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Understanding the Formation and Effects of General Computer Self-Efficacy in Business Students

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ABSTRACT

The aim of this study is to investigate the formation and effects of general computer self-efficacy among business students. Antecedents of computer self-efficacy were investigated, and computer attitudes and MIS intention (defined as one's intention to select MIS for his or her future study and career) were selected as dependent variables. The results supported that computer knowledge, current computing experiences, computer anxiety, and age affected the formation and development of computer self-efficacy among the sampled students; computer self-efficacy and social norms had strong effects on computer attitudes and MIS intention. Implications for both research and MIS education are also discussed.

Keywords

Computer self-efficacy, computer anxiety, MIS education

INTRODUCTION

One objective of MIS education is to provide students with computer knowledge and skills that will be needed for the success in their future careers. As IT increasingly saturates our daily life, assessing one's ability to use information technologies to cope with business problems has received increasing attention in business education, recruiting, and career training. However, there is no commonly accepted list of which computer applications are deemed relevant to certain careers, and to what extent the mastery of these applications is considered adequate. With the fast pace of technology development, producing a detailed list of concrete computing skills may be even an improbable task. Perception-based measures therefore become a realistic solution for the assessment of computer knowledge and skills in most situations.

Several perception-based measures of one's computer knowledge and skills, such as perceived ease of use (Davis et al., 1989; Venkatesh, 2000; Venkatesh et al., 2003), computer anxiety (Harrison and Rainer, 1992; Compeau et al., 1999), and personal innovativeness in IT (Thatcher and Perrew, 2002) have been proposed in the IS literature. Among the existing measures, computer self-efficacy (CSE), defined as an individual's belief about his or her capabilities to use computers (Compeau and Higgins, 1995b), is a commonly used proxy for assessing one's capability of using computers. In the IS literature, the construct of CSE has been applied to the study of technology usage behavior (Venkatesh, 2000; Lewis et al., 2003), IT training (Compeau and Higgins, 1995a), and job performance and status (Compeau et al., 1999). In the business education literature, CSE has been used to investigate software training (Havelka, 2003) and computer learning behavior (Vincent et al., 2002).

Given the increasing research attention placed on this construct, however, our understanding of CSE is still imperfect with its special makeup and impacts in various situations. Marakas and colleagues (1998) have theorized the multilevel and multidimensional nature of CSE, arguing that CSE exists at both the general computing level and at the specific computer task or application level. The selection and development of a CSE instrument should be deliberated with attention to the particular task environment under study. However, many CSE studies have not carefully examined the alignment between CSE instruments and task contexts under study, causing equivocal or counter-theoretic results (Marakas et al., 2007).

With a solid theoretical ground (Marakas et al., 1998), Marakas and colleagues (2007) have recently developed and validated a measurement of computer self-efficacy at the general computer level ((hereinafter referred as General CSE). The implications of the newly refined construct to IT training and education have not been explored in the literature. This study aims to investigate the formation and effects of general CSE among business students, with computer attitudes and MIS intention (defined as one's intention to select MIS for his or her future study and/or career) as dependent variables.

THEORETICAL FOUNDATIONS AND HYPOTHESES

Social Cognitive Theory and Self-Efficacy

CSE is a special application of the more general construct of self-efficacy, which is a key element of social cognitive theory developed in the field of learning and individual behavior (Bandura, 1977). Self-efficacy is defined as beliefs about one's ability to perform a specific behavior. As a perception, self-efficacy is induced from psychological procedures of deliberating information from various sources. These sources can be summarized into four categories (Bandura, 1977; 1982). From most to least influential, they are:

1. performance accomplishments, or one's previous mastery experience with a target behavior;
2. vicarious experience, or observations of others' performance of the target behavior;
3. verbal persuasion, or suggestions and comments from others on one's ability to perform the target behavior; and
4. emotional arousal, or physiological states caused by stressful and taxing situations.

The perceived self-efficacy helps regulate one's behavior and choice of activities based on forethought of the balance between behavior costs (or the required effort) and motivations (e.g., the expected benefits of performing the behavior). "Expectations of personal efficacy determine whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences" (Bandura, 1977, p. 191).

