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Abstract

Investments in computerised information systems in the health industry in evident in most parts of the world. In hospitals and other Healthcare settings, increasingly, hands-on computer use is becoming an important behaviour for effective job perfonnance for health professionals. As the pre-employment (professional) training is provided at a number of different settings the exposure health workers have to computing will vary. Providing training and support to such end-users becomes a complex problem. In addition, based on their prior exposure to computer technology in their work place individuals will have different experiences that make implementation of such systems more complex. Individual psychological characteristics of computer end users have been widely researched and debated in studies in management infonnation systems (MIS), organizational behaviour and educatiol1. From as early as the 1970's researchers sought a better understanding ofindividual psychological characteristics towards computers and its use. Factors that have been implicated most commonly in studies based on health professionals include computer attitude, compilter anxiety, experience in using computers and user involvement (Krampf and Robinson, 1984; Moralee et al., 1993; Henderson et al., 1995). Computerised information systems in health care settings in most cases are mandatory. Therefore prediction of its use is inconsequential. Based on prior studies, it has been shown that behavioural intention predicts behaviour in voluntary situations (Davis et aI., 1989). Behavioural intention refers to the strength of one's intention to perfonn a specific behaviour (Fishbein and Ajzen, 1975). Studies in business and student settings conducted to ascertain factors that predict behaviour intention to use computer system have identified individual psychological factors to he important. However very few empirical studies have examined these factors in health care settings. In addition there is continued debate and contention ofthe influence ofthese factors in the literature. Given the emerging situation in health care settings of wider implementation of computerised systems the present study was undertaken to test the relationships of these factors to behavioural intention to use computers in a health care setting.

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The effect of individual psychological characteristics in the use of Computerised Information Systems

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Introduction

Investments in computerised information systems in the health industry in evident in most parts of the world. In hospitals and other Healthcare settings, increasingly, hands-on computer use is becoming an important behaviour for effective job performance for health professionals. As the pre-employment (professional) training is provided at a number of different settings the exposure health workers have to computing will vary. Providing training and support to such end-users becomes a complex problem. In addition, based on their prior exposure to computer technology in their work place individuals will have different experiences that make implementation of such systems more complex.

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Individual psychological characteristics

Computer attitude

Attitude towards computers has been shown to be a critical determinant in its use (Culpan, 1995; Hartwick and Barki, 1994). However, there has not been no single accepted definition of this construct

(Kay, 1993, Smith et al, 2000). Attitude has been defined as "...a learned predisposition to respond in a consistently favourable or unfavorable manner with respect to given object " (Fishbein and Ajzen, 1975). Attitudes can predict the intention of an individual to perform a behaviour in relation to the object of concern. The adoption of computer technology is facilitated by favorable attitudes towards automation. Studies in the business sector has shown that attitudes of users was a key determinant of the effective use of computers in the work place and that employees may resist using computers if they have a negative attitude (Igbaria and Parasuraman, 1991). Others have shown that user's favorable attitude was associated with high levels of system usage (Igbaria, 1993). In a health care setting, it was shown that behavioural intention to use computer systems was predicted by nurses attitudes towards the system (Herbert, 1994)

Computer anxiety

Computer anxiety has been identified as a variable related to resistance and commitment to use computers (Kay, 1990). Jacobson et al (1989) found that nursing staff may exhibit high levels of computer anxiety. Nurses have also been found to have more anxiety than clerical/administrative staff (Henderson et al, 1995). Szanja (1994) found significant negative correlation between computer anxiety and the performance of computer tasks in introductory and intermediate-level business computer courses. While this relationship was seen only early in the course, once students obtained more experience the anxiety dissipated. Similar findings in student nurses showed that subjects with more hands-on computer experience had significantly less anxiety (Wilson, 1991).

Individuals with high computer anxiety scores report a greater frequency of behaviours associated with avoiding computers (Deane et al, 1995). Deane et al (1995) also posited that computer anxiety is a trait that manifests itself as heightened state anxiety in the presence of relevant stressors (computers). Using the state-trait anxiety model, it was demonstrated that both computer experience and state anxiety had little effect on trait anxiety and task completion latency (Mahar et al, 1997). Therefore the precise nature of the relationship between computer experience and computer anxiety is still in debate.

Computer Experience

Computer experience has usually been used as an explanatory variable to predict computer usage (Igbaria, 1990 ; Taylor and Todd, 1995). Schwiran et al. (1989) found that nurses' attitudes to computers become more positive as the level of computer experience increases. Caputi et al. (1995) found that positive computer attitudes of professional nurses was associated with their degree of computer experience. Previous computer experience is an essential variable in human-computer interactions, because individuals with low or high levels of experience interact with computers in different ways. Studies have shown that there is a consistent relationship between computer experience, knowledge and attitudes (Durndell et al. 1987). Computer experience can also directly affect the attitudes of users (Robinson-Staveley and Cooper 1990; Igbaria and Chakrabarti 1990). Culpan (1995) argues that attitudes toward information systems can be formed by past experience. Thus, there is sufficient evidence of a positive relationship between computer experience and computer attitude. Experience can promote the formation of attitudes and these attitudes then operate to modify the quality of subsequent experiences.

