student learning performance or other outcomes (Davis, 2001; Kandell, 1998; Odaci, 2011; Odaci & Kalkan, 2010; Widyanto & Griffiths, 2006; Young, 2008).
1996), Young (1996) concluded that (1) the more interactive the Internet function is, the more addictive it becomes, and (2) although normal users report minimal negative effects of Internet use, “dependents” spend more time online (38.5 h per week) and report significant impairment in many areas of their lives, including health, occupational, social, academic, and financial areas. Problematic Internet use also has negative effects on academic success (Young, 2004). Odaci (2011) demonstrated a significant negative correlation between problematic Internet use and academic self-efficacy. Nevertheless, the relationship between problematic Internet use and academic procrastination is not statistically significant. inconsistent research results may be caused by generational differences, the available applications, the Internet usage tasks, and the research tools used. Such results imply that not all Internet use is beneficial to individuals and that the benefits reaped depend on how different types of Internet use can cause positive effects on an individual’s perceived self-efficacy, learning performance, health or other aspects. However, the Internet is widely used in daily life, especially in educational environments. Therefore, the Internet can be an important learning and teaching tool when appropriately used. Subsequently, the focus is on what Internet use can bring to children. People have paid considerable attention to this question in the decades since the Internet emerged, and the issue remains a perpetual concern among stakeholders, especially parents and teachers.

However, stakeholders cannot monitor and manage the Internet usage conditions of children at all times; thus, the main concern is how to boost learning performance under autonomous conditions (i.e., without control from parents or teachers). Other studies have started to examine the appropriate predictors of student performance (e.g., Cheung & Huang, 2005). Fortunately, several studies concluded that academic self-efficacy could be a moderator or mediator between Internet usage and individual performance (Walumbwa, Avolio, & Zhu, 2008; Zhu et al., 2011) because self-efficacy affects academic performance by influencing a number of behavioral and psychological processes (Bandura, 1986, 1997). As a result, academic self-efficacy has played a mediating role between Internet use and student learning performance. Compared with Internet use for a specific purpose related to a particular course, using the Internet for general purposes, such as browsing web pages, chatting with friends and shopping online, may not be significantly related to learning performance, although academic self-efficacy may have several indirect mediating effects on learning performance. The intervention of academic self-efficacy may mitigate the negative effect of Internet addiction, dependency, or excessive and problematic Internet use. Furthermore, the intervention may transform such effects into more positive ones.

Social cognitive theory provides a solid and comprehensive theoretical framework for self-efficacy, human behavior, social interaction, and psychological well-being (Bandura, 1986, 1989, 1997). Self-efficacy is the belief of individuals in their ability to successfully perform tasks in a particular domain (Bandura, 1993). Therefore, academic self-efficacy refers to a belief specifically formed for the academic domain. The concept of reciprocal determinism addressed by Bandura (1978, 1986) suggests that (a) personal factors, in the form of cognition, affect, and biological events, (b) behavior, and (c) environmental influences create interactions resulting in triadic reciprocity. Individuals are viewed both as products and producers of their environment and social systems because personal agency is socially rooted and operates within a context of sociocultural influences. Events in which personal influences are exercised vary with what is being managed and involve the regulation of personal motivation, thought processes, affective states and actions or changing environmental conditions. Self-efficacy beliefs are sensitive to these contextual factors. They differ from other expectations and beliefs in that self-efficacy judgments are more task- and situation-specific. Therefore, individuals use these judgments in reference to certain types of goals (Bandura, 1986, 1989; Pajares, 1996a, 1996b; Printhrich & Schunk, 1995). Given the aforementioned perspectives, academic self-efficacy (the perception of self-efficacy as a personal trait in a specific academic domain) can be a crucial mediating factor in Internet use (a type of behavior in Internet environmental settings) and learning performance.

Recently, a body of research has emerged emphasizing Internet use and Internet anxiety (Brosnan & Thorpe, 2001; Chou, 2003; Joiner, Brosnan, Duffield, Gavin, & Maras, 2007; Presno, 1998; Thorpe & Brosnan, 2001). According to Joiner et al. (2007), a significant and negative relationship exists between Internet anxiety and Internet use. People who are more anxious about using the Internet utilize the Internet less although the magnitude of the effect is small. Internet anxiety may be assessed by three measures, i.e., general Internet anxiety from actual Internet use, Internet infrastructure related to hardware or software and direct or indirect Internet involvement (Marcoulides, 1989; Chou, 2003; Dyck, Gee, & Smither, 1998; Marcoulides & Wang, 1990). Our exploration into the relationship between Internet use and academic learning performance involves the important factor of Internet anxiety because a significant relationship exists between Internet use and Internet anxiety (Barbiete & Weiss, 2004; Cody, Dunn, Hoppin, & Wendt, 1999; Chou, 2003; Cooper & Weaver, 2003; Durndell & Haag, 2002; Jackson et al., 2001; Joiner et al., 2005, 2007). Why do we include Internet anxiety as a moderator in this study? A significant relationship that exists between Internet anxiety and Internet use, but Internet use anxiety may lead to different outcomes. Mild anxiety can cause mild stress and motivate a student’s learning process, while excessive anxiety may discourage students, who then lose their will to tackle conundrums.

In summary, this study draws on the Social cognitive theory of Bandura (1994) and the academic self-efficacy literature to develop a theoretical framework for the conceptual model that links general Internet use, professional Internet use, academic self-efficacy, Internet anxiety, and student learning performance. Based on the theory and literature, academic self-efficacy can be a crucial mediating factor in Internet use and student learning performance, and academic self-efficacy may be affected by Internet use. According to the literature (March et al., 2000; Torkzadeh, Chang, & Demirhan, 2006), anxiety can be a moderator for different constructs (e.g., pre-training and post-training self-efficacy).
Therefore, we also postulate that Internet anxiety may moderate mediating effects. By testing these models, this study provides insight into Internet use and academic self-efficacy, Internet anxiety, and their combined effects on student learning performance in a specific course. Thus, the purpose of our study can be divided into two parts: (1) confirming the relationship between general Internet use, professional Internet use and academic learning performance in an "Introduction to Computer Science" class, and (2) examining the moderating and mediating effects of academic self-efficacy and Internet anxiety.

The rest of this paper is organized into five sections. Section 2 illustrates the theory and hypotheses and then provides theoretical support for relationships between the investigated constructs. Section 3 describes the methodology used and explains the rationale behind it. Section 4 reports empirical results from an industrial vocational high school in Taipei, Taiwan. Section 5 summarizes the findings and presents conclusions. Section 6 provides suggestions for future research.

2. Theory and hypotheses

Earlier Internet use studies tended to focus on the antecedents and various negative outcomes of the development of Internet addiction (Odaci, 2011; Odaci & Kalkan, 2010). Several studies also reported a relationship between Internet use and learning performance (Chen & Peng, 2008; Jackson et al., 2006; Zhu et al., 2011). Furthermore, these studies indicated that academic self-efficacy moderates and mediates the relationship between information searching and academic performance in high school students (Zhu et al., 2011) and that self-efficacy can mediate and moderate academic performance (Saks, 1995; Walumbwa et al., 2008; Zhu et al., 2011). Moreover, a significant relationship has been found between Internet use and Internet anxiety (Joiner et al., 2007). Therefore, since Internet use may help boost the efficacy of beliefs and behavior, the involvement of Internet anxiety should be discussed. Fig. 1 summarizes our research framework.