Computer Self-Efficacy at the General Level

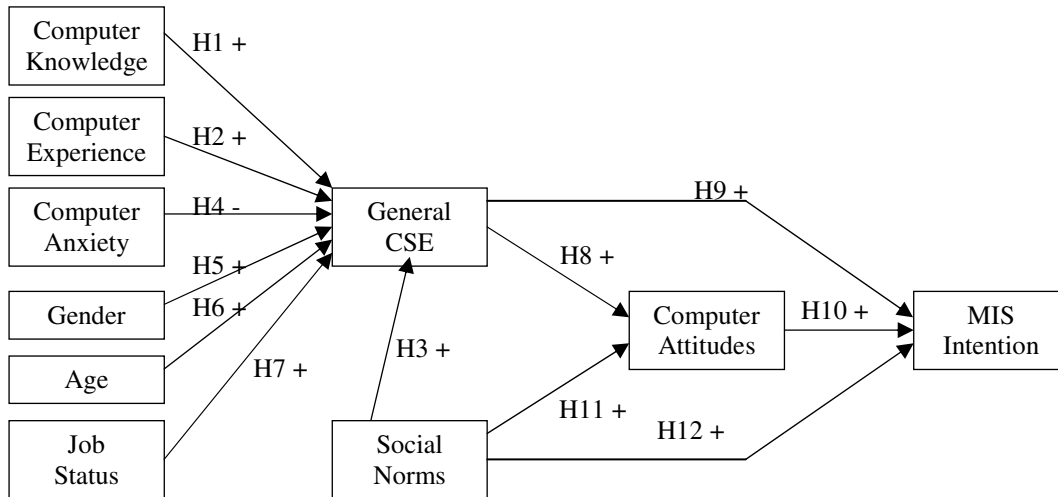
Bandura and Adams (1977) emphasized that behavior must be measured precisely in the analysis of efficacy and that measures should be tailored to the domain being studied. CSE is a special application of the self-efficacy concept in the field of MIS. CSE is commonly defined as one's judgment of his/her capability to use a computer (e.g., Compeau and Higgins, 1995b). But this definition has been criticized as vague in specifying the particular domain to which the concept is most relevant. For example, a CSE measure designed for studying Excel computing performance should be distinct from one designed for studying Internet surfing performance because the two target applications require different sets of computing skills. The lack of acknowledgement of the complex nature of CSE could lead to inappropriate operationalization of the construct and result in equivocal or contradictory findings (Marakas et al. 1998).

Marakas et al. (1998) theorized that CSE exists at both the general computing behavior level and the specific computer task or application level. General CSE refers to an individual's judgment of his or her ability to perform across multiple computer application domains; specific CSE refers to an individual's perception of efficacy in performing specific computer-related tasks within the domain of general computing. Following this framework, Marakus and colleagues (2007) developed and validated different instruments for general CSE and application-specific CSEs including Windows CSE, Spreadsheet CSE, Word Processing CSE, Internet CSE, and Database CSE.

To understand how students select MIS for their future study and/or career, CSE at the general computing level is deemed as a more appropriate construct for this study than any CSE addressing a specific task or application. Another motivation for studying general CSE is that "over time and multiple experiences within the general computing domain, a measure of GCSE will become an equally effective, or possibly superior, predictor of future performance with the domain as any appropriately designed task-specific measure of CSE" (Marakas et al., 2007, p. 17).

Antecedents of General Computer Self-Efficacy

In line with the social cognitive theory that self-efficacy is formed based on the deliberation of different information sources, this study proposes that various factors such as computer knowledge, current computing experience, computer anxiety, social norms, gender, age, and job status may serve as information sources for an individual to judge his or her level of general CSE. These factors are graphically presented in the research model of Figure 1.



Note:

1. Signs indicate a hypothesized effect is positive or negative;
2. Gender is coded as 1 for female, and 2 for male.
3. Job Experience is coded as 1 for having no job experience, and 2 for having job experience.

Figure 1. Research Model

Computer Knowledge and Current Computing Experience: Computer knowledge is defined as a self-perception of the extent of knowledge regarding the use of computers across different application domains. Current computing experience is defined as the frequency of using computers for different tasks and purposes in one’s current situations. Both factors reflect one’s direct experience with computers from the past and the present. Following the social cognitive theory, knowledge from one’s own experience provides the most important source of information for the formation and development of one’s self-efficacy (Bandura, 1977).

Hypothesis 1: The level of computer knowledge is positively associated with the level of general computer self-efficacy.

Hypothesis 2: The frequency of current computing usage is positively associated with the level of general computer self-efficacy.

Social Norms: Social cognitive theory suggests verbal persuasion as an important information source for one to judge his or her ability of performing a target behavior. In the MIS literature, social influence on one’s use of technology is captured by the construct of social norms (also labeled as subjective norms in Fishbein and Ajzen (1975) and Davis et al. (1989)), defined as “the person’s perception that most people who are important to him think he should or should not perform the behavior in question” (Fishbein and Ajzen 1975, p. 302).

Social cognition theory contends that people can be socially persuaded, through suggestions, into believing that they possess the capabilities to cope with even difficult situations (Bandura 1977). With encouraging words from people one trusts, the person will be more confident of his/her ability and tends to exert more efforts into using computers. Thus, social norms are expected to positively affect one’s perception of general CSE.

