Gender Differences in Information Technology Acceptance

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INTRODUCTION

Gender differences in computer use has been always a topic of research interest. The understanding of the patterns among gender, including beliefs, intention and use behavior of IT/IS would provide us a better picture to the process of design and implementation, which gives support to IT/IS success. However, published works explaining why and how beliefs and attitudes varied between different genders are still scarce, yet the topic was of widespread relevance.

We direct our empirical work on user's beliefs, intention and usage behavior. Gender differences in beliefs would likely make a corresponding impact on the intention to use or not to use computer in the future, and hence, the actual usage pattern. Assumed to be behavioral manifestations of users' gender differences, we infer these gender differences in the beliefs of computer use from their self-reported intention and usage behavior. Therefore, we aim to explore the factors affecting the intention and usage behavior; and their corresponding strengths in affecting the intention and usage behavior; in order to suggest effective implementation strategies accordingly.

The research questions of this empirical study are:

1. What are the emergent constructs that drive the intention and usage behavior of computer use?
2. Do users' beliefs regarding IT/IS usage differ among genders?
3. To what extent do these effects differ?

To address these research questions, we applied technology acceptance model (TAM) to a group of pre-service teachers, and measured their beliefs in using computer to explain the gender differences in their beliefs, intention, and usage of computer. The rest of the article proceeds as follows. The next section starts with a review on gender and technology. The third section explains the model framework TAM. The fourth section describes the instrument construction and validation. The fifth section reports the model testing results. The final section discusses the thrusts of the study and future trends.

BACKGROUND

There have been findings showing that gender differences in computer acceptance are prevailing. Young (2000) found significant gender differences in computer attitudes of 462 middle and high school students. The male domain scale showed that boys were more likely to have claimed computers as a male area. Thus, higher levels of confidence and, for males, the absence of negative teacher attitudes were associated with greater computer skills. Using TAM as the theoretical framework, Venkatesh & Morris (2000) found that, compared to women, men placed a greater emphasis on perceived usefulness in determining behavioral intention. On the other hand, women weighted perceived ease of use more strongly in determining behavioral intention than men did at earlier time frame. A few more empirical studies showed that gender differences in information technology do exist: Yuen and Ma (2002) found significant gender differences in beliefs while applying the technology acceptance model to a group of pre-service teachers; Houtz and Gupta (2001) found that males generally are more interested in information technology; Gattiker and Nelligan (1988) suggested that there is an association between gender

and attitudes of information technology. On the other hand, interestingly, in their study of *Australian Women in IT*, Hellens and Nielsen (2001) indicated gender and IT were socially constructed as they suggested that cultural differences might be more important than gender alone, "Women of Asian background significantly outnumber all other ethnic female students in Australian IT degree studies" (p. 48). However, whether this applied to teachers is still in doubt and further empirical investigation was in need. Thus, the aim of this article was to explore gender differences in teacher computer acceptance in contrast to the studies in other workplaces. To prepare this article for the "Encyclopedia of Gender and Information Technology", part of the findings were extracted from a previous article of the authors (Yuen & Ma, 2002).

METHOD

Subjects

The study targeted pre-service teachers who were mostly fresh degree holders, joining the one-year full-time teacher education program (Postgraduate Certificate in Education) at a local university in Hong Kong. According to past experience, majority of these graduates would become teachers and work locally. It was believed that a study to these subjects would provide a good understanding of the pre-service teachers, but also shed light to understand the future computer use of in-service teachers. A summary of the 186 respondents who had successfully completed the survey instrument was listed as seen in Table 1.

Table 1. A summary of respondents details

Particulars	Composition
Gender	Male (24.9%)
	Female (75.1%)
Age	Less than 22 (9.8%)
	22-24 (68.5%)
	25-27 (12.5%)
	28-30 (2.7%)
	Over 30 (6.5%)
Full-time teaching experience	No teaching experience (87.5%)
	Less than 1 year (7.6%)
	1-2 year (3.8%)
	3-5 year (1.1%)
Major teaching areas	Art subjects (42.4%)
	Science subjects (35.5%)
	Social science subjects (22.1%)
Access to computers at home	Yes (98.4%)
	No (1.6%)
Formal computer training	Not at all (46.3%)
	1-8 hours (17.9%)
	9-16 hours (13.6%)
	17-24 hours (6.0%)
	25-32 hours (6.5%)
	33 or above (21.7%)

