December 2006

Exploring the Differences in Information Technology Acceptance between Healthcare Professionals

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ABSTRACT

Although the acceptance of information technology (IT) has been a leading issue in the field of information system research for decades, what factors affect healthcare professionals' technology acceptance process is relatively unknown. Based on the technology acceptance model, this study compares IT acceptance among different professionals. The analyses were conducted using data samples comprising nurses, physicians and office workers. The results show that the IT acceptance process differs between these professional groups. The IT support provided was not as important for the office workers as for the nurses and physicians. Perceived ease-of-use explained less of perceived usefulness among nurses than in other groups. In addition, perceived usefulness did not have a significant influence on the amount of use in the group of physicians, as it did in the other groups. These results are discussed further and implications for practice are considered.

Keywords

Technology acceptance, TAM, Training, Support, Nurses, Physicians, Office workers, Healthcare

INTRODUCTION

Users' acceptance of information technology (IT) is one of the critical success factors in achieving the benefits expected from IT investments. Although this field has been heavily researched, what affects an individual professional's decision to adopt technology is still relatively unknown (Yi, Jackson, Park and Probst, 2006), especially among healthcare professionals (Menon, Lee and Eldenburg, 2000). The healthcare sector can be characterized as knowledge intensive and skill based, where the division of work and the hierarchical structures are different from other sectors. Complex co-operation with several professionals, all with strong professional identities and cultures, is also characteristic of the sector. In previous studies, the acceptance of IT in the healthcare sector has appeared to be problematic, especially since it includes not only technological changes but also cultural and social level changes (Bashshur, Reardon and Shannon, 2001). Ultimately, the success of new IT has mainly been found to depend on human and organisational factors (Aas, 2001).

The effective implementation and utilisation of IT in the healthcare setting requires multi-professional co-operation and involvement. All professional groups should accept the IT and motivate themselves to use it. The adoption of telehealth has been found to induce a redefinition of traditional professional roles (Aas, 2001). Other studies, too, have suggested that professional level factors are important in influencing IT adoption in the healthcare setting (Gagnon, Lamothe, Fortin, Cloutier, Godin, Gagné and Reinharz, 2005). A better understanding of the acceptance of IT in the healthcare sector would, therefore, require further knowledge about how different professional groups accept IT and how these acceptance processes differ between different professionals.

Of the various models used to explain the IT acceptance process, the technology acceptance model (TAM) has been the most widely employed. Introduced by Davis (1989), TAM is widely tested and verified (Chau, 1996; Gefen and Straub, 1997; Gefen and Keil, 1998; Pavlou, 2003; Venkatesh and Morris, 2000), and is one of the most broadly used models for describing IT usage behaviours (Igbaria, Guimaraes and Davis, 1995). TAM explains IT use by examining the meditating role of perceived ease-of-use (PEOU) and perceived usefulness (PU) in relation to external variables. TAM studies among physicians (Chau and Hu, 2001; Chau and Hu, 2002; Yi et al., 2006) and medical students (Liu and Ma, 2005) have delivered evidence that TAM provides a solid theoretical base to describe IT acceptance behaviour, also in the healthcare setting.

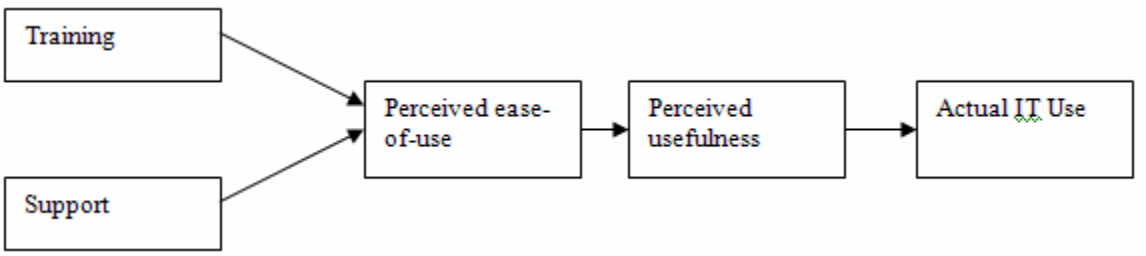
This paper aims to explore whether the technology acceptance process differs between healthcare professionals. Using TAM constructs and the external variables IT training and support, the acceptance process relations are tested and compared between nurses, physicians and office workers. First, this paper defines the scope of the study and based on previous

literature draws the hypotheses to be tested. The paper then describes the methods used to gather the data and presents the analysis and results. The theoretical and practical implications of the results are then discussed. The results of this study can be applied when planning the implementation of new IT or aiming to increase the use of IT in the healthcare sector. Understanding factors that have an influence on IT acceptance in different professional groups makes it possible to customize training and IT services in the healthcare sector. Furthermore, this study aims to add information to the theoretical discussion about the differences in technology acceptance between different groups of professionals.