Hypothesis 3: The level of social norms is positively associated with the level of general computer self-efficacy.

Computer Anxiety: According to the social cognitive theory, anxiety is an emotional arousal that is caused partly by fear of aversive physiological reactions (i.e., nausea, dizziness, high blood pressure) to a stressful and taxing situation. “Fear reactions generate further fear of impending stressful situations through anticipatory self-arousal” (Bandura, 1977, p. 198-199). Such fear-provoking thoughts will lead to elevated levels of anxiety and lend doubts about one’s ability to perform the target behavior successfully, therefore reduce the levels of perceived self-efficacy. Compared to other sources of information, social cognitive theory suggests anxiety as less important in affecting self-efficacy.

Computer anxiety refers to a feeling of apprehension or anxiety toward using computers (Compeau et al., 1999). Computer anxiety is less likely caused by clinic physiological reactions (e.g., the so-called “computer phobia” observed among a minority of computer users (Weinberg and Fuerst, 1984)). Rather, computer anxiety is more affective in nature and reflects “fear and apprehension, intimidation, hostility, and worries that one will be embarrassed, look stupid, or even damage the

equipment” (Heinssen et al., 1987, p. 50). Such a psychological state of affect is expected to have strong impact on one’s perception of self-efficacy. Previous empirical studies have repeatedly observed the relationship between computer anxiety and CSE as negative and strong (e.g., Harrison and Rainer, 1992; Staples et al., 1999; Thatcher and Perrewe, 2002).

Hypothesis 4: The level of computer anxiety is negatively associated with the level of general computer self-efficacy.

Gender, Age, and Job Status: Demographics of an individual may provide another source of information to justify one’s perception of general CSE. Generally speaking, males tend to be more technologically oriented than females. Several studies have observed gender differences on the perceived levels of self-efficacy on general computing skills (e.g., Harrison and Rainer, 1992).

Hypothesis 5: Gender has an effect on computer self-efficacy in a way that males tend to have higher levels of general computer self-efficacy than that of females.

Age has long been studied as an important antecedent for the formation of IT attitudes. Common perception holds that younger users tend to be more comfortable with information technology than do older people (Igbaria et al., 1989; Igbaria and Nachman, 1990). However, recent studies suggest that senior people (especially Americans) are extremely active on learning new computing skills. A national survey done by the American Association of Retired People (AARP) found that “computer users age 45 and older report having used computers for an average of 8.5 years. Eight in ten (81%) report having access to the Internet, spending an average of five hours per week using Internet email and nice hours per week on other Internet activities...” (AARP, 2000). Older Americans are the fastest growing segment using high-speed Internet access of the participating computer users used the Internet (Nielsen/NetRatings, 2003). In a recent study on electronic commerce usage, age has been found to be positively correlated with perceived ease of use and perceived usefulness among senior people (McCloskey, 2006).

This study aims to investigate the formation of computer self-efficacy in business students. As a demographically-homogeneous group, it can be argued that students, both young and old, are equally interested in learning new skills that are important in their future careers. Other factors being equal, older students may have more chances to use various computing technologies and accumulate computing experiences. Following the social cognition theory that the development of self-efficacy is largely induced by experience (Bandura, 1977), it is expected that older students may feel more confident with computers than do younger students.

Hypothesis 6: Age is positively associated with levels of general computer self-efficacy.

Job status also reflects students’ experiences. Students with job experiences are expected to have more chances to expose themselves to and use a new technology, observe other people using the technology, and receive comments and suggestions from others regarding the technology. In contrast, students without job experiences may have limited chances to learn how different information technologies are applied in real situations. Therefore, students with jobs are expected to have higher levels of general CSE than that of students without jobs.

Hypothesis 7: People with job experience tend to have higher levels of general computer self-efficacy than people with no job experience.

Effects of General Computer Self-Efficacy

Social cognitive theory assumes that people decide on their behavior and activities in a cognitive fashion. In addition to the expected outcomes of performing certain behaviors, one’s perceived self-efficacy will significantly influence his or her choice of behavioral settings. Especially when motivation of performing a behavior is adequate, high levels of perceived self-efficacy will encourage the performance of certain activities in pursuit of desired outcomes, even in the face of obstacles and aversive experiences. “The stronger the perceived self-efficacy, the more active the efforts” (Bandura, 1977, p. 194).

This study selects computer attitudes and MIS intention as the dependent variables. Given the pervasiveness of IT in today’s world, few people doubt the importance of mastering computers to their career success. With adequate motivation, general CSE is expected to serve as a key determinant of one’s computer attitudes and intentions of selecting MIS for his or her future study and/or career.

