Technology Usage Among construction Students
The Moderating Role of Gender

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Abstract: This study examines the impact of perceived usefulness and perceived ease of use on the extent of personal computer (PC) usage among a group of undergraduates at the School of Housing, Building and Planning, Universiti Sains Malaysia. It also looks at the moderating role of gender in the above said relationship. Data was collected using a structured questionnaire. A total of 244 students responded to the survey. Results showed that perceived ease of use (β = 0.309, $p < 0.01$) was positively related to PC usage. A surprising finding of this study was that perceived usefulness was not a significant predictor of PC usage whereas perceived ease of use was. This can be explained in the context of mandated use where the usefulness is no longer an issue and ease of use becomes the primary concern. Gender was not a moderator in the above said relationship but was a significant independent predictor of usage. Males exhibited higher usage of the PC compared to the female students.

Keyword: PC Usage, Construction undergraduates, Perceived usefulness, Perceived ease of use

INTRODUCTION

Computers are a relatively new phenomenon and until very recently their use in junior school was limited, now they have been pushed to the forefront. For the inexperienced, simply logging on to the internet can be a challenge, and even the computer literate lack experience integrating the internet into the curriculum (Cooper, 1999).

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In Malaysia, the use of the personal computer (PC) in the education sector began to gain momentum in early 1990s before which the typewriter was the preferred mode of assignment and project paper preparation. Now the PC has actually become a part and parcel of the everyday life of a student.

The School of Housing, Building and Planning (SHBP), Universiti Sains Malaysia, is where courses related to architecture, planning, construction management, quantity surveying and interior design are offered. With the advancement of information technology at university level, students are encouraged to have PCs in doing their

project. Since they have to be familiar with computers before their graduation, almost all the project implementations need to be carried out using computers.

In SHBP, all programmes emphasised their students to learn and have skills in using specific software. In relation to the advancement of new software technology in the industry, the software application in SHBP has been upgraded continuously. This can ensure that the exposure will be beneficial to the students to compete globally after their graduation.

Although much efforts have been put into integrating technology especially PC into the daily lives of students, the usage has not really caught on with the students. As with many developing countries, there are various factors that impede in the total utilisation. Cost of the PC, availability, motivation of the students, knowledge and command of the usage have led to underutilisation. For example, the school has only one laboratory with 80 computers but only 10 computers are connected to the internet.

Universities in the world have been investing millions of dollars in building usable online libraries, but researches have shown that potential users may still not use them (Thong et al., 2002). With all these resources invested in developing systems and improving functional performance, online libraries can still remain unnoticed by students or be seriously underutilised in spite of their availability (Hammond, 1994; Wood et al., 1995; Hsieh-Yee, 1996; Jamaludalin, 2004; Tay et al., 2004; Ramayah, 2006a, 2006b). The statement that the online library is seriously underutilised is based on anecdotal evidence gathered by talking to students and also in two unpublished reports. The first, by Jamaludalin (2004) found that only 24% of the respondents used the online library as most were comfortable going to the physical library as a form of social networking. Tay et al. (2004) also found that only 46% had experience of using the online library. Again, from this 46% of users, 84% used the online library less than once a week, which points to a wastage of the services provided. We can also conjure that it is the same for PC usage as peculiar to SHBP, the software packages used can be quite challenging like AutoCAD, Microsoft Project and Microstation.

In a study on PC usage among students of private institutions of higher learning, Ramayah et al. (2005) found that most students were still ignorant about the usefulness of advanced applications although they are frequent users of PC with many years of experience (taking into consideration both the number of hours in contact with PC and the years since first being introduced to the technology). Most use the PC for basic tasks only such as using word processing and spreadsheets, and have not

moved on to more challenging programmes like graphics, web page design, statistical software, etc.

As such, the first objective of this paper is to gauge the extent of usage of the PC among the HBP undergraduates and the second objective is to test the determinants of usage (i.e., perceived usefulness and perceived ease of use) whereas the third objective is to see the moderating role of gender in the perceived usefulness, perceived ease of use and usage relationship.