In all the above studies computer experience has been measured as a self reported measure of their level of experience or the number of years using computers. In a similar manner in the MIS literature, the majority of researchers have measured computer experience using objective measures. A theoretical distinction between objective computer experience and subjective computer experience has been made and a study of undergraduates using computers has shown that objective computer experience was conceptually distinct from factors reflecting users' psychological reactions to computers (Smith et al. 1999; Smith et al, 2000).

Qualitative differences in computing experience (subjective experience) have been used to show that it affects other variables such as computer anxiety (Henderson et al, 1995). Subjective computer experience has been defined as a private psychological state, reflecting thoughts and feelings a person ascribes to some existing computing event (Smith et al, 1999).

An important assertion of the Theory of Reasoned Behaviour (TRA) is that extraneous variables, such as computer experience, influence behaviour indirectly through their influence on attitudes concerning the behaviour (Fishbein and Ajzen, 1975). Whether attitude mediates the relationship of computer experience to behaviour intention requires further testing.

User Involvement

Researchers have studied user participation in development of information systems as it was deemed to be critical to implementation, user acceptance and success of information systems (Ives and Olsen, 1980). Though the terms user involvement and user participation have been frequently used to mean the same thing, Hartwick and Barki (1994) identified that user involvement is a subjective psychological state reflecting the importance and personal relevance that the user attaches to the system. Based on consumer behaviour research, consensus is emerging that involvement is the degree to which a person perceives an object, action, event, or situation to be personally relevant (Hartwick and Barki, 1994).

Summary of review of past research and research questions

The above review shows clearly that each of these psychological constructs of individual psychological characteristics have many inter-relationships. All of them have been shown to have an effect on behavior intention to use computers but the mediating effects of attitudes and anxiety are still debated. There is yet insufficient understanding of the role of user involvement and the distinction between subjective computer experience and computer attitude.

The research questions for this study were to:

1. test reliability and construct validity of the psychological variables
2. ascertain the relationship of each variable on behaviour intention to use computers
3. test the mediating effect of computer attitudes to extraneous variables (computer experience and user involvement).

Methods and measures

The sample for the study consisted of nurses and health workers who were employed in community health centers in one region of NSW. Computers were used for office administration and the collection of patient statistics. A new computerised system for client management was being developed and the respondents were aware of this envisaged change. The data were collected through a self-administered questionnaire. The questionnaires were mailed to an identified site champion in each community health centre and were collected by the same person. Of 430 questionnaires sent out, 302 (response rate 70%) were returned.

The data were coded and entered to a SPSS data set for analysis. Factor analysis, using principal component analysis with varimax rotation, was carried out. A model was tested that examined the relationship between Perceived Computer experience, User Involvement, Computer attitude and Computer Anxiety and intention to use the system. This model was tested using general linear modelling (GLM) in the SPSS statistical package.

Measures

Computer experience was measured using the Perceived Computer Experience Scale (PCES). This scale was developed using items derived from a similar context (nursing) resulting in a 12 item instrument. The psychometric properties of the PCES such as content validity, face validity, concurrent validity, constructs validity, test-retest reliability and internal consistency were measured in a previous study (Yaghmaie F, et al. 1997).

We had developed an instrument to assess attitudes towards computers in nursing that is relevant to the Australian context that has sound internal consistency and evidence of concurrent and construct validity (Jayasuriya and Caputi, 1996). The instrument (NCATT) measures 'computer attitudes in nursing' and is multi-dimensional, consisting of three factors, 'computers and nursing work', 'computer anxiety' and 'computers and confidentiality'. The scale has 22 items and the factors accounted for 90% of the variance. For this study the wording in the items was changed from 'nursing' to 'health workers'. Computer anxiety was measured using the sub scale in the NCATT.

User involvement was measured using a nine-item instrument developed by Hartwick and Barki (1994). This instrument is based on a seven point semantic differential scale. Behavioural intention was measured using 3 item scale selected from a similar study. Responses to intention of use in the future, use frequently and heavy use of computers are made using a 5 point likert scale (Herbert et al, 1994).

Results

Internal consistency reliabilities (Cronbach's alpha given in Table 1) for each scale and sub scales were calculated and shown to be adequate. A factor analysis of computer attitude, computer anxiety , perceived computer experience and user involvement revealed four unique factors corresponding to each of the variables. This solution explained 59.4% of the variability.

The inter-correlations of the variables that were tested are presented in Table 1.