The theory of reasoned action (TRA) argues that one’s intention of performing a behavior is the single most important factor in determining the execution of the behavior (Fishbein and Ajzen 1975). Intention is largely determined by social norms and attitudes, and attitudes are formed based on a set of beliefs toward performing the behavior. General CSE is in fact a set of beliefs about one’s ability of using computers in various situations. Following the frameworks of TRA and the social cognitive theory, we propose that general CSE has effects on both computer attitudes (i.e., positive feelings toward using

computers) and MIS intention (i.e., the intention of selecting MIS for one's future study and/or career); as a partial intervening mechanism, computer attitudes also helps to shape MIS intention in addition to the effects of general CSE.

Hypothesis 8: The level of general computer self-efficacy is positively associated with computer attitudes.

Hypothesis 9: The level of general computer self-efficacy is positively associated with the intention of selecting MIS for one's future study and/or career.

Hypothesis 10: The level of computer attitudes is positively associated with the intention of selecting MIS for one's future study and/or career.

In addition, social norms may have strong effects on computer attitudes and MIS intention. The significance of social norms as a predictor for one's computing behavior has been well established especially in the technology acceptance literature (e.g., Lucas and Spitzer, 1999; Venkatesh and Davis, 2000; Venkatesh et al., 2003). The social cognitive theory also acknowledges that although social norms as an information source may be weak in affecting self-efficacy it may be strong in regulating behaviors (Bandura, 1977). Thus, we propose that general CSE only partially mediates the effects of social norms on one's computer attitudes and MIS intention.

Hypothesis 11: The level of social norms is positively associated with attitudes toward selecting MIS for one's future study and/or career.

Hypothesis 12: The level of social norms is positively associated with intention of selecting MIS for one's future study and/or career.

METHODS

Participants

281 undergraduate business students of a Mid-western public university of US participated in this study. The students enrolled in two MIS courses: one course was about basic computing skills designed for freshmen, the other course was an MIS survey course designed for students with sophomore status and beyond. Students were instructed to take two online surveys during the first month of their MIS study.

Although encouraged by the course instructor, participating in the study was voluntary. Students were told that survey responses would not affect their course grades in any way. Some students failed to take the two surveys on time, and some submitted incomplete answers. This resulted in 243 usable sets of individual data for analysis, or an 86.5% effective response rate. Demographics of participants are reported in Table 1.

		Counts	Percentage
Gender	Female	127	52.26%
	Male	116	47.74%
	Total	243	100.00%
Age	17	21	8.64%
	18	81	33.33%
	19	32	13.17%
	20	40	16.46%
	21-25	43	17.70%
	26-30	13	5.35%
	31-40	7	2.88%
	41-52	6	2.47%
	Total	243	100.00%
Status	Freshmen	111	45.68%
	Sophomore	52	21.40%
	Junior	65	26.75%
	Senior	15	6.17%
	Total	243	100.00%
Job Status	Having Job	187	76.95%
	No Job	56	23.05%
	Total	243	100.00%

Table 1. Demographics of Participants

Procedures

Data were collected at two points in time. Participants were instructed to take the first survey during the first week of their MIS course; two weeks later, the participants were instructed to take the second survey. The purpose of designing two surveys was to reduce possible common-source bias by separating the measurement of predictors and dependent variables (Podsakoff et al., 2003). More specifically, the dependent variables (computer attitudes and MIS intention), and antecedents of general CSE such as computer knowledge, current computing experiences, computer anxiety, and participants' demographic information were asked in the first survey, and general CSE was asked in the second survey.

Measures

This study investigates the formation and effects of general CSE among MIS students. The measurements of involved factors are explained below.

Computer Knowledge was measured by six questions using a 5-point Likert scale (from strongly disagree to strongly agree), asking students whether they have good knowledge and skills about computers, operating systems, Excel, HTML, Access, and PowerPoint. Current computing experience was measured by six questions, asking students to rate the frequency on a five point scale (from once a month to several times a day) regarding the use of computers for different purposes. The way of operationalization suggests the two constructs being modeled as formative indicators in the test of the research model.

Computer Anxiety was measured by a four-item instrument adopted from Compeau et al. (1999). This instrument was based on the Computer Anxiety Rating Scale development by Heinssen and colleagues (1987), and the four items were found to best capture the feeling of anxiety associated with computer use (Compeau and Higgins, 1995a).

Social norms were measured by a two-item instrument adopted from Venkatesh and Davis (2000). This instrument has been widely used and validated particularly in technology acceptance studies (Venkatesh et al., 2003).

General CSE was measured by a six-item instrument recently developed by Marakas and colleagues (2007). Marakas and colleagues (2007) critically reviewed previous instruments of CSE, and argued that they were outdated and should be re-designed with articulated alignment to the situation under study. The six-item instrument of general CSE was developed with special attention on general computing skills across various situations, and was validated using data collected from business students. Marakas and colleagues (2007) also suggested that general CSE should be modeled as formative indicators based on its theoretical conceptualization (i.e., the perceived ability of performing a certain set of activities). The six-item instrument used for measuring General CSE is provided in Appendix 1.