CONCEPTUAL FOUNDATION

The adoption of technological products and services has been often explained with the use of the Technology Acceptance Model (TAM) (Davis, 1989). TAM, pioneered by Davis (1989) advances the Theory of Reasoned Action (TRA) advanced by Ajzen and Fishbein (1980) by postulating that perceived usefulness and perceived ease of use are key determinants that inevitably lead to the actual usage of a particular technology or system. Perceived usefulness is defined as "the degree to which an individual believes that using a particular system would enhance his or her productivity" while perceived ease of use is defined as "the degree an individual believes that using a particular system would be free of effort" (Davis, 1989). Between the two, perceived ease of use has a

direct effect on both perceived usefulness and technology usage (Adams et al., 1992; Davis, 1989).

THE RESEARCH MODEL

The modified TAM model developed by Davis (1989) is applied to our research context as presented in Figure 1.
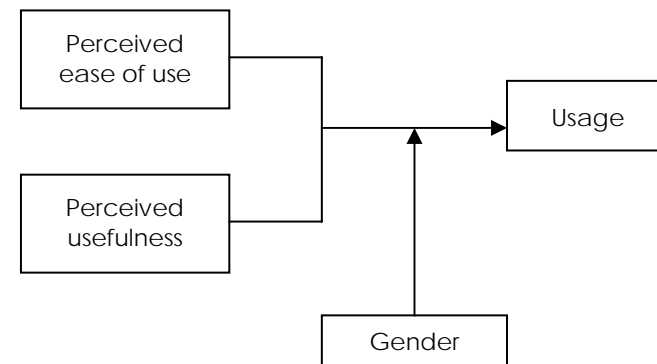

Figure 1. Research Model

Perceived Ease of Use

Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989). Effort is a finite resource that a person may allocate to the various activities for which he or she is responsible (Radner and Rothschild, 1975). All else being equal, an application perceived to be easier to use is more likely to be accepted by the users. All others being equal, a teacher is likely to consider technology to be useful when it is easy (Hu et al., 2003). Nysveen et al. (2005) also found that perceived ease of use was a significant predictor of intention to use mobile services in Norway. There are also many researches that have found ease of use to be influential in system usage (Adams et al., 1992; Davis, 1989; Koay, 2002; Ramayah et al., 2002; Ramayah et al., 2005; Ramayah and Lo, 2007). In a recent study of course website usage in Malaysia, Ramayah (2006a) found that ease of use was a significant predictor of course website usage. In another study on online library, Ramayah (2006b) found the same support. Thus, we hypothesise that:

H$_1$:   Perceived ease of use is positively related to the usage of PC among students

Perceived Usefulness

Venkatesh (1999) proposed that usefulness is an extrinsic motivator which is based on goal achievement and has been identified as the main motive for behavioural intention. Davis (1989) suggested that perceived usefulness is the subjective probability that using the technology would improve the way a user could complete a given task. Nysveen et al. (2005) found that perceived usefulness was a significant predictor of intention to use mobile services in Norway. In a study on teacher's use of technology, Hu et al., (2003) found that usefulness was a strong predictor of intention to use. Past researches (Davis, 1989; Mathieson, 1991; Adams et al., 1992; Segars and Grover, 1993; Igbaria et al., 1995, 1996, 1997; Ndubisi et al., 2001; Ramayah et al., 2002, 2003a, 2003b, 2005; Ramayah and Lo, 2007) have shown that perceived usefulness influences computer usage directly. Ramayah (2006a) also supported the notion that usefulness was positively related to the usage of a course website. Thus, we hypothesise that:

H$_2$:   Perceived usefulness is positively related to the usage of PC among students

Gender

Of late, there has been a growing interest among researchers to look at gender differences in terms of technology usage and adoption, and more recently in terms of internet usage. Gefen and Straub (1997) found that there were differences in perception of male and female in terms of e-mail usage whereas Venkatesh and Morris (2000) found that there were motive differences for use of a new software system in the workplace. These two studies highlight that the differential effects of gender on motives for using information technology are worth investigating (Nysveen et al., 2005). Also Nysveen et al.'s (2005) study on intention to use mobile chat services found that usefulness influenced the intention to use more strongly for male as compared to female. They also did not find any significant impact of gender on the perceived ease of use and intention although they hypothesised that the relationship would be stronger for female compared to male. Ono and Zavodny (2002) also found that women were significantly less likely than men to use the internet either at home or elsewhere. Dahlan et al. (2002), in their study on data mining readiness of Malaysian banking employees found male employees were more ready in data mining readiness compared to female employees. In a recent study on course website usage, Ramayah and Osman (2005) found that males use the course websites more than female students.