Table 1. Correlation matrix for the variables in the study (n= 302)#

Factors	CT	CA	PC	PE	NE	IN	IU
Computer Attitude (CT)	(0.88)						
Computer Anxiety (CA)	-.43**	(0.87)					
Attitude to confidentiality (PC)	.47**	-.32**	(0.78)				
Perceived positive experience (PE)	.44**	-.76**	.29**	(0.84)			
Perceived negative experience (NE)	-.15*	.46**	-.12*	-.27**	(0.75)		
Involvement (IN)	.56**	-.44**	.23**	..50**	-.11	(0.93)	
Intention to use (IU)	.54**	-.47**	.23**	.58**	-.11	.56**	(0.83)

Diagonal elements indicate the scale internal reliability and the off diagonal elements indicate inter-correlations.

We used Schmitt's criteria (Webster and Martocchio, 1992) to test for discriminant validity of the factors. Evidence for validity was obtained by comparing factor reliabilities with interscale correlations (see Table 1) . Adequate discriminant validity was demonstrated as the internal consistency reliabilities were much higher in all factors than their inter-correlations.

We tested a model that examined the relationships between perceived computer experience (PCE), computer attitude, computer involvement and intention to use a system. Specifically, attitude was regressed onto PCE, intention to use was regressed onto attitude and intention to use was regressed onto PCE. The results of these analyses indicated that perceived positive experience (PE) predicted attitudes towards patient care (B= .396, t[292] = 8.40, p < 0.001), attitudes towards confidentiality (B= .345, t[292] = 4.84, p <0.001), and computer anxiety (B= -.789, t[292] = -18.69, p <0.001). Increased PE was associated with more positive attitudes toward using computers in patient care, more positive attitudes towards issues of patient confidentiality, and less computer anxiety.

PE also predicted computer involvement, (B= .851, t[292] = 9.72, p <0.001). Increased PE was associated with greater computer involvement. On the other hand, perceived negative experience (NE) also predicted computer anxiety (B= .272, t[292] = 7.50, p <0.001. This finding indicated that high levels of negative experience predict high levels of computer anxiety.

In examining the relationship between attitudes, computer involvement and intention to use, we found that attitudes towards patient care (B= .404, t[288] = 4.79, p <0.001), computer anxiety (B= -.194, t[288] = -3.57, p <0.001) and computer involvement (B= .322, t[288] = 7.91, p <0.001 predicted intention to use. Those with positive attitudes about using computers for patient care, less computer anxiety and a greater sense of computer involvement show greater intention to use computers. PE also predicted intention to use (B= .777, t[296] = 12.29, p <0.001). Interestingly, NE did not predict intention to use.

When PE , attitude toward patient care, computer anxiety and computer involvement were used to predict intention to use, it was found that PE was still a significant predictor of intention (B= .394,

t[288] = 4.72, p <0.001). This result suggests that attitude may not completely mediate the relationship between PE and intention, but there is some evidence of partial mediation.

Discussion

An aim of this study was to investigate the role of psychological factors in predicting the intention to use computers by health professionals in their work environment. The research findings indicate that computer attitudes, anxiety and computer involvement predicted whether or not a health professional intends to use a work-based computer system. These findings provide continued support for social psychological models of computer adoption, such as the Technological Acceptance Model (Davis, 1989). Moreover it provides some support for the utility of such models in understanding computer adoption and acceptance among health professions.

The current research findings also provide evidence of the importance of computer experience in predicting intention to use computer systems. Computer experience was related to intention to use computer. However, positive rather than negative experiences were related to intention to use. This finding has important practical ramifications for how the implementation of computer systems in health care settings is managed. It is not necessarily the bad experiences users have with computers that influence their intention to use a system. Focus should then be given to ensuring that users have sufficient positive experiences with existing systems. Our findings also show that perceived positive experiences predicted greater computer involvement – a construct which encapsulates notions of the relevance and importance of the technology in the workplace.

In addition, attempting to change the attitudes of users will not affect in a significant way the relationship between experience and intention to use as attitudinal factors only partially mediate the experience-intention to use relationship. Given the important role of perceived computer experience, future research should focus on obtaining a better understating of this construct. Furthermore, the interaction of computer involvement and experience needs to be investigated, in particular whether experience mediates the relationship between involvement and intention to use.

Conclusions

The findings of the study confirm the importance of individual psychological characteristics in predicting the intention to use computer systems in health care settings. It also confirms that computer experience, computer attitude and user involvement are distinct constructs, that have effects on the intention to use computers. Pragmatically, in order to reach a high level of system usage, health organisations should provide their staff an opportunity to obtain positive computer experience. It seems, past negative experiences do not affect attitudes , they only increase computer anxiety. However, as this was a cross sectional study it cannot disentangle the effects of past experience and past use in predicting future use. Future research should address this issue using longitudinal studies.

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