Computer attitudes were measured by four items asking respondent to rate on a 1-5 point scale that knowing how to use computers is important to the success of his or her future career. MIS intention was measured by two items asking respondents whether he or she would like to select MIS for his or her future study and/or career (with binary answers of yes or no).

Construct Validity

The test of construct validity was conducted with Partial Least Squares (PLS) – a structural equation modeling (SEM) technique that has been commonly used in IS research. Similar to other SEM techniques (e.g., LISREL), PLS tests the validity of constructs and the structural model at the same time, and is therefore considered methodologically rigorous when compared with regression-based techniques that separate the test of construct validity (e.g., factor analysis) from the test of the research model (Gefen et al., 2000). Two other distinctive features of PLS made the technique a particularly suitable testing tool for this study:

1. PLS has the flexibility of accepting single-item constructs (e.g., gender, age, and job status in this study);
2. The algorithm of PLS, which is component-based rather than covariance-based, allows the modeling of formative indicators (Chin 1998). In this study, the constructs of computer knowledge, current computing experiences, and general CSE were modeled as formative indicators based on their conceptualizations and special operationalizations.

Validity of Formative Indicators

Conventional procedures used to assess the validity of reflective constructs (e.g., factor analysis) may not be appropriate for assessing the validity of formative constructs (Diamantopoulos and Winklhofer, 2001). A multitrait-multimethod (MTMM) approach (Campbell and Fiske, 1959) with some modification designed for assessing of the validity of formative constructs (Loch et al., 2003) was used here to examine the convergent and discriminant validity of the three formative indicators. This method is also practiced in Marakas et al. (2007) for the development of different types of CSEs.

In this method, a composite score of each formative indicator was calculated based on the sum of products between its formative items and their associated weights. The weight represents the extent to which an item contributes to the overall value of a latent variable. A correlation matrix is then calculated between items of formative constructs and all constructs under study. To establish convergent validity, items should correlate high with items measuring the same construct, and low with items measuring other constructs. To establish discriminant validity, items should correlate high with the assigned constructs and low with unassigned ones. If the number of items under test is large, some violations may be observed due to chance. Thus, the validity test of formative indicators is both a science and an art (Marakas et al., 2007).

The matrix calculated for assessing the validity of formative indicators is reported in Table 2.

There are 333 correlations calculated in Table 2. Among them, 14 correlations violated the rules discussed above. Close examination of the 14 violations, one could note that two items of computer knowledge correlated high with most general CSE items. The two items measured one's general knowledge about computers and operating systems. These high correlations might not be surprising. The two items were retained to preserve the integrity of the construct for two reasons: (1) the two items were closely aligned with the conceptualization of the computer knowledge construct; (2) the features of a reflective indicator (e.g., indicators are exogenously determined by items; therefore, within-construct item correlations need not necessarily be high, and cross-construct item correlations need not necessarily be low (Diamantopoulos and Winklhofer, 2001)) allows violations to the rules of convergence and discriminance among valid measures.

In addition, the percentage of violations was low (the number of violations of the comparison parameters was 14 out of the 333 correlations, or a 4% violation rate, which is below the 5% rule suggested in Campbell and Fiske (1959)) and therefore could not reject chance as an alternative explanation. Because the overall pattern of correlations was not much different from the expectation, validity of these formative indicators could be concluded.

