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2009

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### Recommended Citation

Hu, Tao; Zhang, Ping; Zhang, Xihui; and Dai, Hua, "Gender Differences in Internet Use: A Logistic Regression Analysis" (2009).  
*AMCIS 2009 Proceedings*. 300.

<http://aisel.aisnet.org/amcis2009/300>

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# Gender Differences in Internet Use: A Logistic Regression Analysis

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## ABSTRACT

In today's higher education, Internet technologies play increasingly essential roles in creating, storing, and disseminating information and knowledge. This study investigates gender differences in Internet usage patterns and perceptions of Internet technologies using data gathered from 805 business students. A three-variable logistic regression model is assessed in terms of the overall model fit, as well as the direction of variable association and its magnitude among the research variables. It is found that gender differences of business students do exist in terms of Internet usage patterns and perceptions of Internet technologies. Such differences are reflected in perceptions of Internet self-efficacy, experience, and information overload. Our findings indicate that the gender neutrality among business students in the Internet era is yet to be a social reality. Research implications and methodological issues of logistic analysis are also discussed.

## Keywords

Gender, Internet use, higher education, logistic regression, self-efficacy, Internet experience, information overload.

## INTRODUCTION

In today's higher education, Internet technologies play increasingly essential roles in creating, storing, and disseminating information and knowledge. Martins and Kellermanns (2004) suggest that one of the most significant trends in business education is to integrate Internet technologies into educational environments. Leading business schools are reengineering curricula and moving to the e-education age (Argaugh, 2002; Davis, 2007). A decade ago, about 2000 of the 3200 accredited 4-year colleges and graduate schools in USA opened online courses (Clarke, 1999). In Fall 2005, more than 3.2 million students in USA registered one or more online courses (Sloan-C, 2007).

As Internet technologies show various potentials in higher education, Argaugh (2002, p. 204) raises a fundamental question regarding the use of Internet technologies in higher education: "What attributes add value to education in the online environment?" Currently, most research focuses on technical aspects of the Internet in delivering online courses, and classroom behaviors of students and instructors (e.g., Arbaugh, 2000, 2002; Conaway, Easton, and Schmidt, 2005; Jih, 2003; Martins and Kellermanns, 2004; Parnell and Carraher, 2003; Vongchavalikul, Singh, Neal, and Morris, 2005). In contrast, some other studies approach the question from the administrative perspectives to define effectiveness of online education (e.g., Zeleny, 2000; Shea, Motiwalla, and Lewis, 2001).

Our literature review shows that to understand the phenomenon, we need to systematically examine the interactions of individuals, institutions, and technologies. Specifically, in business schools, most students have considerable Internet experience before entering online programs (Marakas, Johnson, and Clay, 2007). Business students' perceptions and temporal experience of the technology may shape their actual interactions with the online education environment.

This study investigates gender differences in Internet usage patterns of business students. It addresses one major research question:

*How do male and female students differ in perceptions and experience of Internet use in the online business education?*

## RESEARCH VARIABLE CONCEPTUALIZATION

This research aims to contribute to the business education through the systematic examination of gender differences of business students in perceptions of the Internet use. To portray a comprehensive picture of gender roles in Internet usage activities of business students, five research variables are derived from information systems (IS) literature; each is conceptualized to play a determinant role in shaping gender differences in perceptions of the Internet technology. They are Internet self-efficacy (InternetSE), perceived ease of Internet use (EaseUse), perceived Internet usefulness (InternetUsefulness), Internet information overload (InfoLoad), and Internet experience (Experience).

### Internet Self-Efficacy

Self-efficacy (SE) is conceptualized as “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances” (Bandura, 1986, p. 391). Compeau and Higgins (1995) suggest a substantial relationship between individuals’ SE and their computing usage behaviors. Empirical studies confirm that computing SE exerts significant impact on individuals’ actual usage of computing technologies. Following Bandura’s (1986) as well as Ma and Liu’s (2005) conceptual notions, this study defines InternetSE as individuals’ self-judgment of their ability to use the Internet. Conceptually, InternetSE is a task-specific computer SE (Marakas et al., 2007).