CONCEPTUAL MODEL AND RESEARCH SCOPE

TAM studies conducted in the healthcare sector have found PU to be the strongest component in explaining the use (or intention to use) of IT, whereas PEOU has not been found to influence strongly the use directly but through PU (Chau and Hu, 2002; Yi et al., 2006). We therefore posit in our conceptual model (Figure 1) that PEOU has an effect on PU, but not directly on actual IT use. Although the intention to use has been evaluated in some studies as a more suitable construct to measure via a survey-based research design (Agarwal and Prasad, 1999), this paper employs actual, self-reported, IT use. Since the respondents in this study are likely to use IT in their work already, the intention to use could be a misleading construct. Furthermore, a recent study testing end user acceptance via a survey found PU to have a strong influence also on the actual IT use (Wu et al., 2006). In order to add an organizational perspective to the conceptual model, we use the external variables support and training. Empirical research has found training to be a key factor influencing the effective use of IT (Thompson, Higgins and Howell, 1991.) Although Venkatesh (1999) found training to lead to a change of only 10% in the behaviour of trainees in their jobs, the impact of training on PEOU has been found to be strong (Venkatesh and Davis, 1996; Wu, Chen and Lin, 2006). IT support has in several studies also been found to be a factor influencing users' IT satisfaction (Bowman, Grupe and Moore, 1993; Mirani and King, 1999; Rainer and Carr, 1999; Schaw, Niederman and DeLone, 2002), also in the healthcare setting (Cox and Dawe, 2002; Liu and Ma, 2005).

Figure 1 Conceptual model of the study



The conceptual model (Figure 1) states that training and support affect PEOU, PEOU affects PU, and PU in turn affects actual IT use. The relations of this model are tested in three samples consisting of three different professional groups: nurses, doctors and office workers, all working in the Finnish healthcare sector. The explanation rates of each of these relations in each sample are then compared with each other to find the significance of the differences in the findings. The scope is neither a particular information system nor a new innovation. IT is defined in this study as all the information systems and applications that the respondents use in their work. Communication technologies such as mobile telephones were excluded. It is likely that a majority of the respondents uses more than one application during their everyday work. These combinations could be, for instance, a patient record and an e-mail system. Thus, the purpose of this study is not to evaluate one particular system or even one stream of systems (like e-mail, text editor), but to explore the acceptance process from an attitudinal perspective. Since this study was conducted using a self-reported questionnaire and there was no pre-evaluation about the stage of the IT use, some of the respondents might have been using the technology for a long time, whereas some had a new system in use.

HYPOTHESES

The participation in and motivation towards training has been found to be positively related to education level (Renaud, Lakhdarin and Morin, 2004). The theoretical explanation offered is that better educated employees have a greater aptitude and willingness to be trained than less educated employees (see Spence, 1974). Male employees were found to participate more in training (Renaud et al., 2004). Since the professional group of physicians comprises more men than does that of nurses or office workers, and their education level is higher, we use the demographic differences to predict the differences in the professional groups and argue that:

H1 The impact of training on PEOU is stronger among physicians than among nurses.

H2 The impact of training on PEOU is stronger among nurses than among office workers.

Since it can be expected that the importance of support would decrease as the skills to use IT increase, the hypotheses are drawn in the opposite order to those concerning training. Therefore we posit:

H3 The impact of support on PEOU is stronger among office workers than among nurses.

H4 The impact of support on PEOU is stronger among nurses than among physicians.

Chau & Hu (2002) have suggested that the impact of PU is stronger in professional groups that are more "practical". If the benefits attained with IT are more practical in nature than strategic, PEOU is assumed to have a stronger influence on PU. Therefore, our next hypotheses are:

H5 The impact of PEOU on PU is stronger among office workers than among nurses.

H6 The impact of PEOU on PU is stronger among nurses than among physicians.

Testing TAM among physicians (Hu, Chau, Liu Sheng and Kar Yan Tam, 1999; Chau and Hu, 2001) has provided results that TAM explains around 40% of physicians' intention to use. A study using TAM constructs found in a regression analysis that PU explained 53% of nurses' and hospital administrators' use of database system (Jayasuriya, 1998). These results, although not totally comparable, provide evidence that the impact of PU on the amount of use could be stronger among nurses and office workers; therefore we present our last hypotheses as:

H7 The impact of PU on IT use is stronger among office workers than among nurses.