	Computer Knowledge (CK) Items						Current Computing Experiences (CEXP) Items							General Computer Self-Efficacy (GCSE) Items					
	CK1	CK2	CK3	CK4	CK5	CK6	CEXP1	CEXP2	CEXP3	CEXP5	CEXP6	CEXP7	GCSE1	GCSE2	GCSE3	GCSE4	GCSE5	GCSE6	
CK1																			
CK2	0.75																		
CK3	0.50	0.50																	
CK4	0.41	0.32	0.55																
CK5	0.42	0.39	0.35	0.46															
CK6	0.49	0.50	0.58	0.33	0.33														
CEXP1	0.24	0.28	0.22	0.09	0.12	0.21													
CEXP2	0.32	0.35	0.19	0.18	0.13	0.15	0.32												
CEXP3	0.20	0.26	0.19	0.09	0.12	0.23	0.62	0.16											
CEXP5	0.24	0.27	0.20	0.11	0.20	0.15	0.68	0.21	0.65										
CEXP6	0.30	0.29	0.19	0.08	0.12	0.16	0.54	0.41	0.48	0.62									
CEXP7	0.17	0.17	0.14	0.04	0.08	0.10	0.52	0.32	0.30	0.49	0.50								
GCSE1	0.36	0.35	0.15	0.2	0.35	0.13	0.19	0.19	0.05	0.19	0.25	0.16							
GCSE2	0.46	0.55	0.29	0.27	0.39	0.27	0.28	0.25	0.22	0.28	0.32	0.19	0.50						
GCSE3	0.49	0.51	0.31	0.19	0.31	0.34	0.17	0.26	0.14	0.16	0.17	0.16	0.52	0.51					
GCSE4	0.39	0.42	0.22	0.24	0.31	0.19	0.20	0.31	0.24	0.21	0.30	0.15	0.38	0.60	0.46				
GCSE5	0.41	0.5	0.24	0.17	0.26	0.22	0.23	0.19	0.20	0.20	0.23	0.14	0.39	0.62	0.53	0.57			
GCSE6	0.45	0.46	0.29	0.23	0.27	0.29	0.21	0.25	0.13	0.19	0.18	0.19	0.37	0.53	0.46	0.44	0.51		
CK	0.83	0.9	0.48	0.47	0.71	0.44	0.25	0.33	0.23	0.28	0.28	0.16	0.44	0.58	0.52	0.46	0.49	0.47	
CEXP	0.38	0.4	0.25	0.17	0.17	0.20	0.65	0.81	0.48	0.64	0.83	0.52	0.28	0.36	0.27	0.36	0.27	0.27	
SN	0.12	0.08	0.15	0.03	0.08	0.13	0.11	-0.05	0.10	0.12	0.07	0.01	0.10	0.13	0.06	0.03	0.07	0.10	
CA	-0.39	-0.34	-0.24	-0.19	-0.24	-0.22	-0.14	-0.20	-0.11	-0.14	-0.17	-0.10	-0.37	-0.35	-0.34	-0.34	-0.31	-0.27	
Gender	0.19	0.19	0.07	0.11	0.15	0.01	0.23	-0.03	0.20	0.20	0.15	0.00	0.23	0.21	0.21	0.26	0.21	0.09	
Age	0.01	-0.05	-0.09	0.01	-0.02	-0.28	0.01	0.21	-0.20	0.06	0.16	0.16	0.17	0.11	0.06	0.12	0.06	0.02	
Job	-0.12	-0.15	-0.12	-0.10	-0.04	-0.14	-0.15	-0.18	-0.10	-0.20	-0.08	-0.10	-0.14	-0.14	-0.11	-0.18	-0.11	-0.05	
GCSE	0.54	0.59	0.31	0.29	0.43	0.29	0.28	0.32	0.21	0.28	0.34	0.22	0.75	0.86	0.72	0.78	0.73	0.65	
Computer Attitude	0.23	0.23	0.15	0.12	0.05	0.09	0.10	0.13	0.01	0.17	0.23	0.16	0.20	0.23	0.11	0.18	0.15	0.17	
MIS Intention	0.21	0.12	0.08	0.13	0.16	0.04	0.03	-0.03	0.01	0.13	0.11	0.04	0.19	0.19	0.12	0.18	0.21	0.16	

- Note:
- Expected high correlations are presented in bold. More specifically, item-item correlations are expected to be high at within-construct level and low at cross-construct level; item-construct correlations are expected to be high with assigned constructs and low with unassigned constructs.
 - Cells in shade indicate violations of note 1.
 - N=243

Table 2. Validity Test of Formative Indicators

Validity of Reflective Indicators

Assessing the validity of reflective items follows the conventional practice based on the examination of construct reliability, convergent validity, and discriminant validity. Construct validity can be assessed by composite reliability calculated in PLS (should be larger than 0.70). Convergent validity can be assessed by the average variance extracted (AVE) among measures (should be larger than 0.50). Discriminant validity can be assessed by comparing the square root of AVEs and inter-construct correlations – the former should be larger than the latter to support discriminant validity. Close examination of Table 3 suggested that all the conditions were satisfied. Thus, validity of the reflective indicators under study was ready to be concluded.

	Reliability	1	2	3	4	5	6	7	8	9	10
1. General Computer Self-Efficacy [†]	-	-									
2. Computer Knowledge [†]	-	0.65	-								
3. Current Computing Experience [†]	-	0.42	0.46	-							
4. Computer Anxiety	0.90	-0.44	-0.39	-0.24	0.83						
5. Gender	1	0.28	0.22	0.13	-0.23	1					
6. Age	1	0.14	-0.03	0.08	-0.16	-0.06	1				
7. Job	1	-0.17	-0.13	-0.16	0.12	-0.07	-0.07	1			
8. Social Norms	0.84	0.11	0.09	0.12	-0.01	0.19	-0.08	0.07	0.85		
9. Computer Attitude	0.89	0.25	0.22	0.28	-0.16	0.03	0.17	0.04	0.44	0.81	
10. MIS Intention	0.85	-0.24	-0.19	-0.14	0.16	-0.21	-0.10	-0.02	-0.31	-0.27	0.86