Technology Acceptance Model (TAM) and Its Measurement Items

In prior studies, there have been extensive investigations on developing computer attitude scale. Attitude was viewed in a hierarchical manner, including firstly the *affective responses to attitude*, then the *cognitive responses to attitude*, and the highest level of *conative responses to attitude* (Ajzen, 1988). Applying this attitudinal process to computer use, it might explain as: (1) firstly an user heard about computers and tried to evaluate them; (2) then, the user got chance to have hands-on experience with computers and formed perceptions about computers; and (3) finally, the user reflected his or her attitude on computers through behavioral intention and actual usage behavior. How to measure perceptions would become an important process to predict and explain computer use.

TAM was one of the widely validated and applicable model frameworks to measure perceptions on technology use. It was firstly suggested by Davis, Bagozzi, and Warshaw (1989). TAM suggested that perceived usefulness and perceived ease of use as two fundamental determinants to intention and technology usage. Other empirical tests of the TAM (e.g., Adams, Nelson, and Todd, 1992; Hu, Chau, Liu Sheng, & Tam, 1999) had for the most part, been supportive of the model for the last 20 years. Legris, Ingham, & Collerette (2003) conducted a critical review of the technology acceptance model and confirmed the wide applicability of the model towards a wide range of technologies, organizational contexts, and subject domains.

The use of TAM to investigate student-teachers' computer acceptance was advantageous because of its well-researched and validated measurement instrument. Specifically, the questionnaire was designed to include five items of perceived usefulness (PU1 to PU5), five items of perceived ease of use (PEOU1 to PEOU5), two items of intention to use

(ITU1 to ITU2). All items are measured in a 7-point Likert scale, with 1 indicating strongly disagree and 7 indicating strongly agree. The major measurement items were listed in the appendix. Subjects were also asked to report their self-reported usage. Duration of usage was measured in hours per week and was coded into seven categories, namely, "Less than or equal to 4 hours"; "4 to 6 hours"; " more than 6 to 9 hours"; "more than 9 to 12.5 hours"; "more than 12.5 to 16 hours"; "more than 16 to 20 hours"; and "over 20 hours". The degree of current usage of computer was measured in a 7-point Likert scale. At the same time, subjects were asked to state demographic data in the first part of the questionnaire, including gender, age range, major teaching areas, access to computer at home and if there was any previous formal computer training experience.

Procedure

Data were collected using a user-reported self-assessment approach. It deemed to be appropriate because of considerable literature support for its use in intention-based studies and being the common method used in TAM research (e.g., Collopy, 1996; Davis, 1989). At the beginning of the semester in October, a total of 282 questionnaires were distributed through the various group representatives. Subjects were asked to return the completed questionnaires to their group representatives within a week's time, just before they left for their school experience. Group representatives collected the questionnaires and sealed in an envelope and returned to the researcher for collection. 186 questionnaires were collected with return rate 66 percent.

FINDINGS

Summary of the Observed Variables and Scale Validation

The descriptive statistics of the measurement items were shown in Table 2. It showed that all the items showed generally positive perceptions towards computer use, all mean scores over four. The mean scores ranged from 4.60 to 5.79 while the standard deviations ranged from 1.15 to 1.51. All constructs satisfied the criteria of reliability (alpha > 0.80).

Table 2. Summary of descriptive analysis

	Mean	StdDev	Alpha	Factor Loadings
Perceived Usefulness (PU)				
PU1	5.19	1.23	0.88	0.81
PU2	4.92	1.33		0.73
PU3	5.21	1.25		0.89
PU4	5.19	1.30		0.83
PU5	5.37	1.25		0.66
Perceived Ease of Use (PEOU)				
PEOU1	4.72	1.33	0.86	0.88
PEOU2	4.60	1.29		0.85
PEOU3	4.99	1.15		0.83
PEOU4	4.75	1.22		0.78
PEOU5	5.04	1.51		0.57
Intention of Use (ITU)				
ITU1	5.79	1.17	0.85	0.87
ITU2	5.68	1.19		0.88

Discriminant validity was demonstrated if an item correlated more highly with items within the same factor than with items in a different factor (Campbell & Fiske, 1959). The inter-item Pearson correlation coefficients showed the discriminant validity where the coefficients of inter-item within each measurement construct were much higher than correlations across constructs. The factor components were then analyzed by a principal component factor analysis with varimax rotation method. The components generated confirmed the corresponding constructs as predicted by the TAM model. The EigenValues of the three components extracted were 5.436, 1.879, and 1.349 respectively. The percentages of variance explained by the components ranged from 11.245 to 45.302, with a total variance explained of 72.21%.