### Perceived Ease of Internet Use and Internet Usefulness

Davis (1989, p. 321) conceptualizes perceived ease of use of computing technology as “the degree to which a person believes that using a particular system would be free of effort,” and perceived usefulness as “the degree to which a person believes that using a particular system would enhance his or her job performance.” Davis, Bagozzi, and Warshaw (1989) found that perceived usefulness is a primary determinant of individuals’ intention to use the technology, and perceived ease of use is a significant secondary predictor of usage intention. Likewise, Davis (1989) empirically shows that perceived usefulness mediates the effect of perceived ease of use on the actual usage of computing technologies. In this study, we define InternetUsefulness as the degree to which individuals believe that using the Internet will enhance their task performance, and EaseUse as the degree to which individuals believe that using the Internet will be free of effort.

### Internet Information Overload

InfoLoad refers to the extent to which the amount of information and data derived from the Internet exceeds the processing capacity of individuals (Eppler and Mengis, 2004). The concept addresses a phenomenon where individuals gain too much information and data from the Internet which is essentially beyond their actual cognitive capacity to process (Eppler and Mengis, 2004).

### Internet Experience

This study defines Internet experience as an individual’s actual use of the Internet. Amoroso and Mann (2006) indicate that increasing Internet experience makes an individual more comfortable with the technology. IS research generally suggests a positive relationship between IS experience and ease of use, usefulness, and attitude to using an IS. Empirical studies confirm that Internet experience increases individuals’ Internet SE in terms of task performance (Kraemer, Danzinger, Dunkle, and King, 1993).

## HYPOTHESIS DEVELOPMENT

The Internet has exercised significant impact on broad social and cultural underpinnings. Gender differences in Internet use have been interpreted as a social-technical issue, and Internet experiences manifest gender essences of social processes and value systems (Sproull and Faraj, 1997). Research suggests that Internet use is and will continue to be a male-dominant phenomenon (Sherman, End, Kraan, Cole, Campbell, Birchmeier, and Klausner, 2000). Meanwhile, social arguments arise that gender differences in Internet use are disappearing (Ono and Zavodny, 2003). Built upon the aforementioned conceptions, this section develops research hypotheses to address the following question: Does the gender neutrality in the Internet use exist?

### Internet Self-Efficacy

Bandura (1977) identifies four SE antecedents: enactive mastery, vicarious experience, verbal persuasion, and emotional arousal. Among these factors, enactive mastery is the strongest determinant of SE, and emotional arousal the weakest (Bandura, 1977). As the social division of gender roles in the modern society is widely accepted, we believe the framework is still relevant to understanding gender differences in Internet use.

Social Cognitive Theory (Bandura, 1977, 1986) suggests that individual beliefs and cognitive competencies are developed and modified by social influence and structures within the environment. When individuals interact with their environment, an interplaying relationship forms, in which individuals choose and create the environment; and in the meantime, they are being influenced and socialized by the environmental factors (Bandura, 1977, 1986). Since no single individual can escape out of the iron cage of socialization, it is reasonable to infer that gender differences in the Internet use exist due to differences in enactive mastery, vicarious experience, verbal persuasion, and emotional arousal.

IS research has long realized gender differences in computing technology usage (Marakas et al., 2007). Empirical studies suggest that female users are more risk-averse and show a relatively lower level of initial computer SE (CSE) than male users (Venkatesh and Morris, 2000). Li and Kirkup (2007) found that male users are more self-confident in their Internet skills than female users. Thus, we propose:

*Hypothesis 1: In business schools, male students have a higher level of Internet self-efficacy than female students.*

### **Internet Experience**

Empirical studies reveal certain aspects of gender differences regarding individuals' experience with the Internet. Li and Kirkup (2007) argue that the male-dominance of the Internet may lead to more experienced male users of the technology. As time and effort dedicated to the Internet reflect the level of the Internet experience, Teo and Lim (1997) found that male users are more experienced with the technology because they spend more time on the Internet-related activities. Empirical findings also indicate that males have richer Internet experience because they are more interested in learning and using Internet technologies (Qureshi and Hoppel, 1995). Collectively, these studies suggest that male users differ from female counterparts in Internet experience.