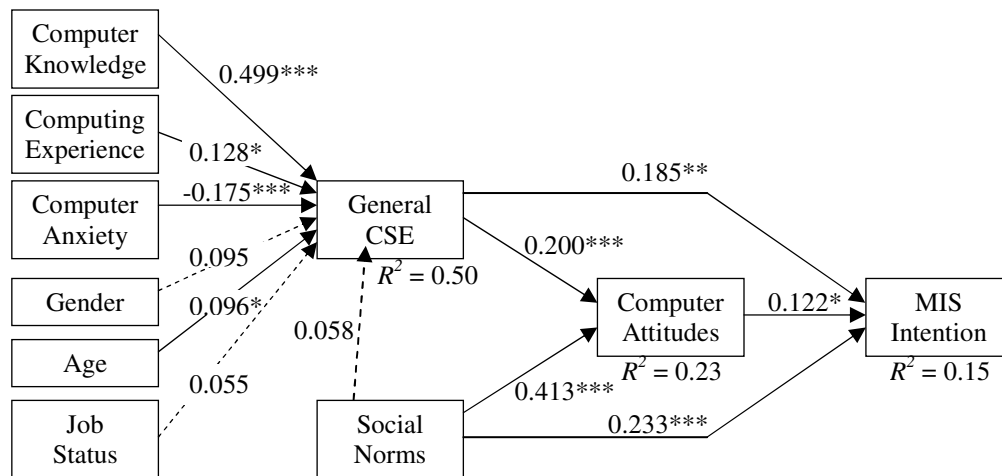
Notes:

1. Reliability: composite reliability calculated in PLS
2. Numbers in bold on the diagonal are the square root of the average variance extracted (AVE).
3. [†] These constructs are modeled as formative indicators. Calculations of construct reliability and shared variance are not relevant for them.
4. Off diagonal elements are correlations among constructs.
5. For discriminant validity of reflective constructs, diagonal elements should be larger than off-diagonal elements.

Table 3. Inter-Construct Correlations

Hypothesis Testing

The test of the research model and the results are presented in Figure 2. Examination of the resulting path significances suggested the rejection of several hypothesized relationships. More specially, the effects of gender, job, and social norms on general CSE, although in their expected directions, were found insignificant.



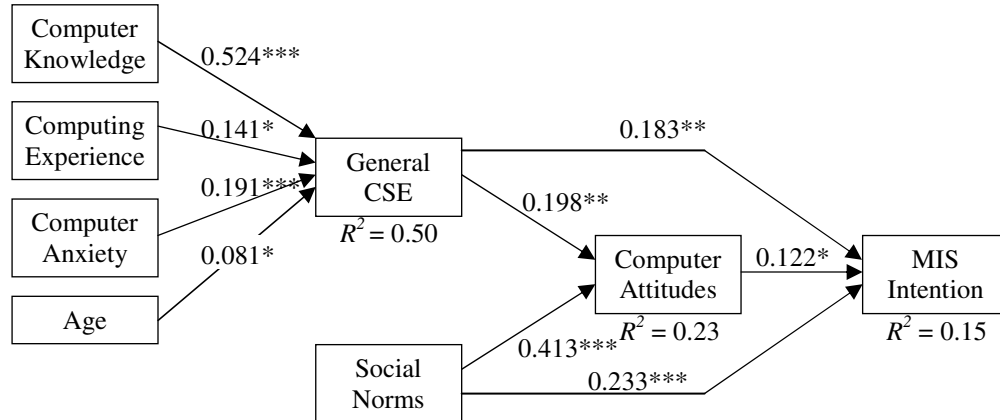
Note:

1. Dashed lines indicate insignificance with $p > 0.05$ (2-sided).
2. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (2-sided)

Figure 2. Testing Results

The research model was then revised by dropping the insignificant paths from the original model. The testing results of the revised model are presented in Figure 3.

The revised model demonstrated overall a good model fit with significant path coefficients (all with $p < 0.05$), acceptable R^2 , and good construct reliability with high levels of internal consistency (Gefen et al., 2000). In addition, the predictive power on general CSE was satisfactory, with 50% of the variance being explained by the four investigated predictors. In contrast, the explained variances of computer attitudes and MIS intention were moderate, with 23% and 15% respectively. The results suggest that one's formation of favorable attitudes and intentions toward using computers and selecting MIS for future study and career is a more complicated phenomenon than can be explained by self-efficacy. Nonetheless, computer self-efficacy, with acceptable predictive power, provides a solid ground upon which we can continue our investigation and enrich our understanding of the complex and important phenomenon.