One-way ANOVA was employed to determine the mean differences between the different gender groups on the major variables (teaching experience, computer training, PU, PEOU, ITU, and Usage). No significant differences were found between gender groups for each variable.

LISREL Models

LISREL was a software product designed to estimate and test statistical models of linear relationships among latent and manifest variables. It was an extremely powerful structural equation modeling technique that had been used extensively in research (e.g., Hu et al., 1999). LISREL was then used to analyze the survey data and to perform the

Table 3. Summary of causal path analysis

		Path coefficients		
Construct	**Causal Path**	**Overall**	**Male**	**Female**
PEOU	PEOU → PU	***0.58	***0.85	***0.47
	PEOU → ITU	0.15	0.07	*0.23
PU	PU → ITU	***0.43	0.33	***0.43
	PU → USAGE	***0.38	*0.31	***0.45
ITU	ITU → USAGE	***0.33	***0.61	*0.23
R^2		PU (0.33); ITU (0.29); USAGE (0.38)	PU (0.72); ITU (0.15); USAGE (0.61)	PU (0.22); ITU (0.33); USAGE (0.36)

Note: * p<0.05; ** p<0.01; *** p<0.001

analysis towards model testing. Table 3 showed the resulting model testing findings.

For the overall model, the data supported most of the individual causal paths postulated by TAM. Perceived usefulness had a significant direct positive effect on pre-service teacher's intention to computer use, with standard path coefficient 0.43 (p<0.001). Literally, this coefficient suggested that every unit increment in perceived usefulness would strengthen an individual's (positive) intention to computer use by 0.43 units. Perceived usefulness also had a direct and significant effect on usage, with standard path coefficient 0.38 (p<0.001). Effect of intention to computer use towards self-reported usage was significant and shown a 0.33 path coefficient. Thus, perceived usefulness had a direct effect, as well as an indirect effect, through the mediating intention to computer use, on usage. Perceived ease of use had positive effects on both perceived usefulness (path coefficient = 0.58) and intention to computer use (path coefficient = 0.15). Although it was a significant direct effect on perceived usefulness (t = 7.41, p<0.000), its effect on intention to computer use was statistically non-significant.

From the R square values, it showed that perceived ease of use explain 33% of the variance in perceived usefulness, while perceived ease of use and perceived usefulness together explained 29% of the variance in intention to computer use. Intention to computer use and perceived usefulness accounted for 38% of the variance in usage.

This finding was consistent with prior research (e.g., Venkatesh & Davis, 2000) that while "the effect of usefulness on usage was significant," "the effect of ease of use on usage, controlling for usefulness, was non-significant" with the reason that "ease of use operates through usefulness" (Davis, 1989, pp. 331-332).

The LISREL model was then analyzed on male as well as female data in order to examine the gender differences of the effect of each construct to the model. All data segments provided an overall fit of the model postulated by TAM. However, compared to women, men placed a greater emphasis on perceived ease of use in determining perceived usefulness (0.85 for male; 0.47 for female). On the other hand, women weighted perceived ease of use more strongly in determining intention to computer use than men did (0.07 for male; 0.23 for female). The causal path from perceived usefulness to intention to computer use was non-significant for men. For the case of women, the strong direct significant effect of perceived usefulness in determining intention to computer use showed that was hindered by the overall model, which was not consistent to prior research findings of Venkatesh and Morris (2000).

In agreement with what most literature postulates, the two independent variables, perceived usefulness and perceived ease of use, contributed significantly to the behavioral intention to computer acceptance and actual self-reported usage, accounted for 38%, 61% and 36% of the overall, male and female model respectively.

MAIN THRUST AND FUTURE TRENDS

Key Findings

The research questions of this empirical study were:

1. What were the emergent constructs that drive the intention and usage behavior of computer use?
2. Did users' beliefs regarding IT/IS usage differ among genders?