Research of this aspect built upon higher education data is still rare. Comparing usage patterns and attitudes of college students, Sherman et al. (2000) found that male students report a significantly higher level of participation than females in Internet activities, and that male students usually express more positive attitudes than females about their experience with the technology. Therefore, we propose:

*Hypothesis 2: In business schools, male students have a higher level of Internet experience than female students.*

### **Perceived Ease of Use and Perceived Usefulness of the Internet**

Venkatesh and Morris (2000) found that (1) perceived usefulness of information technologies (IT) influences behavioral intention of male users more significantly than that of females, and (2) perceived ease of IT use influences behavioral intention of females more significantly than that of males. Various theoretical and empirical justifications validated the findings. For instance, Rosen and Maguire (1990) report that female users usually feel more computer anxiety than males. Provided the intertwining of IT anxiety and CSE, a higher level of Internet anxiety among female users may lower their level of Internet self-efficacy, which in turn may lead to a lower level of perceived ease of use and perceived usefulness of the Internet.

Generally, it is believed that males tend to be more technically inclined and more versatile in IT use than females. Therefore, males are more likely to engage in the Internet activities, and find the Internet easier to use than females. Teo and Lim (1997) found that males report significantly higher mean scores on four items measuring perceived ease of Internet use than females. Their research also shows that male users feel the Internet are more useful to their work than females. Thus,

*Hypothesis 3: In business schools, male students have a higher level of perceived ease of use and perceived usefulness of the Internet than female students.*

### **Information Overload of the Internet**

In the age of social computing, data and information overload exists in conjunction with the dramatic ubiquitous deployment of computer-mediated communication technologies. Information overload occurs when individuals are overwhelmed with varying modes, formats, channels, and contents of the Internet activities. Internet information overload is sometimes referred as "techno stress," which may induce an informational perception that individuals are being controlled rather than being empowered by loads of information from the Internet.

Surprisingly, the phenomenon of information overload has not been systematically examined in IS research (Eppler and Mengis, 2004). In this study, we hypothesize that, because of their higher level of Internet self-efficiency, experience, and

perceived ease of use and usefulness of the Internet, male students in business schools experience more Internet information overload than females. Thus, we propose:

*Hypothesis 4: In business schools, male students have a higher level of Internet information overload than female students.*

## METHODOLOGY

### Measurement Development

This study applied a survey methodology in data collection for the purpose of assessing of the proposed hypotheses. The development of the survey instrument followed Boudreau et al. (2001) and Straub (1989). Except the items for Internet Experience, all of survey items are adapted and modified to fit the context of this research from scales that have been developed and empirically validated in previous IS research (see the Appendix for the survey items).

Specifically, measures of *Internet self-efficacy* are developed from Compeau and Higgins (1995). Measures of *Internet experience* are generated from Venkatesh et al. (2003). Items for *Information overload* are adapted from Eppler and Mengis (2004). The measurements for *perceived ease of use* and *perceived usefulness* are adapted from Davis (1989) and Venkatesh et al. (2003).

### Survey Procedure

This study is built upon the analysis of a dataset collected from 805 undergraduate business students at a North American university. At the beginning of the data collection effort, a CD containing a hyper-link to the business web sites were randomly distributed to the participants. Participants were then asked to surf on the websites according to their professional and personal interests. Thirty minutes later, a set of survey questions were distributed among the participants to capture their perceptions on Internet SE, experience, information overload, perceived ease of use, and perceived usefulness.

### Data Analysis

This study aims to examine gender differences of business students in perceptions of Internet use. The logistic regression analysis is used to test the research hypotheses. This statistical approach is more appropriate than other multiple regression techniques because the core phenomenon being investigated (i.e., gender differences in Internet use) is dichotomous. When the underlying assumptions, particularly variable normality, are not met, which is the case of our dataset, logistic regression is more robust than discriminant analysis, and has analytical advantages such as ease of interpretation and diagnostics (Hair, Black, Babin, Anderson, and Tatham, 2005).