2.1. Internet use

Since the Internet is becoming more powerful and accessible, its use should be seriously discussed. Internet use is a common term, but without a practical definition. Nevertheless, we find that past research reported on different types of Internet use and investigations into their causes and consequences. These investigations focused on the media used to go online, the purpose of going online (e.g., e-mailing or web surfing), the time spent online, the websites visited, and the search strategies employed (Anderson & Tracey, 2001; Hargittai, 2003). The ability to find the resources needed and the reasons for going online vary with the extent of Internet use. Therefore, identifying the effects of global (especially binary) measures of Internet use or access is unlikely (DiMaggio, Hargittai, Celeste, & Shafer, 2004). Internet use or usage may be defined in terms of its various purposes to explore its effects on individuals. Internet usage is commonly assessed using four criteria: (1) frequency of use, (2) intensity of use, (3) use of applications or tools, and (4) use for a variety of tasks (Cheung & Huang, 2005; Igbaria & Tan, 1997). Cheung and Huang (2005) suggested that Internet use is helpful to further motivate students to learn, to increase their verbal communication skills, to stimulate thought and to enhance creative thinking skills. Furthermore, Internet use may support and enhance comprehensive learning activities for university students and help students improve their constructive learning by enhancing their motives and strategies. Internet usage is highly correlated with student perceptions and job prospects (Cheung & Huang, 2005).

Joiner et al. (2007) assessed Internet use by measuring three items: (1) frequency of Internet use or time spent using the Internet, (2) public Internet use, and (3) professional Internet use. Frequency of Internet use means how often or how long a person uses the Internet, which can be measured by self-reported estimates of time spent on the Internet. Public Internet use is for general purposes, whereas professional Internet use is for educational purposes. Potosky (2007) identified e-mail and searching for information the two most common Internet uses. In terms of purpose, Internet use can be classified as pathological or healthy. Healthy Internet use refers to the use of the Internet for an expressed purpose and for a reasonable duration without cognitive or behavioral discomfort (Davis, 2001). Davis (2001) defined two distinct types of pathological Internet use: specific and generalized. The former is related to only one aspect of the Internet and is entirely independent from multiple Internet functions, whereas the latter involves general and multidimensional overuse of the Internet.

In this regard, Internet use or usage refers to using the Internet as a tool, and by its nature, this use can be viewed as a set of behaviors exhibited while using the Internet in specific environmental settings. Some people need to acquire skills to use the Internet or the computer. For example, adults or senior citizens need to learn the skills necessary to use basic Internet functions, such as browsing web pages, receiving and sending e-mails and using Skype. However, this study focuses on the effect of Internet use on student self-efficacy beliefs and subsequent learning performance. Given the characteristics of assessing Internet use, we adopt the three assessment measurements suggested by Joiner et al. (2007) in our study.

2.2. Academic self-efficacy

Academic self-efficacy refers to self-efficacy beliefs specifically formed within the academic domain as opposed to general, social, emotional, physical, or non-academic domains. Academic self-efficacy also refers to the desire to perform successfully at certain designated levels (Schunk, 1991). Self-efficacy research has proliferated since the publication of Bandura's seminal article (1977), in which self-efficacy is defined as the beliefs an individual has about their abilities to learn or act at designated levels (Bandura, 1986, 1997). According to Bandura (1994), self-efficacy is a student’s believed abilities and influences on their academic performance in a learning environment. Bandura (1994) identified self-efficacy as a key factor influencing both task performance and cognitive cultivation. Individuals with a strong sense of self-efficacy view difficult tasks as challenges that can be dealt with rather than problems to be avoided.

Bandura (1994) also posited that four main factors influence efficacy: (1) mastery experiences, (2) vicarious experiences, (3) social persuasion, and (4) somatic and emotional states. Mastery experiences are the most effective at creating a strong sense of efficacy. Britner and Pajares (2006) confirmed that mastery experiences positively predict scientific self-efficacy beliefs and recommended that teachers design science-related learning activities to develop strong self-efficacy beliefs among students. A mastery experience occurs when a person is convinced of their

![Fig. 1. Hypothesized mediated model and moderated mediation model.](image-url)
ability to succeed subsequent to successfully completing tasks in the past. When students have positive Internet use experiences, they are more likely to overcome new obstacles with the same or similar Internet use practices, whether for general or educational purposes. Students engaged in Internet-related activities interpret the results of their actions, use these interpretations to develop beliefs about their ability to engage in subsequent Internet-related activities, and act according to these beliefs.

Students also form self-efficacy beliefs vicariously by observing other people perform tasks (e.g., Internet-related activities). Vicarious experiences mean that people seek individuals with the skills they covet and look to these individuals as capable models (Bandura, 1994). Students use this type of information to evaluate their own likelihood of success for the same or for similar Internet-related activities and tasks. Although this source of information is less effective than mastery experiences at creating self-efficacy beliefs, students become more sensitive to this type of experience when they are uncertain about their own abilities or when they have limited prior experience. Models perceived to possess characteristics similar to those of the observer are the most effective at increasing the self-efficacy of the observer (Britner & Pajares, 2006). When students encounter problems related to schoolwork, they learn to observe other, successful students. When students need to answer questions provided by experts, teachers, and classmates, they use the Internet to virtually observe others or seek someone on the Internet for answers. Internet use related to specific domains and schoolwork problems can be referred to as professional Internet use, while other uses are denoted as general Internet use. Mastery and vicarious experiences are much more effective at boosting self-efficacy than either of the last two sources. According to Bandura’s Social cognitive theory, general and professional Internet use may also influence academic self-efficacy.2

2 Other self-efficacy beliefs, i.e., Computer self-efficacy and Internet self-efficacy, are considered in this study. Computer self-efficacy refers to self-efficacy in using computers (Murphy, Cooper, & Owen, 1989). Similarly, Internet self-efficacy refers to an individual’s perceptions of their Internet use abilities (Tsai & Tsai, 2003). Internet use is different from computer use, although they share many characteristics. Internet use and computer use exist in different environments and require a variety of skills. This paper does not extensively discuss computer self-efficacy. Internet self-efficacy is an important factor in Internet use. Tsai and Tsai (2003) confirmed that Internet self-efficacy could moderate the relationship between information searching and search results because individuals with high Internet self-efficacy deploy better strategies, thereby achieving better learning results. However, academic self-efficacy may be more appropriate and directly related to the dependent variable in this research because student learning performance in a specific domain is the subject of discussion in this study. Although discrepancies between Internet and academic self-efficacy are elaborated in this study, and the Internet self-efficacy scale proposed by Tsai and Tsai (2003) is sufficient to measure the perceived ability of an individual to interact with the Internet, the scale cannot appropriately evaluate knowledge about computer networks and applications, and especially learning performance in relation to such knowledge. This observation is likely due to several factors. First, the Internet self-efficacy scale focuses on general topics, but the academic self-efficacy scale focuses on the “Introduction to Computer Science” course. Items that belong to Internet self-efficacy scale include “I am confident in handling a web browser, such as Internet Explorer or Google Chrome” and “I believe I can use the Internet efficiently.” Items that belong to the academic self-efficacy scale include, “I expect to do very well in this specific domain or program.” Second, by nature, academic self-efficacy has more influence on learning performance than Internet self-efficacy. Third, we pay more attention to the relationship between Internet use, academic self-efficacy, and learning performance, although Internet self-efficacy is more significant to Internet users. Internet self-efficacy may not have as much of an effect on learning performance compared with academic self-efficacy. Subsequently, the academic self-efficacy scale is more appropriate than the Internet self-efficacy scale for evaluating performance.