3. To what extent did these effects differ?

The empirical findings were that female and male users' differ in beliefs, intention, and usage. From the testing summary of the models, the beliefs were influenced and differed among different gender. Female users were influenced by both perceived usefulness and perceived ease of use to their intention and usage of computer, in a more balanced manner. Both factors were significant in predicting intention and usage, though perceived usefulness was stronger in effect (ß=0.47 at $p<0.001$ versus ß=0.23 at $p<0.05$). On the other hand, male users were nearly totally influenced by perceived usefulness to their intention and usage of computer. Perceived usefulness was significant and strong (ß=0.85 at $p<0.001$) while perceived ease of use was non-significant and had only an indirect effect through perceived usefulness toward intention and usage of computer.

Limitations of the Study

It was believed that the study on a longitudinal perspective would be conducted in order to gain better understanding about the users' acceptance behavior. Moreover, this study collected pre-service teachers' view on "computer" acceptance in a general term. This might also limit us from knowing the differences among other technologies or software applications. Therefore, further studies on the area of the acceptance towards different technologies and the acceptance differences on a continuous basis would also be recommended.

Contributions to Practice

This empirical study had unique contributions for IT/IS practitioners. Successful system implementation required users to effectively use the system while effective management required a better understanding of the beliefs of users toward IT/IS systems. The findings of gender differences in beliefs and their corresponding beliefs' strengths could assist in the proactive implementation planning of IT/IS (e.g., user training, system support, etc.) for minimizing the impacts while using IT/IS.

Contributions to Research

This study attempted to explore the teachers' computer acceptance and re-confirmed that perceived ease of use and perceived usefulness were the two independent variables towards computer use. It also revealed the gender differences in the application of the TAM. These findings were definitely important to the design of teachers' professional development. Viewing teacher training as a kind of remedy for teachers' inadequacy, teachers' computer training was, still in many cases, unified and one-off. Without a continuous development plan to teachers (e.g., Bradley, 1991), the problem of acceptance would still be an important barrier to the successful use of computers in education. The study had collected the views of pre-service teachers at a given point of time, however, studies found that the factors to pre-adoption and post-adoption might be different (e.g., Bhattacherjee, 2001; Karahanna, Straub, & Chervany, 1999), that was, a factor contributes positively to acceptance might not necessarily contribute to the same extent and degree after adoption. Sometimes, on the contrary, a factor might hinder further computer use.

CONCLUSION

In summary, this study extended the applicability of the technology acceptance model over teachers' computer use. It validated the instrument and the model framework using survey data from a group of pre-service teachers, as well as reflected gender differences in technology acceptance. We suggested that this model could be applied in the teachers' computer use context and used to explain the use intention and use behavior. We recommended that these findings to be included in future gender and IT/IS research studies.

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KEY TERMS

Affective Responses to Attitude: They are the responses that reflect evaluations of, and feelings toward the attitude object.

Attitude: An attitude is a disposition to respond favorably or unfavorably to an object, person, institution, or event.

Cognitive Responses to Attitude: They are the responses that reflect perceptions of, and information about, the attitude object.

Computer Attitude Scale: A composite instrument to measure an overall attitude of an user to respond favorably or unfavorably to computer.

Conative Responses to Attitude: They are responses that reflect behavioral inclinations, intentions, commitments, and actions with respect to the attitude object.

Perceived Ease of Use: The degree to which the prospective user expects the target system to be free of effort.

Perceived Usefulness: The prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context.

Technology Acceptance Model (TAM): A model framework which is composed of two fundamental determinants, perceived usefulness and perceived ease of use, to explain computer usage behavior.

APPENDIX: MEASUREMENT ITEMS

Perceived Usefulness	
PU1	Using computer improves my job performance.
PU2	Computer enables me to accomplish tasks more quickly.
PU3	Using computer enhances my effectiveness on the job.
PU4	Using computer increases my productivity.
PU5	Overall, I find computer useful in my job.
Perceived Ease of Use	
PEOU1	Learning to operate computer is easy for me.
PEOU2	It is easy for me to become skillful in using computer.
PEOU3	Computer is flexible to interact with.
PEOU4	My interaction with computer is clear and understandable.
PEOU5	Overall, I find computer easy to use.
Intention to Use	
ITU1	I intend to use computer when it becomes available in my work place and at home.
ITU2	I intend to use computer in my job as often as possible.

Source: Adopted from Davis, 1989, p. 331