## FINDINGS

### Descriptive Statistics

The descriptive statistics on the five research variables were first examined. Except Internet Experience, the rest of the variables are not normally distributed, which is the major reason that we choose logistic regression analysis over other techniques (Hair et al., 2005). Table 1 shows demographics of the respondents.

	Value	Frequency	Percentage
<b>Gender</b>	Male	414	51.4%
	Female	391	48.6%
<b>Ethnicity</b>	Caucasian	418	51.9%
	African-American	245	30.4%
	Other	142	17.7%
<b>Education</b>	Sophomore	188	23.4%
	Junior	249	30.9%
	Senior	268	33.3%

	Other	100	12.4%
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**Table 1: Demographics of the Respondents**

**Stepwise Model Estimation**

In this study, a logistic regression analysis was conducted with the five research variables entered with the forward stepwise method, based on the significance of the score statistics and the probability of the Wald statistic. With this technique, this study attempts to build a logistic regression model that best describes gender differences in Internet use. The parameters of the model are estimated using the maximum-likelihood mechanism. The significance level of each variable at 0.05 is used to determine which variables are significantly different between gender.

According to the significance of the score statistics of the five research variables, InternetSE was identified for entry in the first step of the estimation process. The entry of InternetSE produces a reasonable model fit, with corresponding values of -2 Log likelihood, Cox & Snell R<sup>2</sup>, and Nagelkerke R<sup>2</sup> being 1094.360, 0.19, and 0.025, respectively. This step of logistic analysis results in a regression model with overall correct prediction percentage of 57.1%. The model is significant with a Chi-square of 15.401 at the significant level of 0.000 (Table 2, Step 1). Following the same procedure, Internet Experience was selected for entry in the second step, and InfoLoad in the third. The final logistic regression model was derived with the following equation, and the respective statistics are shown in Table 2.

$$M/F \text{ in the Internet Use} = f(\text{InternetSE} + \text{Experience} + \text{InfoLoad})$$

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	InternetSE	.289	.075	14.762	1	.000	1.335
	Constant	-1.614	.412	15.306	1	.000	.199
Step 2(b)	InternetSE	.246	.077	10.156	1	.001	1.279
	Experience	.012	.005	4.957	1	.026	1.012
	Constant	-1.529	.412	13.735	1	.000	.217
Step 3(c)	InternetSE	.259	.078	11.136	1	.001	1.296
	InfoLoad	.178	.083	4.617	1	.032	1.195
	Experience	.012	.005	5.015	1	.025	1.012
	Constant	-2.051	.482	18.108	1	.000	.129

**Table 2: Variables in the Logistic Regression Model**

- a Variable(s) entered on step 1: InternetSE.
- b Variable(s) entered on step 2: Experience.
- c Variable(s) entered on step 3: InfoLoad.

**Assessment of the Overall Model Fit**

This study used three approaches to estimate the overall model fit of the three-variable logistic regression model derived from the stepwise forward method: statistical measures, measures of Cox & Snell R<sup>2</sup> and Nagelkerke R<sup>2</sup>, and classification accuracy. The Chi-square statistics of the omnibus tests of mode coefficients confirms that the model is improved from step 1 to step 3 as the three variables entered are significant. Likewise, the decrease in the values of -2 Log likelihood (-2LL) from step1 to step 3 indicate an overall model fit. The Hosmer and Lemeshow test suggests that the three-variable model reduces the significance level to 0.278, indicating that the model fit is acceptable (Hair et al., 2005). The examination of the classification accuracy suggests a similar result.