2.3. The mediating role of academic self-efficacy

Prior studies reported that efficacy beliefs can facilitate integration and effective Internet use, and people with high efficacy can benefit more from Internet use (Bandura & Jourden, 1991; Brown, Ganesan, & Challagalla, 2001). On the basis of the triadic reciprocity of Bandura’s Social cognitive theory (1978, 1986, 1989, 1997) and on mastery and vicarious experiences (Bandura, 1994), human achievement depends on interactions between behavior (e.g., using the Internet), personal factors (e.g., thoughts and beliefs) and environmental conditions (e.g., Internet environmental settings). Self-efficacy beliefs are sensitive to contextual factors and are affected by personal behavior and environments. Students can acquire mastery or vicarious experiences independently through Internet use and increase their self-efficacy beliefs. Internet use is helpful to enhance student motivation, perceptions, self-efficacy beliefs, communication skills, creative thinking skills, job prospects, and performance (Cheung & Huang, 2005; Walumbwa et al., 2008; Wang & Newlin, 2002; Wittwer & Senkbeil, 2008). Wang and Wu (2008) reported that self-efficacy can predict a student’s use of learning strategies and elaborated on feedback behavior. Receiving elaborate feedback significantly promotes student self-efficacy and receiving correct responses improves student performance. The meaning of Internet use also provides support for the effects of Internet use on the academic self-efficacy of students.

Internet use inherits a number of traits from computer use and is considered a set of behaviors. Therefore, Internet use may enhance Internet-related skills and increase self-efficacy while being viewed as a set of feedback behaviors and as a skill or proficiency. Zhu et al. (2011) argued that Internet information seeking is positively correlated with academic self-efficacy, which echoed McCoy’s (2010) findings indicating that home computer use may enhance computer skills and improve self-efficacy. Theoretically and empirically, Internet use may boost academic self-efficacy and is positively correlated with academic self-efficacy. In this study, we adopt the classification suggested by Joiner et al. (2007) and focus on the effect of Internet use on academic self-efficacy and subsequent student learning performance. With this in mind, we propose the following hypotheses:

Hypothesis 1a. General Internet use is positively correlated with academic self-efficacy.

Hypothesis 1b. Professional Internet use is positively correlated with academic self-efficacy.

Over the past three decades, a number of researchers have demonstrated that efficacy beliefs have a strong and positive influence on various aspects of student motivation and achievement or performance (Bandura & Schunk, 1981; Bassi, Steca, Fave, & Caprara, 2006; Betz & Hackett, 1981; Joo, Bong, & Choi, 2000; Multon, Brown, & Lent, 1991; Pajares, 1996a, 1996b; Pajares & Miller, 1994; Paul & Gore, 2006; Pintrich & De Groot, 1990; Schunk, 1982, 1983, 1984; Zimmerman, Bandura, & Martinez-Pons, 1992). Self-efficacy, described as academic self-efficacy, is more appropriate for this study because we focused on a specific domain. Specific self-efficacy (e.g., academic self-efficacy in this specific case) and state anxiety (e.g., Internet anxiety) are both part of Bandura’s self-efficacy framework (1997). Specific self-efficacy is more closely related to task performance and is strongly correlated with actual behavior and performance level. Academic self-efficacy can predict and improve performance in special areas, such as mathematical problem-solving (Bouffard-Bouchard, Parent, & Larivée, 1991; Collins, 1982), mathematical performance (Nijenhuis, Tolboom, Resing, & Bleichrodt, 2004), computer-related achievements (Wittwer & Senkbeil, 2008), science performance (Brunner & Pajares, 2006), writing (Britten & Pajares, 2001; Pajares & Valiante, 1997), math-related courses for undergraduates (Lent, Brown, & Gore, 1997), business courses for postgraduates (Lane & Lane, 2001; Lane, Lane, & Kyriianou, 2004), and more generally, overall academic
expectations and performance (Chen et al., 2011). Thus, an important connection exists between academic self-efficacy, effects, and subsequent performance. As a result, academic performance is boosted, as is academic self-efficacy. In addition, a positive relationship develops between academic self-efficacy and performance. We propose Hypothesis 2, which involves the relationship between academic self-efficacy and learning performance.

**Hypothesis 2.** Academic self-efficacy is positively correlated with the learning performance of students.

Self-efficacy beliefs can effectively mediate the influence of skills and self-belief on subsequent performance and attainment (Bandura, 1997; Zimmerman, 1995; Zimmerman & Bandura, 1994). Zimmerman and Kitsantas (2005) suggested that self-efficacy learning beliefs could have a significant mediating influence on academic achievement and homework practices. Students with perceived high self-efficacy are more successful in school activities and use more effective learning strategies regardless of designated domain or ability level (Bouffard-Bouchard, Parent, & Larivée, 1991; Schunk, Ertmer, & Boekaerts, 2000; Zhang & Zhang, 2003; Zimmerman, 1995). Zhu et al. (2011) reported that academic self-efficacy could both mediate and moderate the relationship between Internet information seeking and academic performance. This finding is similarly confirmed in the study of Walumbwa et al. (2008), in which the role of the Internet in moderating and mediating the effects of self-efficacy on job performance was identified. Furthermore, general and professional Internet use can be included in the repertoire of school activities, with academic self-efficacy possibly mediating the influence between general Internet use, professional Internet use, and learning performance in high school students. Consequently, H3a and H3b are proposed.

**Hypothesis 3a.** Academic self-efficacy mediates the relationship between student general Internet use and learning performance.

**Hypothesis 3b.** Academic self-efficacy mediates the relationship between student professional Internet use and learning performance.

### 2.4. Internet anxiety and its moderating role

Internet anxiety, which is closely related to computer anxiety, is an important construct to describe student Internet use. Internet anxiety is the fear or apprehension experienced by individuals when they use the Internet (Presno, 1998). Although Internet anxiety shares a number of similar concepts with computer anxiety, the former still has several different constructs compared with the latter, including Internet terminology anxiety, Internet search anxiety, Internet time delay anxiety, and a general fear of Internet failure (Chou, 2003; Presno, 1998). Thatcher, Loughry, Lim, and McKnight (2007) refer to Internet anxiety as a feeling or emotion evoked by the use of web-enabled technologies. The difference between computer anxiety and Internet anxiety is that Internet anxiety reflects current IT encounters while computer anxiety reflects a lifetime of experience with computers (Hackbartth, Grover, & Yi, 2003; Thatcher et al., 2007). Similar to the definition of Library Anxiety proposed by Jiao and Onwugbufie (2004), Internet anxiety can be interpreted within the context of the Internet and is a phenomenon that occurs while an individual is undertaking Internet-related tasks. As such, Internet anxiety can be defined as “an uncomfortable feeling or emotional disposition, experienced in an Internet setting, which has cognitive, affective, physiological and behavioral ramifications”.

Previous studies determined that a significant relationship exists between Internet anxiety and Internet use (Barbate & Weiss, 2004; Chou, 2003; Cody et al., 1999; Cooper & Weaver, 2003; Duffield, Gavin, & Joiner, 2003; Jackson et al., 2001; Joiner et al., 2005, 2007; Rezaei & Shams, 2011). Internet anxiety can play an important role between Internet adoption and business performance (Sugiharto, Suhendra, & Hermana, 2010) and between IS design and implementation (Kalwar, Heikkinen, & Porras, 2012), as well as influence personal IT innovativeness (Thatcher et al., 2007). Therefore, exploring the role of Internet anxiety in student Internet use, academic self-efficacy and learning performance is interesting for educators and parents. What kind of role does Internet anxiety play? Trait anxiety, competitive trait anxiety and locus of control were examined as possible moderator variables in the life change-injury relationship, and were found to have no significant effects (Passer & Seese, 1983). On the contrary, March et al. (2000) demonstrated that anxiety has a moderating effect that continues to favor psychosocial treatment for anxious children with attention deficit hyperactivity disorder. Likewise, anxiety is considered a moderator in our study. Torkzadeh et al. (2006) viewed computer anxiety as a moderator between pre-training and post-training self-efficacy. They suggested that individuals with low computer anxiety improve their computer and Internet self-efficacy to a greater extent than individuals with high computer anxiety do. Wang, Jackson, and Zhang (2011) proposed that adolescent social anxiety can moderate the relationship of online communication and online self-discourse. According to the aforementioned studies, anxiety may or may not actually play a moderating role between some constructs, however, few studies have suggested that Internet anxiety can facilitate the integration and effective use of the Internet. This study aims to examine Internet anxiety as a moderator between professional Internet use and student learning performance through academic self-efficacy and to adopt the Internet anxiety scale from the Joiner et al. (2007) study to further investigate the moderated mediation induced by Internet anxiety. Thus, we elaborate the following two hypotheses:

**Hypothesis 4a.** The positive relationship between academic self-efficacy and learning performance will be stronger for students with low Internet anxiety than for students with high Internet anxiety.