Thus, we hypothesise that:

H_3 : The relationship between the belief and usage will be moderated by gender

H_{3a} : Perceived ease of use will influence usage more strongly for female than for male

H_{3b} : Perceived usefulness will influence usage more strongly for male than for female

METHODOLOGY

The population of the study was all undergraduate students enrolled in the HBP degree programme. The total number of students enrolled is 730. A convenience sampling was used to gather data using a structured questionnaire adopted from Davis (1989). Students were intercepted after their classes at the various lecture halls and completed a self-administered questionnaire. The questionnaire elicited responses on perceived ease of use and perceived usefulness using a seven-point Likert scale with 1 = strongly disagree to 7 = strongly agree, whereas for usage of several software was measured using a five-point Likert scale with 1 = not at all to 5 = to a great extent, adapted from Igbaria et al. (1995) and Teo et al. (1999) (see Table 1).

Table 1. Sample Questions from the Questionnaire and the Sources

Variable	Sample Question	Source
Perceived ease of use	It was easy for me to become skillful at using the PC.	Davis (1989)
Perceived usefulness	Using the microcomputer improves my work performance.	Davis (1989)
Usage	Extent of use of word processing, spreadsheets, graphics, project management, drawing, etc.	Adapted based on Teo et al., (1999); Igabria et al., (1995)

Table 2. Profile of Respondents

		Frequency	Percentage
Gender	Male	102	41.8
	Female	142	58.2
Race	Malay	87	35.7
	Chinese	143	58.6
	Indian	11	4.5
	Others	3	1.2
Age	Below 21 years old	81	33.2
	21–22 years	144	59.0
	23–24 years	19	7.8
Staying	In campus	108	44.3
	Outside campus	136	55.7

Findings

The profile of the respondents is presented in Table 2. A majority of the students were female students which is the current trend in most of the public universities of higher learning where females make up about 65% of the population. The ethnic composition shows a majority of Chinese students which is a result of the recent policy where the intake is based on meritocracy and not quota. This new move has resulted in some courses having mostly Chinese students whereas earlier, the majority were Malays. Since the policy of the university is to provide in-campus accommodation only for the first year students, most second and third year students have to find alternative accommodations outside which is reflected in a bigger majority staying outside campus.

GOODNESS OF MEASURE

Two criteria to measure goodness of measures are validity and reliability. Validity tests how well an instrument that is

developed measures the particular concept it is supposed to measure. Reliability tests how consistently a measuring instrument measures whatever concept it is measuring (Sekaran, 2003). The most popular validity test used is the factor analysis which measures the factorial validity; whereas for reliability the inter item consistency measure of Cronbach's alpha is computed.

A factor analysis with principal component analysis employing an orthogonal varimax rotation was carried out to ascertain the validity of the measures. The factor analysis (see Table 3) yielded a two factor solution explaining 70.02% variance. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.862 whereas the Bartlett's test of sphericity was significant (χ^2 = 908.505, p < 0.01) indicating sufficient intercorrelations for the factor analysis. The perceived usefulness component explained 51.63% variance whereas perceived ease of use explained 18.39%.

The reliability of the measures was assessed using the Cronbach's alpha reliability coefficient. The results of the analysis are presented in Table 4. All the coefficients were above the value of 0.7 as suggested by Nunnally (1978) which indicates sufficient reliability.

Table 5 presents the mean and standard deviation of all study variables whereas Table 6 presents the intercorrelations among the variables. Most students agree that PC's are useful and easy to use as indicated by the high mean values and the usage level is slightly above average as indicated by a mean value of only 3.20.