**Interpretation of Findings**

In this study, the Wald statistic is used to assess the statistical significance of the estimated coefficients of the derived logistic model with the three variables and the constant. Table 2 shows that the logistic coefficients for Internet SE (0.259), InfoLoad (0.178), Experience (0.012), and the constant (-2.051), are all significant at the 0.05 significant level. In the logistic analysis, there are three measures comparable to the measure of R<sup>2</sup> in multiple regressions: the Cox & Snell R<sup>2</sup>, the Nagelkerke R<sup>2</sup>, and

the pseudo  $R^2$  (Hair et al., 2005). In this study, Cox & Snell  $R^2$  and Nagelkerke  $R^2$  derived from the three-variable logistic model are 0.31 and 0.42, respectively, all being statistically significant at the 0.05 significant level. The model accounts for 35-42 percent of the variances in gender differences in Internet use. Overall, the three-variable logistic model demonstrates an acceptable level of statistical significance.

Furthermore, the direction of the research variable association is assessed through the examination of the original logistic coefficients and the exponentiated coefficients. Each of the three remaining variables differs along the line of gender (See Table 2). That is, as the values of InternetSE, Internet Experience, and InfoLoad increase, the predicted probability of one specific user being a male increases. The magnitude of changes in probability is assessed through the examination of the exponentiated coefficients. It was found that a one-point hike increases the possibility of one user being a male by 29.6% for InternetSE, 19.5% for InfoLoad, and 1.2% for Internet Experience, respectively.

The logistic regression model indicates that males and female users show significant differences of their Internet use in aspects of Internet self-efficacy, experience, and information overload. Thus, hypothesis 1, 2, and 4 are supported, whereas hypothesis 3 is not supported.

## DISCUSSIONS

The results of this study show that gender differences of business students do exist in terms of their Internet usage patterns as well as perceptions of the Internet technology. Such differences are reflected in aspects of Internet self-efficacy, experience, and information overload. Based on the findings, this study concludes that the gender neutrality among business school students in Internet use is not a social reality yet.

While male users of the Internet tend to have higher level of variations in Internet self-efficacy, experience, and information overload than females, no evidence was found on gender differences in the aspects of perceived ease of use and usefulness of the Internet. To get further insights into this finding, correlation analysis was conducted to assess the degree of multicollinearity among the five research variables. Correlation matrix (Table 3) shows most of the correlations are relatively low except that the one between EaseUse and Usefulness of the Internet is rather significant ( $r = 0.768$ ) at the level of 0.01 (2-tail).

		InternetSE	InfoLoad	EaseUse	Usefulness	Experience
InternetSE	Pearson Correlation	1	-.076(*)	.095(**)	.075(*)	.240(**)
	Sig. (2-tailed)	.	.032	.007	.034	.000
	N	805	805	805	805	802
InfoLoad	Pearson Correlation	-.076(*)	1	-.117(**)	-.028	-.021
	Sig. (2-tailed)	.032	.	.001	.423	.546
	N	805	805	805	805	801
EaseUse	Pearson Correlation	.095(**)	-.117(**)	1	.768(**)	-.002
	Sig. (2-tailed)	.007	.001	.	.000	.944
	N	805	805	805	805	801
Usefulness	Pearson Correlation	.075(*)	-.028	.768(**)	1	-.009
	Sig. (2-tailed)	.034	.423	.000	.	.805
	N	805	805	805	805	801
Experience	Pearson Correlation	.240(**)	-.021	-.002	-.009	1
	Sig. (2-tailed)	.000	.546	.944	.805	.

	N	802	801	801	801	802
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**Table 3: Correlations among Research Variables**

\* Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

The analysis reveals very low positive correlations between InternetSE and EaseUse and between InternetSE and Usefulness ( $r = 0.095$ , and  $0.075$ , respectively). This provides reasonable explanations on the surprising findings of no gender differences in perceptions of EaseUse and Usefulness of the Internet. SE reflects not only individuals' perceptions of their capabilities to perform a particular task based on experience, but also exerts critical influence on their behavioral intentions. In the context of IS usage, empirical studies have found that SE is an important determinant of perceived ease of use (e.g., Agarwal, Sambamurthy, and Stair, 2000; Venkatesh and Davis, 1996). Theoretically, we would expect gender differences in perceptions of EaseUse and Usefulness of the Internet. However, such differences may be canceled out by the variations in InternetSE, because of the multicollinearity between InternetSE and these two variables.