**Hypothesis 4b.** Internet anxiety will moderate the indirect effect of professional Internet use on student learning performance (through academic self-efficacy). Specifically, academic self-efficacy will mediate the indirect effect of professional Internet use when Internet anxiety is low but not when it is high.

### 3. Data and methods

#### 3.1. Samples and procedures

This study was conducted in an industrial vocational high school in Taipei, Taiwan. Participants included 212 twelfth-grade students. Survey questionnaires were distributed to the students in class. The students answered the questionnaires anonymously, and the questionnaires were collected after completion. Once the students had completed the questionnaires, they were asked to provide their self-reported actual grades for the “Introduction to Computer Science” class first mid-term examination as the dependent variable of learning performance.

Participants came from eight classes. We obtained a 92% response rate because some returned questionnaires had missing data. Most of the degrees being offered in the school were...
engineering-related, which explains why the student body and the survey population were essentially male (167 males or 78.8% and 45 females or 21.2%). The mean age of the participants was approximately 18 years (ages ranged from 17 years of age to 19 years of age).

The questionnaires were distributed during the week following the first mid-term exams. Individual questionnaires contained the following sections: (i) measurement of general Internet use, (ii) measurement of professional Internet use, (iii) an Internet anxiety scale, and (iv) an academic self-efficacy scale. After completing the questionnaires, the participants were asked to indicate the number of hours per week they use the Internet as well as their respective age, gender and grades in the “Introduction to Computer Science” course.

3.2. Measures

Measures to assess student Internet use were divided into three parts. The first part was a measurement of general Internet use. This evaluated 10 items: (i) e-mail use, (ii) chat room use, (iii) newsgroup use, (iv) online game use, (v) pornography use, (vi) online shopping, (vii) music downloads, (viii) Facebook use, (ix) YouTube use and (x) blog browsing or Wretch use (Wretch is a popular blog service in Taiwan). The last three items were added in this study, whereas the first seven were adopted from Joiner et al. (2007). Students used a five-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always) to respond to the questions. Three items were dropped from the 10-item scale because their loadings were below 0.5. The Cronbach’s $\alpha$ for this seven-item scale was 0.774, and reliability was determined to be adequate for this measure.

The second part, professional Internet use, had eight items adopted from Joiner et al. (2007). These items were intended to measure the frequency with which students use the Internet for school coursework. Students responded to eight items in how often they (i) searched library websites for references, (ii) communicated with classmates via e-mail for information, (iii) communicated with teachers or external experts via e-mail for information, (iv) downloaded relevant materials for courses or learning, (v) used the web to search for relevant materials, (vi) interacted with Internet communities for learning, (vii) communicated with classmates using Yahoo! Messenger (YM), MSN, or Skype to obtain information, and (viii) communicated with teachers or external experts through YM, MSN, or Skype to acquire information. Respondents answered according to a five-point scale ranging from “never” to “always.” The Cronbach’s $\alpha$ for the eight-item scale was 0.897, which satisfied the reliability requirement.

The third part was “hours per week” online. The students indicated the number of hours they spent using the Internet in one week. The number of hours was converted into a five-point scale (1 = 0–7 h, 2 = 7–14 h, 3 = 14–21 h, 4 = 21–28 h, and 5 = over 28 h). The range contained the upper bound but not the lower bound.

Joiner et al. (2007) developed the Internet anxiety scale to measure Internet anxiety. Participants completed this scale, which consisted of six questions using a five-point Likert scale ranging from “never” to “always.” Two items were dropped from the six-item scale because their loadings were below 0.6. We used items, such as “I always feel anxious when using the Internet” and “I am more anxious about using the Internet than I should be.” The Cronbach’s $\alpha$ for this four-item scale was 0.831, and reliability was determined to be adequate on this measure.

The academic self-efficacy scale was adopted from the self-efficacy subscale of the Motivated Strategies for Learning Questionnaire, and included statements such as, “I am sure that I can do an excellent job on the problems and tasks assigned in this ‘Introduction to Computer Science’ program” and “I expect to do very well in this ‘Introduction to Computer Science’ program.” This scale was validated in different ways by several prior studies (Bong, 1997; Joo et al., 2000; Pintrich & De Groot, 1990) in different manners. Participants were asked to fill out the items using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) to describe their beliefs and expectations in the “Introduction to Computer Science” program. The Cronbach’s $\alpha$ of the nine-item scale was 0.949.

Learning performance was measured by using the students’ most recent mid-term examination grades (scores ranged from 1 to 100). Unlike general high school tests, this examination had open-ended questions. One of the questions, which accounted for 30 points, was “Please describe at least ten kinds of components you need to assemble a computer by yourself.” The remaining questions accounted for 60 points and were single-choice questions on computer networks and applications. The grades used were for the “Introduction to Computer Science” course, and these grades were considered the dependent variable.

3.3. Data analyses

Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed because the general Internet use scale and the professional Internet use scale were modified in this study. In EFA, all items were loaded into a single factor, and each factor had a loading higher than 0.5. LISREL 8.8 software was used to run a CFA to assess the quality of the measurement model. This study followed the recommendations of Anderson and Gerbing (1988) and used maximum likelihood with LISREL to assess convergencies and discriminate the validity of the six constructs with CFA. In the six-construct (i.e., general Internet use, professional Internet use, Internet anxiety, academic self-efficacy, learning performance, and hours per week) CFA model, the relationships between each item and their respective variables were statistically significant, with all indicator loadings exceeding 0.5, thereby achieving convergent validity. Moreover, the 95% confidence intervals of all inter-factor correlations were not over 1.00, demonstrating satisfactory discriminant validity (Hair, Black, Babin, Anderson, & Tatham, 2006). Multiple fit indices were used to assess the measurement model fit: $x^2$, $x^2/df$, the Root Mean Square Error of Approximation (RMSEA) and its confidence interval, the Comparative Fit Index (CFI), and the Incremental Fit Index (IFI). The $x^2$ index (Jöreskog & Sörbom, 1993) is sensitive to sample size, such that an $x^2/df$ of three or less is taken as a useful alternative guideline for accepting a model (Carmine & McVler, 1981). Moreover, the RMSEA value must be lower than 0.08 for a model to be accepted (Jöreskog & Sörbom, 1993), and the minimum acceptable value for CFI, IFI (Bentler & Bonett, 1980), the Normalized Fit Index (NFI) and Non-Normed Fit Index (NNFI) is 0.90 (Hu & Bentler, 1999). The overall fit of the measurement model was almost good, and these indices were still in an acceptable range ($x^2 = 1239.60, df = 541, x^2/df = 2.29, NFI = 0.91, NNFI = 0.94, CFI = 0.95, IFI = 0.95, RMSEA = 0.078$). Item loadings and reliability are summarized in Table 1.