The correlations show a low to moderate correlation between the main variables thus eliminating the possible problem of multicollinearity. Multicollinearity is a situation where the independent variables are found to have high correlation between them (more than 0.8) which can become a serious issue in the multiple regression analysis.

Table 3. Results from the Factor Analysis

Dimensions	Component	
	Usefulness	Ease of Use
Using the PC would enhance my effectiveness in my undergraduate study	**0.868**	0.158
Using the PC in my undergraduate study would enhance my productivity	**0.847**	0.197
Using the PC would improve my performance in the undergraduate study	**0.734**	0.301
I would find the PC useful in the undergraduate study	**0.801**	0.185
It would be easy for me to become skilful at using the PC	0.278	**0.756**
I would find the PC easy for me	0.196	**0.836**
Learning to use the PC would be easy for me	0.186	**0.822**
I would find it easy to get the PC to do what I want	0.161	**0.798**
Eigenvalue	4.131	1.471
Percentage variance (70.019)	51.631	18.388

Table 4. Reliability Analysis

Factor	No. of items	Cronbach's Alpha
Perceived usefulness	4	0.86
Perceived ease of use	4	0.84
Usage	5	0.67

Table 5. Descriptive Analysis

Variables	Mean	Standard deviation
Perceived usefulness	5.48	1.03
Perceived ease of use	5.13	0.99
Usage	3.20	0.60

Table 6. Intercorrelations of the Major Variables

	PU	PEU	Usage
Perceived usefulness	1.000		
Perceived ease of use	0.480**	1.000	
Usage	0.322**	0.168**	1.000

Note: **$p < 0.01$, *$p < 0.05$
PU – Perceived usefulness, PEU – Perceived ease of use

Three hypotheses were generated for this study. These hypotheses were tested using the hierarchical regression analysis presented in Table 7. Hierarchical multiple regression is used to determine what proportion of the variance in a particular variable is explained by other variables when these variables are entered into the regression analysis in a certain order and whether these proportions are significantly greater than would be expected by chance (Cramer, 2003). Hierarchical multiple regression has been advocated as a more appropriate method for determining whether a quantitative variable has a moderating effect on the relationship between two other quantitative variables (Baron and Kenny, 1986). Baron and Kenny (1986, pp. 1174, 1178) describe a moderator variable as the following:

A qualitative (e.g. sex, race, class) or quantitative variable... that affects the direction and/or strength of a relation between an independent or predictor variable and a dependent or criterion variable... a basic moderator effect can be presented as an interaction between a focal independent variable and a factor (the moderator) that specifies the appropriate conditions for its operation... Moderator variables are typically introduced when there is an unexpectedly weak or inconsistent relation between a predictor and a criterion variable.

For the purpose of this study, a three-step hierarchical regression was conducted. In the first step, the direct effect of the two independent variables will be gauged, in the second step the moderator variable will be entered to gauge whether the moderator has a significant direct impact on the dependent variable and in the third step the interaction terms (the product of the independent variable and the moderator variable) will be entered to see the additional variance explained. For moderator effect to be present, the third step must show significant R^2 increase with a significant F-change value.

The results (see Table 7) show that perceived ease of use ($\beta = 0.309$, $p < 0.01$) was positively related to usage of PC thus supporting H_1 of the study. Perceived usefulness was not associated to usage thus H_2 is not supported. H_3

which posited that gender will moderate the relationship between the beliefs and usage were also not supported (see Step 3, the interaction terms were not significant).

Table 7. Results from the Hierarchical Regression Analysis

	Std. Beta Step 1	Std. Beta Step 2	Std. Beta Step 3
Perceived ease of use	0.309**	0.282**	0.299
Perceived usefulness	0.040	0.062	0.102
Gender (Male =1, Female = 0)		0.171**	0.579
PU*Gender			–0.274
PEU*Gender			–0.146
R^2	0.109	0.137	0.141
Adjusted R^2	0.101	0.126	0.123
R^2 change	0.109	0.028	0.004
F change	14.428**	7.773**	0.554

Note: **$p < 0.01$, *$p < 0.05$
PU – Perceived usefulness, PEU – Perceived ease of use

DISCUSSION

The extent of PC usage among the students can be termed as above average where the mean value showed 3.20 which is towards the higher extent of usage. This finding augurs well as the nation pushes towards knowledge based society, where these undergraduates will in the near future become our human capital.