The objective of this study is to examine gender differences of Internet usage patterns as well as perceptions of the Internet technology. The findings suggest a series of practical guidelines for higher education. As the Internet technology plays increasingly essential roles in creating, storing, and disseminating information and knowledge, the integration of the Internet into the online educational environment is becoming a ubiquitous phenomenon around the world. While business students have universal access to the Internet, they show significant differences in their perceptions of Internet self-efficacy, experience, and information overload. When building general educational platforms and portals, higher education practitioners and administrator should exercise caution on gender characteristics of the Internet users to add real value to the Internet-based education environment.

Our study yielded meaningful results; however, some limitations should be noted. The validity of our results strongly depends on the sampling of the surveyed subjects. We used student data to inform our analysis. Our samples are not random, and thus may not be completely representative of typical Internet users. Furthermore, we only considered the gender effect on the Internet usage patterns and perceptions of Internet technologies. There might be other demographic variables that are significantly associated with the Internet usage patterns. In addition, the sample of African-American in the dataset is 245, accounting for as high as 34.4% of the sample ethnicity. Thus, in this study, the African-American may be overrepresented the US Internet users comparing to US census estimates. This is the case probably because the data was elicited in one of the U. S. research universities, where the African-American account for 48% of the total local population (US Census, 2000), and, as of this paper was written, the enrollment of African-American students is 35.4% of the total in the university. These limitations shed light on future research directions. Specifically, in our future research, we plan to extend the current study based on an exhaustive literature review of information overload and other factors that are related to Internet usage pattern, and to conduct a close-up analysis of the factors affecting Internet usage pattern and users' perception of Information Technology.

## CONCLUSION

This study looked at gender differences of business students in Internet usage patterns and perceptions of Internet technologies. We built a three-variable logistic regression model using data gathered from 805 business students. Our findings suggest that gender differences of business students do exist in terms of Internet self-efficacy, experience, and information overload. No evidence is found on gender differences in perceived ease of use and usefulness of the Internet technology. Our findings indicate that the gender neutrality among business students in the Internet era is yet to be a social reality. As the Internet-based education is becoming a ubiquitous phenomenon, it is our hope that this study will provide practical guidelines to help achieve the goals of higher education effectively and efficiently in the Internet age.

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## APPENDIX: SURVEY ITEMS

### Internet Self-Efficacy (InternetSE (1 = SDA, 5 = SA):

I'm proficient at using the Internet  
 I feel confident that I can use the Internet to achieve my goals.  
 Using the Internet is probably something that I am good at.  
 I will never use the Internet as well as I would like.  
 I believe that using the Internet is a skill that I can use easily.  
 I believe that my skills at using the Internet are quite good.  
 When it comes to using the Internet, my skills are top-notch.

### Internet Experience (Experience):

How many hours per week do you use the Internet?

### Perceived Ease of Internet Use (EaseUse) (1 = SDA, 5 = SA):

This web site was easy to use.  
 I found it easy to get the web site to do what I wanted it to do.  
 It was easy to get the web site to give me the information I was looking for.  
 I found it easy to search for the type of job information I wanted.  
 The job search functions of the web site were easy to use.  
 It was easy to get the job search functions to give me the information I was looking for.

### Perceived Usefulness of the Internet (Usefulness) (1 = SDA, 5 = SA):

This web site helped me to quickly make a decision about whether I would like to work for the company.  
 This web site enabled me to effectively get the information I needed.  
 This web site was useful for deciding whether to pursue employment with this organization.  
 The search functions enabled me to get the information I wanted.  
 The search functions helped me get information in the order I was looking for it.  
 The search functions helped me decide whether I would like to work for this company.

### Perceived Internet Information Overload (InfoLoad) (1 = SDA, 5 = SA):

This web site overloaded me with information.  
 Too much information was provided at one time.  
 There was more information than I could interpret right away.