We tested our study hypotheses in two interlinked steps. First, we tested two simple mediation models [Hypotheses 1–3]. Next, we integrated the proposed moderator variable into the model [Hypothesis 4a] and empirically examined the overall moderated mediation [Hypothesis 4b]. Prior to the analyses, all continuous measures were mean-centered (Aiken & West, 1991).

3.3.1. Test of mediation

Hypotheses 1a, 1b, 2, 3a and 3b collectively suggested two indirect effect models, in which the relationship between student professional Internet use and learning performance is transmitted
through academic self-efficacy. We followed the procedures of Baron and Kenny (1986) to examine such mediation hypotheses. Moreover, Kenny, Kashy, and Bolger (1998) presented an updated account of Baron and Kenny (1986) and noted that the necessity of the significant direct effect of initial, independent variable $X$ to outcome $Y$ is no longer essential to establish mediation (p. 260). Therefore, the main effect may be weak or nonsignificant and an indirect effect may exist (Kenny et al., 1998; Shrout & Bolger, 2002). For this reason, we tested the mediation hypotheses (Hypotheses 1a, 1b, 2, 3a, and 3b) by using an application provided by Hayes (2012b) and executed by Cole, Walter, and Bruch (2008). The SPSS macro called PROCESS is a computational tool for path analysis-based moderation and mediation analysis as well as for their combination (“conditional process model”) (Hayes, 2012a, 2013). PROCESS offers many of the features of SOBEL (Preacher & Hayes, 2004), INDIRECT (Preacher & Hayes, 2008), MODPROBE (Hayes & Matthews, 2009), MODMED (Preacher, Rucker, & Hayes, 2006), and MED3/C (Hayes, Preacher, & Myers, 2011) while greatly expanding the number and complexity of models that combine moderation and mediation (“mediated moderation” and “moderated mediation”). PROCESS can facilitate estimations of the indirect effect by using the SOBEL test and a bootstrap approach to obtain the confidence interval (CI) and to incorporate the stepwise procedure suggested by Baron and Kenny (1986).

3.3.2. Test of moderated mediation

Hypothesis 4a predicted that Internet anxiety would moderate a positive relationship between academic self-efficacy and learning performance. Assuming that this moderation hypothesis can be proven, the strength of the hypothesized indirect (mediation) effect is plausibly conditional on the value of Internet anxiety, as described in Hypothesis 4b. Preacher et al. (2006) called this effect a conditional indirect effect or, alternatively, moderated mediation. We used PROCESS designed by Hayes (2012b) to examine Hypotheses 4a and 4b. This SPSS macro facilitates the execution of bootstrapping methods and provides a method for probing into the significance of conditional indirect effects at different moderator variable values.

4. Results

Table 2 presents the descriptive statistics and intercorrelations between the study variables, including means and standard deviations. An assessment of the correlations revealed that general Internet use was positively correlated with academic self-efficacy ($r = 0.351$, $p < 0.01$) and professional Internet use ($r = 0.378$, $p < 0.01$), whereas academic self-efficacy was positively correlated with student learning performance ($r = 0.208$, $p < 0.01$). Moreover, learning performance was only correlated with professional Internet use ($r = 0.177$, $p < 0.01$) and academic self-efficacy ($r = 0.208$, $p < 0.01$).

4.1. Tests of mediation

Table 3 presents the results for Hypotheses 1a, 2, and 3a. Student general Internet use was positively correlated with student academic self-efficacy, as indicated by a significant non-standardized regression coefficient ($B = 0.425$, $r = 5.426$, $p < 0.001$). Hypothesis 1a was supported. A positive relationship was found between student academic self-efficacy and learning performance ($B = 0.433$, $r = 2.647$, $p < 0.01$). This relationship controls general Internet use and supports Hypothesis 2. Student general Internet use was determined to have an indirect effect on student learning performance. This indirect effect was positive (0.184), as hypothesized in Hypothesis 3a. The formal two-tailed significance test (assuming a normal distribution) demonstrated that the indirect effect was significant (SOBEL $z = 2.347$, $p < 0.05$). Bootstrap results confirmed the results of the SOBEL test (see Table 3), with a bootstrapped 99% CI around the indirect effect, which did not contain zero (0.055, 0.378). Therefore, Hypotheses 1a, 2, and 3a were supported.

Table 4 presents the results for Hypotheses 1b, 2, and 3b. Student professional Internet use was positively correlated with student academic self-efficacy, as indicated by a significant non-standardized regression coefficient ($B = 0.774$, $r = 21.2$).

Table 1

<table>
<thead>
<tr>
<th>General Internet use</th>
<th>Professional Internet use</th>
<th>Internet anxiety</th>
<th>Academic self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>Factor loading</td>
<td>Item</td>
<td>Factor loading</td>
</tr>
<tr>
<td>1</td>
<td>0.889</td>
<td>1</td>
<td>0.638</td>
</tr>
<tr>
<td>2</td>
<td>0.527</td>
<td>2</td>
<td>0.767</td>
</tr>
<tr>
<td>3</td>
<td>0.898</td>
<td>3</td>
<td>0.879</td>
</tr>
<tr>
<td>4</td>
<td>0.640</td>
<td>4</td>
<td>0.830</td>
</tr>
<tr>
<td>5</td>
<td>0.665</td>
<td>5</td>
<td>0.792</td>
</tr>
<tr>
<td>6</td>
<td>0.755</td>
<td>6</td>
<td>0.801</td>
</tr>
<tr>
<td>7</td>
<td>0.797</td>
<td>7</td>
<td>0.728</td>
</tr>
<tr>
<td>8</td>
<td>0.770</td>
<td>8</td>
<td>0.770</td>
</tr>
</tbody>
</table>

Cronbach's $z = 0.774$

% of variances: 43.694%

Cronbach's $z = 0.897$

% of variances: 58.744%

Cronbach's $z = 0.831$

% of variances: 66.601%

Cronbach's $z = 0.940$

% of variances: 71.498%

Note: All tests are two-tailed. $N = 212.$

*p < 0.05.

*p < 0.01.
student academic self-efficacy, as indicated by a significant non-standardized regression coefficient ($B = 0.358$, $t = 5.924$, $p < 0.001$). Hypothesis 1b was supported. A positive relationship was found between student academic self-efficacy and student learning performance ($B = 0.372$, $t = 2.528$, $p < 0.05$). This relationship controls professional Internet use and supports Hypothesis 2. Student professional Internet use was likewise determined to have an indirect effect on student learning performance. This indirect effect was positive (0.133), as hypothesized (Hypothesis 3b). The formal two-tailed significance test (assuming a normal distribution) demonstrated that the indirect effect was significant (SOBEL $z = 2.084$, $p < 0.05$). Bootstrap results further confirmed that the indirect effect did not contain zero (0.021, 0.271). Therefore, Hypotheses 1b, 2, and 3b were supported.

By comparing Tables 3 and 4, student professional Internet use was positively correlated with student learning performance ($B = 0.380$, $t = 2.612$, $p < 0.05$), but general Internet use was not ($B = 0.314$, $t = 1.669$, $p > 0.05$). According to prior research (Kenny et al., 1998; Shrout & Bolger, 2002), regardless of whether a direct effect of independent variable $X$ (general Internet use or professional Internet use) on dependent variable $Y$ (learning performance of students in “Introduction to Computer Science”) exists, an indirect effect may occur through academic self-efficacy. As a result, student general Internet use has no significant relationship with student learning performance of students. However, student general Internet use has a significant indirect effect on student learning performance mediated through academic self-efficacy. The effects attributed to general Internet use and professional Internet use were different in nature.