Perceived ease of use was found to have a positive influence on the intention to use a PC among HBP students. As noted earlier in the literature, all else being equal, an application perceived to be easier to use is more likely to be accepted by the users (Adams et al., 1992; Davis, 1989; Ramayah et al., 2002, 2003a, 2003b, 2005; Ramayah, 2006a, 2006b; Ramayah and Lo, 2007).

Perceived usefulness was not an influential driver in our study in predicting the usage of a PC. This contradicts past researches (Davis, 1989; Mathieson, 1991; Adams et al., 1992; Segars and Grover, 1993, Igbaria et al., 1995, 1996, 1997; Ndubisi et al., 2001; Ramayah et al., 2002, 2003a, 2003b; Ramayah and Aafaqi, 2004; Ramayah and Osman, 2005; Ramayah, 2006a; Ramayah and Lo, 2007) which have shown that perceived usefulness influences computer usage directly. This can be explained due to the fact that students already perceive the PC to be very useful and in a mandated environment like this, students

have no choice but to use the PC in preparing their projects and assignments.

Gender was found not to moderate the relationship between belief and usage but it was found that there was a direct impact of sex on usage. The male students exhibited higher usage compared to the female students. This finding that gender is a predictor of technology usage is supported by the works of Shashaani (1997), Kay (1992), Gefen and Straub (1997), Venkatesh and Morris (2000), Venkatesh and Davis (2000), Teo (2001), Ono and Zavodny (2002), Dahlan et al. (2002), and Ramayah and Osman, (2005).

IMPLICATIONS

Although perceived usefulness was not a significant predictor of usage, we cannot totally discount the impact of this variable in the actual usage of the technology. As can be seen from the descriptive statistics, the mean value is very high which points to the fact that students already perceive the PC to be very useful. On the other hand, it has been shown that the extent of PC usage is determined by perceived ease of use for HBP students. In relation to the government aspiration to create a knowledge based society, teachers in secondary education or parents should expose their students or children towards the use of PC. With this basic knowledge, once they get into the university, they will be much more comfortable operating the PC. The lecturers should emphasise the importance of using different softwares in the daily life of the students so as to encourage students to use the PC. Most lecturers have resorted to accept only assignments and projects done using the PC as acceptable, as such there is a strong push to get to know the use of PC.

Result also implies that greater attention on using PC should be emphasised and more focused on female students to make them equally competent as the male students. Towards meeting that end, the school can organise some computer classes particularly for the female students to familiarise them with the PC and the various softwares available and which are useful for their daily lives. Once exposed, the level of ease of use would increase and so will the usage. Faculties should also push forward the idea of using course websites to put their lecture notes and other course related materials online so as to encourage students to use the internet for the purpose of learning which will also increase the usage of PC.

CONCLUSION

The research has shown that the students are using PC to a certain extent but this can be improved further. The predictor of usage in this context is perceived ease of use as such more efforts should be directed towards activities that may help students to perceive PC as easy to use. Perceived usefulness was not a predictor as most students are already aware that PC is very useful in their daily lives. We also found that gender did not moderate the relationship between ease of use, usefulness and usage but played a predictor's role with male displaying more usage. Thus, more efforts should be expanded towards encouraging the female users to increase usage and this is an important agenda with the increase of more female students in the Malaysian universities.

PC will continue to be useful to the students in the future. Thus, students have to rise to the call for a knowledge based society. Although early indicators show that these students are using PC, they should not remain complacent due to the continuous upgrades in software applications. Given the short software life-cycle, it is imperative that HBP students upgrade their PC related knowledge continually. These results also support the advancement of information technology era in the construction industry. Graduates who will be the future employees of the industry should have skills in using computers so that the productivity will be higher. In the future, the industry will increasingly become more complex where firms have to be able to compete globally, implement more sophisticated project and deal with professional clients. Even today, project implementation could be done or managed through virtualised project (Ariffin, 2002). This shows that the knowledge of computers can have a strong impact on individual skills and capabilities to participate in the industry.

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