Note:

- * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (2-sided)

Figure 3. Revised Model

SUMMARY AND DISCUSSION

Findings of the Study and Implications for Research

The aim of this study was to investigate the formation and effects of computer self-efficacy among business students. Various factors were investigated as antecedents of general CSE, and computer attitudes and MIS intention were selected to be the dependent variables. Of the 12 hypothesized relationships, three failed to conclude significance at the $p < 0.05$ level. Thus, most of the propositions received support from the sampled students.

The results did not support the effects of gender, job status, and social norms on the formation and development of general CSE. Inter-construct correlations (Table 3) indicated that gender correlated significantly with general CSE ($r = 0.28, p < 0.001$). But in the test of the overall research model, the effect was largely diluted. Thus, other factors, such as computer knowledge and experiences, could capture the difference between females and males regarding their perceptions of general CSE.

Gender effects on general CSE have received mixed support from the literature. There are studies arguing that ubiquitous nature of computing technologies tend to ease the perception gaps between females and males. For example, using computers frequently for communication helps females to view computer as less of a threat (King et al., 2002). Havelka (2003) also found that gender did not lead to different perceptions of software self-efficacy between female and male students. This study found a significant correlation between gender and general CSE and an insignificant path to a comprehensive nomological network. Future research is needed to clarify this issue.

Students' job status was found to be an insignificant predictor of general CSE. This is not surprising. The comparatively homogeneous background among the sampled students might not produce enough variance in the experiences of computer usage. Thus, perception of general CSE could be barely affected.

Social norms did not have significant impact on general CSE. Although the social cognitive theory suggests social norms as an information source for self-efficacy, the theory also acknowledges that social norms may weakly affect self-efficacy but strongly affect behaviors (Bandura, 1977). Results of the study provide evidence to support this argument. The effects of social norms on computer attitudes and MIS intention were found to be positive and significant. The magnitudes were comparable to, if not larger than, that of general CSE.

One should note that the prediction power of the concluded model on MIS Attitudes and MIS Intention is not strong, with modest R^2 of 23% and 15% respectively. The results suggest that computer self-efficacy alone may not predict students' MIS attitudes and intentions well. Other factors, such as job market and economy situations, may play important roles in affecting students' willingness to select MIS for their future study and careers.

Implications for MIS Education

Attracting more students to major in MIS is a big challenge faced by today's MIS educators. Many MIS scholars have expressed concerns regarding the declining enrollment of MIS over the past five years, and much research has been done to study solutions and strategies to encourage more students to select MIS as their major and ultimately as their career.

This study takes another approach and investigates how personal perception of computing capability will affect one's interest in MIS. The strong effects of general CSE and social norms on students' computer attitudes and intention of selecting MIS for future study and/or career have important implications for MIS educators. Given that many business schools require their students to take one or more MIS courses for IT knowledge and computing skills, MIS educators are in a good position to levy legitimate influence on students' perceptions of MIS. Not only the teaching of computing skills helps increase the perceived level of general CSE among students and therefore enhances the chance for students to major and work in MIS, social norms, over which MIS educators may carry out strong control, also affect students' attitudes and intention toward MIS.

Limitations of the Study

Although the results are encouraging, the study has several limitations. One is the operationalization of the constructs of computer knowledge and current computing experiences. The operationalization was based on a set of newly developed, rather than existing, measures. This practice is highly advocated especially for modeling formative indicators (Marakus et al., 2007). However, the lack of validity support from the existing literature could question the validity and generalizability of the two constructs.

Validity tests of the three formative indicators may be another concern for this study. The literature falls short on a commonly accepted procedure to test the validity of formative indicators (Diamantopoulos and Winklhofer, 2001). The method used here was also employed in Marakus et al. (2007) as the best practice so far in the literature. However, several measurement issues, such as the calculation of reliability, situations in which violations of comparison parameters may be accepted or unaccepted, remain unsolved. Given the increasing acceptance of formative indicators among IS researchers, these measurement issues should call for future research.

This study selected business students as the research subject. Thus, special caution is needed when applying the findings to business professionals. Future research with real business settings is desired to test the generalizability of the findings in various contexts.

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APPENDIX 1. INSTRUMENT FOR ASSESSING GENERAL COMPUTER SELF-EFFICACY

Do you agree with the following statements about your capability of using computers? (Adopted from Marakas et al. (2007) with a Likert scale ranging from strongly disagree (1) to strongly agree (5))

1. I believe I have the ability to describe how a computer works.
2. I believe I have the ability to install new software applications on a computer.
3. I believe I have the ability to identify and correct common operational problems with a computer.
4. I believe I have the ability to unpack and set up a new computer.
5. I believe I have the ability to remove information from a computer that I no longer need.
6. I believe I have the ability to use a computer to display or present information in a desired manner.