We ran a regression to examine the relationship between general Internet use, professional Internet use, hours per week on the Internet, and academic self-efficacy in students. Table 5 shows that professional Internet use was more positively correlated with student academic self-efficacy ($\beta = 0.267, t = 3.580, p < 0.001$) than general Internet use was ($\beta = 0.178, t = 2.308, p < 0.05$). According to the calculation of $\beta$ and $t$, the relationship attributed to professional Internet use was more robust and significant. We likewise ran a regression to examine the relationship between general Internet use, professional Internet use, hours per week spent on the Internet and learning performance in “Introduction to Computer Science” in students.

Table 6 indicates that only student professional Internet use was positively associated with student learning performance ($\beta = 0.163, t = 2.018, p < 0.05$), and student general Internet use and hours per week spent on the Internet were both nonsignificantly related to student learning performance. Therefore, the next test of moderated mediation focuses on professional Internet use and omits general Internet use. We presented only the results table for the former and omitted that of the latter.

### 4.2. Test of moderated mediation

Table 7 presents the results for Hypotheses 4a and 4b. In Hypothesis 4a, we predicted that a positive relationship between student academic self-efficacy and learning performance would

---

**Table 3**

Regression results for simple mediation on general Internet Use.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>SE</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct and total effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning performance regressed on general Internet use:</td>
<td>0.314</td>
<td>0.188</td>
<td>1.669</td>
<td>0.097</td>
</tr>
<tr>
<td>Academic self-efficacy regressed on general Internet use:</td>
<td>0.425</td>
<td>0.078</td>
<td>5.426</td>
<td>0.000</td>
</tr>
<tr>
<td>Learning performance regressed on academic self-efficacy, controlling for general Internet use:</td>
<td>0.433</td>
<td>0.164</td>
<td>2.647</td>
<td>0.009</td>
</tr>
<tr>
<td>Learning performance regressed on general Internet use, controlling for academic self-efficacy:</td>
<td>0.130</td>
<td>0.198</td>
<td>0.657</td>
<td>0.512</td>
</tr>
</tbody>
</table>

**Table 5**

Regression results (academic self-efficacy is the dependent variable).

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>SE</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Internet use</td>
<td>0.216</td>
<td>0.178</td>
<td>2.308</td>
<td>0.022</td>
</tr>
<tr>
<td>Professional Internet use</td>
<td>0.252</td>
<td>0.267</td>
<td>3.580</td>
<td>0.000</td>
</tr>
<tr>
<td>Hours per week</td>
<td>0.390</td>
<td>0.090</td>
<td>1.366</td>
<td>0.173</td>
</tr>
</tbody>
</table>

**Table 4**

Regression results for simple mediation on professional Internet Use.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>SE</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct and total effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning performance regressed on professional Internet use:</td>
<td>0.380</td>
<td>0.146</td>
<td>2.612</td>
<td>0.010</td>
</tr>
<tr>
<td>Academic self-efficacy regressed on professional Internet use:</td>
<td>0.358</td>
<td>0.060</td>
<td>5.924</td>
<td>0.000</td>
</tr>
<tr>
<td>Learning performance regressed on academic self-efficacy, controlling for professional Internet use:</td>
<td>0.372</td>
<td>0.165</td>
<td>2.258</td>
<td>0.025</td>
</tr>
<tr>
<td>Learning performance regressed on professional Internet use, controlling for academic self-efficacy:</td>
<td>0.247</td>
<td>0.156</td>
<td>1.587</td>
<td>0.114</td>
</tr>
</tbody>
</table>

**Table 6**

Regression results (academic self-efficacy is the dependent variable).

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>SE</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Internet use</td>
<td>0.216</td>
<td>0.178</td>
<td>2.308</td>
<td>0.022</td>
</tr>
<tr>
<td>Professional Internet use</td>
<td>0.252</td>
<td>0.267</td>
<td>3.580</td>
<td>0.000</td>
</tr>
<tr>
<td>Hours per week</td>
<td>0.390</td>
<td>0.090</td>
<td>1.366</td>
<td>0.173</td>
</tr>
</tbody>
</table>

**Table 7**

Regression results for indirect effect.

<table>
<thead>
<tr>
<th>Effect</th>
<th>$B$</th>
<th>SE</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours per week</td>
<td>0.039</td>
<td>0.010</td>
<td>3.634</td>
<td>0.000</td>
</tr>
<tr>
<td>Learning performance</td>
<td>0.133</td>
<td>0.063</td>
<td>2.105</td>
<td>0.034</td>
</tr>
</tbody>
</table>

**Note.** $N = 212$. Non-standardized regression coefficients are reported. Bootstrap sample size = 5000, LL = lower limit, CI = confidence interval, UL = upper limit.
be more robust for students with low Internet anxiety than for students with high Internet anxiety. The results indicated that the cross-product term between academic self-efficacy and Internet anxiety on learning performance of students was significant ($B = -0.100$, $t = -2.217$, $p < 0.05$; $B = -0.105$, $t = -2.333$, $p < 0.05$ for general Internet use).

The form and nature of interactions should be examined and should conform to the hypothesized pattern to fully support Hypothesis 4a. Therefore, we plotted these interactions by developing separate equations using one standard deviation above and below the mean of Internet anxiety to represent high versus low on each respective variable (Aiken & West, 1991). Fig. 1 graphically depicts the interactions between academic self-efficacy and Internet anxiety. We likewise performed a simple slope analysis, following the process described by Preacher, Curran, and Bauer (2006). Simple slope analyses of the regression involved locating the learning performance of students in academic self-efficacy within high Internet anxiety and low Internet anxiety.

The results are presented in Fig. 2 and Table 7. Consistent with Hypothesis 4a, the slope of the relationship between student academic self-efficacy and student learning performance was steep for students with low Internet anxiety (simple slope = 0.784, $t = 3.945$, $p = 0.000 < 0.001$), whereas the slope was relatively shallow for students with high Internet anxiety (simple slope = 0.135, $t = 0.636$, $p = 0.526 > 0.05$).

Although results indicate that student Internet anxiety among students interacts with student academic self-efficacy to influence the learning performance, such results do not directly assess the conditional indirect effect model described in Hypothesis 4b. We examined the conditional indirect effect of professional Internet use on the learning performance of students (through academic self-efficacy) at three values of Internet anxiety (see middle of Table 7), namely, the mean (8.198), one standard deviation above the mean (11.270), and one standard deviation below the mean (5.126). Normal-theory tests suggested that two of the three conditional indirect effects (based on moderator values at the mean and at one standard deviation below the mean) are positive and significantly different from zero. Bootstrap CIs corroborated these results. Thus, Hypothesis 4b was supported. In other words, indirect and positive effects of professional Internet use on learning performance in students through academic self-efficacy were observed when Internet anxiety was moderate to low, but not when Internet anxiety was high.

The moderated mediation macro proposed by Preacher et al. (2006) computed the conditional indirect effects at various arbitrary moderator values that fell within the data range (see bottom of Table 7). The output complemented more typical probing of the interaction by using one standard deviation below and above the mean and allowed us to identify values of student Internet anxiety, for which the conditional indirect effect was statistically significant at alpha = 0.05 (called regions of significance by Preacher). The results indicated that conditional indirect effects were significant at alpha = 0.05 for any value of student Internet anxiety less than or equal to 9.445 on this standardized scale.

5. Discussion and conclusion

Is time spent on Internet use for general or educational purposes helpful to student learning performance? This study integrated concepts from Internet use, Internet anxiety, and academic self-efficacy literature to identify previously unexplored reciprocations and to provide a number of answers to this question. The findings contribute to our understanding of the interactive relationships between general Internet use, professional Internet use, Internet anxiety, academic self-efficacy and learning performance in senior high school students.

### Table 6
Regression results (students learning performance is the dependent variable).

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>$SE$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Internet use</td>
<td>0.115</td>
<td>0.042</td>
<td>5.00</td>
<td>0.618</td>
</tr>
<tr>
<td>Professional Internet use</td>
<td>0.350</td>
<td>0.163</td>
<td>2.018</td>
<td>0.045</td>
</tr>
<tr>
<td>Hours per week</td>
<td>-0.479</td>
<td>-0.049</td>
<td>-0.682</td>
<td>0.496</td>
</tr>
</tbody>
</table>

### Table 7
Regression results for the conditional indirect effect (moderated mediation).

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$B$</th>
<th>$SE$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic self-efficacy</td>
<td>20.569</td>
<td>1.411</td>
<td>14.574</td>
<td>0.000</td>
</tr>
<tr>
<td>Learning performance</td>
<td>0.358</td>
<td>0.060</td>
<td>5.924</td>
<td>0.000</td>
</tr>
<tr>
<td>Constant</td>
<td>32.185</td>
<td>12.080</td>
<td>2.664</td>
<td>0.008</td>
</tr>
<tr>
<td>Academic self-efficacy (ASE)</td>
<td>1.193</td>
<td>0.401</td>
<td>2.980</td>
<td>0.003</td>
</tr>
<tr>
<td>Internet anxiety (IA)</td>
<td>3.154</td>
<td>1.383</td>
<td>2.278</td>
<td>0.024</td>
</tr>
<tr>
<td>ASE = IA</td>
<td>-0.100</td>
<td>0.045</td>
<td>-2.217</td>
<td>0.028</td>
</tr>
<tr>
<td>Internet anxiety</td>
<td>Boot indirect effect</td>
<td>Boot SE</td>
<td>Boot $t$</td>
<td>Boot $p$</td>
</tr>
<tr>
<td>Conditional indirect effect at IA = M ± 1 SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>−1SD (5.126)</td>
<td>0.784</td>
<td>0.200</td>
<td>3.945</td>
<td>0.000</td>
</tr>
<tr>
<td>+1SD (11.270)</td>
<td>0.125</td>
<td>0.212</td>
<td>0.635</td>
<td>0.526</td>
</tr>
<tr>
<td>Internet anxiety</td>
<td>Boot indirect effect</td>
<td>Boot SE</td>
<td>Boot $t$</td>
<td>Boot $p$</td>
</tr>
<tr>
<td>Conditional indirect effect at range of values of IA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.000</td>
<td>0.903</td>
<td>0.234</td>
<td>3.856</td>
<td>0.000</td>
</tr>
<tr>
<td>5.200</td>
<td>0.777</td>
<td>0.197</td>
<td>3.947</td>
<td>0.000</td>
</tr>
<tr>
<td>6.400</td>
<td>0.650</td>
<td>0.168</td>
<td>3.863</td>
<td>0.000</td>
</tr>
<tr>
<td>7.000</td>
<td>0.586</td>
<td>0.159</td>
<td>3.691</td>
<td>0.000</td>
</tr>
<tr>
<td>7.600</td>
<td>0.523</td>
<td>0.154</td>
<td>3.403</td>
<td>0.001</td>
</tr>
<tr>
<td>8.200</td>
<td>0.460</td>
<td>0.153</td>
<td>3.000</td>
<td>0.003</td>
</tr>
<tr>
<td>8.800</td>
<td>0.396</td>
<td>0.157</td>
<td>2.520</td>
<td>0.013</td>
</tr>
<tr>
<td>9.400</td>
<td>0.333</td>
<td>0.166</td>
<td>2.010</td>
<td>0.046</td>
</tr>
<tr>
<td>9.445</td>
<td>0.328</td>
<td>0.166</td>
<td>1.971</td>
<td>0.050</td>
</tr>
<tr>
<td>10.000</td>
<td>0.269</td>
<td>0.178</td>
<td>1.516</td>
<td>0.131</td>
</tr>
<tr>
<td>10.600</td>
<td>0.206</td>
<td>0.193</td>
<td>1.068</td>
<td>0.287</td>
</tr>
<tr>
<td>11.200</td>
<td>0.142</td>
<td>0.210</td>
<td>0.678</td>
<td>0.499</td>
</tr>
<tr>
<td>11.800</td>
<td>0.079</td>
<td>0.229</td>
<td>0.344</td>
<td>0.731</td>
</tr>
<tr>
<td>12.400</td>
<td>0.016</td>
<td>0.250</td>
<td>0.062</td>
<td>0.951</td>
</tr>
</tbody>
</table>

Note. $n = 212$. Non-standardized regression coefficients are reported. Bootstrap sample size = 5000.

* The range of values represents an abbreviated version of the output provided by the macro.

Fig. 2. The interactive effects of academic self-efficacy and Internet anxiety on learning performance.
First, our results show an interesting relationship between student Internet use and student learning performance. Although professional Internet use can improve the learning performance of vocational senior high school students in an “Introduction to Computer Science” class, general Internet use does not have the same effect. However, when academic self-efficacy was introduced as a mediator, the total mediation effect of student general Internet use and learning performance emerged. The mediating effect of academic self-efficacy between general Internet use and student learning performance is consistent with the role played by academic self-efficacy on information seeking and academic performance, as proposed by Zhu et al. (2011). Although general Internet use has no significant relationship to student learning performance, professional Internet use has a positive relationship to learning performance. The direct effects of general Internet use and professional Internet use on the dependent variable are both nonsignificant; however, both variables have indirect effects on student learning performance that are mediated by academic self-efficacy. Such effects are probably the result of a number of factors: (1) The content of Internet use for general purposes does not have any significant relationship with the course being taken and may not be directly helpful to the grades of students even if the topic of the course is related to the Internet. (2) The quality of Internet use for educational purposes is significantly related to this course. (3) The quantity of Internet use for these two purposes poses a potential problem because they may have reciprocal effects on each other, thereby making it difficult for students to differentiate them. Therefore, the effectiveness of Internet use for general and educational purposes can have meaningful and useful implications for parents and educators. Forbidding children from using the Internet may not be a good idea because Internet use will improve their learning performance by mediating academic self-efficacy.

Second, the mechanisms and conditions under which professional Internet use affects students’ learning performance in the “Introduction to Computer Science” class have been deeply explored. Earlier studies found that individuals with low computer anxiety improved their computer self-efficacy and Internet self-efficacy to a greater extent than individuals with high computer anxiety (Torkzadeh et al., 2006). Studies have shown that anxiety has a moderating effect on children with attention deficit hyperactivity disorder. However, the contexts of these studies were different from the school context of our study. Internet anxiety can also be a moderator. Our results indicated that professional Internet use is correlated with academic self-efficacy, which in turn interacts with Internet anxiety to predict students’ learning performance and represent a moderated mediation effect. However, no prior study has examined such potential interactive effects to explain the process by which professional Internet use relates to student learning performance within a specific curriculum. The results also supported the hypothesized moderated mediation model, demonstrating that the magnitude of the indirect effect is contingent upon the level of student Internet anxiety of students. This finding revealed the presence of an unidentified boundary condition that influences the effect of professional Internet use on student learning performance.

Third, our findings contribute to research on Internet anxiety in the field of computer education. Past research has determined that students with low academic self-efficacy actually benefitted more from the effect of information searching on academic performance than students with high academic self-efficacy did (Zhu et al., 2011). However, their study focused on the influence of academic self-efficacy on information seeking and academic performance, which was defined as total performance on schoolwork, and explored only information seeking on the Internet. Our study introduced not only academic self-efficacy as a mediator but also Internet anxiety as a moderated mediator. Based on the results presented here, students who tend to withhold displays of Internet anxiety seemed to be in a better position to enhance their learning performance via Internet use and as a result, academic self-efficacy. This finding is essential because it suggests that in spite of a strong relationship between student general/professional Internet use and academic self-efficacy, the second relationship between academic self-efficacy and learning performance becomes stronger when student Internet anxiety is low. Our findings are based on the academic self-efficacy of high school students mediated through Internet use and learning performance. Therefore, our results expanded the literature on academic self-efficacy by demonstrating that general Internet use and professional Internet use are related to, rather than dependent on, the learning performance of high school students. Moreover, our findings demonstrated that students with low Internet anxiety who enhanced their academic self-efficacy would achieve higher learning performance, while students with high Internet anxiety would not. The contribution of this study is especially important and significant in computer education.

Finally, we confirmed which Internet use content influences the learning performance of students. Not all Internet use content was significantly related to student learning performance. The use of the Internet for general purposes has no significant effect on student learning performance. However, such use could have a significant indirect effect on student learning performance through the mediation effect of academic self-efficacy. The use of the Internet for educational purposes is positively correlated with the learning performance of students, and the latter is more positively correlated with student academic self-efficacy than the former. Only professional Internet use was found to be positively correlated with student learning performance. This finding is significant because prior research determined only that Internet use was significantly correlated with performance, but did not explain which content actually had an influence on learning performance. However, the ratio of Internet use to general Internet use, professional Internet use, and hours per week spent on the Internet can elaborate the explanation and provide a special point of view to illustrate relationships among these constructs.

In addition, this study provides substantive implications for both theory and practice. Theoretically, our findings highlighted the effects of academic self-efficacy as a mediator on enhancing the learning performance of students, and especially as a mediator between general Internet use and student learning performance. Internet anxiety can be a moderated mediator for student general/professional Internet use, academic self-efficacy, and learning performance. Our results likewise indicated that the crucial issue for parents and educators is to reduce student Internet anxiety. This study presented several empirical implications for practice, parents, and educators. First, encouraging students with relatively low Internet anxiety to have higher academic self-efficacy for a specific subject by using the Internet for educational purposes may be a useful and effective way to boost their learning performance. Second, although Internet anxiety is generally related to higher levels of student learning performance, increasing academic self-efficacy does not prove to be an easy way to improve the learning performance of students with high Internet anxiety. Third, investigating domain-specific self-efficacy for the “Introduction to Computer Science” class can offer a clear and nuanced picture and provides more insight into the effective Internet usage for general and educational purposes. Lastly, Internet anxiety moderated the relationship between academic self-efficacy and student learning performance. The study explored the potentially significant boundary conditions of Internet anxiety that may be partly responsible for explaining such a mediated effect. Therefore, this study diverges from and extends prior research by identifying the moderating influence of Internet anxiety in the mediated relationship.
between professional Internet use and academic self-efficacy to predict students’ learning performance.

6. Limitations and future research

This study tends to restrict the researcher actions and choices to those that fit with experimental design. Accordingly, our study is limited because of several factors. First, the questionnaire data collected for our study came from one single school, which may limit the generalizability of the study. The use of a single school and data from a special class potentially restricts sample range, thereby yielding relationships that appear weaker than they might be in a more diverse sample (such as a sample that also includes junior high school students, freshmen and postgraduate students, for example). The results can only provide only a conservative estimate of the relationship being studied. Second, data were collected in one shot, thereby limiting our ability to draw definitive conclusions about causality. Third, students were requested to write their self-reported scores for the “Introduction to Computer Science” class, which may have been influenced by the desire for social acceptance. However, this desire for social acceptance may have been mitigated because the questionnaire used was anonymous. We likewise asked students to provide their scores only toward the end of the survey, by which time most of the items had already been completed.

Future research can proceed in several directions. First, the self-efficacy for this specific course, such as academic self-efficacy, is only one-dimensional. Other dimensions of self-efficacy may be closely related to our constructs. Specifically, Internet self-efficacy is likely to be highly correlated with Internet use and may be a moderator or mediator between student Internet use and learning performance. In this study, exploring the mediation effect of academic self-efficacy (with respect to the relationship between general Internet use/professional Internet use and learning performance in students who failed to achieve significantly) is more appropriate than exploring that of Internet self-efficacy. However, other constructs, such as Internet identification, Internet knowledge, and Internet attitude, also exist. We may incorporate other constructs to complete this conceptual schema. Future research can focus on determining other key conditions or key constructs that may moderate the relationship between student learning performance and student or individual Internet activities. Second, we investigated a specific self-efficacy domain in this study by focusing on how Internet use affects students’ learning performance. However, discussing general academic self-efficacy will provide a different image of the relationship between Internet use and learning performance. Third, providing evidence of generalizability means that future work needs to explore whether the relationships observed in this study are applicable across a broader range of research settings. Finally, learning how to use the Internet to increase students’ learning performance is a concern for parents and educators. Designing effective approaches in future research will be interesting and valuable.

Acknowledgements

The authors thank three anonymous reviewers for their helpful suggestions and comments in an earlier version of the paper. Dr. Hsiao thanks the support by Ministry of Science and Technology of Taiwan (Grant No: NSC 102-2410-H-309-009). Prof. Chen thanks the support by Ministry of Science and Technology of Taiwan (Grant No: NSC 100-2410-H-002-015-MY3). Prof. Chern thanks the support by Ministry of Science and Technology of Taiwan (Grant No: NSC 100-2410-H-002-022-MY3).

Appendix A

A.1. General Internet usage scale

The last three items of the general Internet usage scale were added in this study. The first four items were developed by Joiner et al. (2007).

1. I will use the Internet to read my email.
2. I will participate in chat rooms on the Internet.
3. I will shop online.
4. I will download music from the Internet.
5. I will browse Facebook or play the games on Facebook.
6. I will watch YouTube videos.
7. I will browse blogs or use Wretch (a popular blog service in Taiwan).

A.2. Professional Internet usage scale

The eight items of professional Internet usage scale were based on the work of Joiner et al. (2007).

1. I will search library websites for references.
2. I will contact classmates via e-mail for peer discussions to acquire information.
3. I will contact teachers or external experts via e-mail for information.
4. I will download relevant materials for courses or learning purposes from the Internet.
5. I will use the web to search for relevant materials.
6. I will interact with Internet communities for learning purposes.
7. I will contact classmates through Yahoo! Messenger (YM), MSN or Skype to obtain information.
8. I will contact teachers or external experts through YM, MSN, or Skype to acquire information.

A.3. Internet anxiety scale

The Internet anxiety scale was developed by Joiner et al. (2007).

1. I feel anxious all the time when using the Internet.
2. I tend to find excuses to avoid using the Internet.
3. My anxiety about using the Internet bothers me.
4. I am more anxious about using the Internet than I should be.

A.4. Academic self-efficacy scale

The Academic self-efficacy scale was adopted from the self-efficacy subscale of the Motivated Strategies for Learning Questionnaire, which was referenced from Pintrich and De Groot’s (1990) research.

1. Compared with other students in the “Introduction to Computer Science” program I expect to do well.
2. I am certain I can understand the ideas taught in “Introduction to Computer Science” program.
3. I expect to do very well in the “Introduction to Computer Science” class and “Introduction to Computer Science” program.
4. Compared with others in the “Introduction to Computer Science” program, I think I am a good student.
5. I am sure I can do an excellent job on the problems and tasks assigned for the “Introduction to Computer Science” program.
6. I think I will receive a good grade in the “Introduction to Computer Science” program.
References