H8 The impact of PU on IT use is stronger among nurses than among physicians.

METHODOLOGY

Study context and sample

The data used to test our hypotheses were collected in 2005 from a nationwide job satisfaction survey that is conducted every fifth year by the Finnish Institute of Occupational Health. The sample was taken using the Finnish Statistic's records of social and healthcare workers. Samples were based on the fields of activities the respondents were working in at that moment and included all the professional groups in the Finnish social and healthcare sector. For this study, we collected all the responses that had indicated their professional group to be nurses, office workers or physicians. There were 320 nurses, 147 physicians and 89 office workers who had responded to the questionnaire. The demographics of the samples are presented in Table 1. Age was queried in years; the highest level of education achieved was queried using the Finnish education system classification, where the level of education and the time spent studying grow in tandem; work experience is shown in years.

		Nurses (n=320)	Physicians (n=147)	Office workers (n=89)
Age	average:	41 years	46 years	48 years
	range:	21–63 years	25–66 years	24–64 years
Gender	female:	94 %	55%	95%
	male:	6%	45%	5%
Highest education achieved	none:	-	-	13%
	vocational training:	-	-	11%
	vocational school:	4%	-	25%
	college level:	69%	-	43%
	vocational high school:	26%	1%	7%
	university:	1%	99%	1%
Work experience	average:	16 years	20 years	16 years
	range:	1–43 years	1–44 years	1–38 years

Table 1 Demographics of the samples

The office workers have the highest average age of the three groups. However, the differences in age ranges or averages are not remarkable. Nursing and office work are highly gender oriented (female) professions as is noticeable. Physicians consist almost equally of male and female respondents. In order to work as a physician in Finland, a university level education is required, and thus physicians have the highest education level achieved of the samples. Nurses have mostly a college level education, whereas office workers consist to some extent of respondents with no education beyond high school. Physicians have on average four years more work experience than nurses or office workers.

Procedures

A pilot study of the survey instrument was conducted prior to the initial data collection phase and showed no problems in the measures. Following the pilot study phase, a mail survey was used to gather the data for this study. Questionnaires were mailed to the sample and two reminders were sent to increase the response rate. Of the 5,000 questionnaires distributed, 2,870 were completed, returned and accepted, representing a response rate of 67%. Measures used in this study were included in a job satisfaction survey conducted every fifth year by the Finnish Institute of Occupational Health.

Measures

The survey consisted of statements each of which the respondents rated on a five-point Likert scale anchored at Strongly Agree and Strongly Disagree. Items used to operationalise PU and PEOU were adopted from Davis (1989). PEOU describes to what extent the respondents regard the employment of IT to be useful in their work. Perceived ease-of-use refers to the level the respondents feel IT to be easy and effortless to use in their work. PU and PEOU were each measured by three items. PU was measured by asking if the respondents considered that the use of IT speeds up the completion of their work tasks, improves the quality of those tasks and eases the work itself. PEOU was measured by asking if the respondents considered that it is easy to get the IT to function as they wish, and that it is flexible and easy to use. The respondents were also asked if they think they have had enough training for their IT use and whether they easily get support when they need it. Furthermore, they were asked how much on average they use IT in their work. This response was announced in hours per week.

RESULTS

Construct reliability and validity

The data analyses were conducted using SPSS version 12.0. Cronbach alpha values were calculated to test the construct reliability for PU and PEOU. Table 2 presents the Cronbach alpha values tested in each professional sample, all of which exceeded the criteria recommendation of 0.70 for applied studies. (Nunnally 1978)

Name of the construct	Cronbach Alpha In nurses sample	Cronbach Alpha In physicians sample	Cronbach Alpha In office workers sample	Number of items
PU	0.878	0.904	0.888	3
PEOU	0.750	0.872	0.908	3

Table 2 Test of reliability

Convergent validity for the measures was assessed using principal components factor analysis. Two factors were extracted from the data, containing the items of one construct. The constructs measured by one question did not fit the factors or have over 0.6 correlations with each other**.** The loading values using Varimax rotation with Kaiser normalisation ranged for perceived usefulness from 0.865 to 0.869 and for perceived ease-of-use from 0.724 to 0.858. Discriminate validity was assessed with a correlation matrix (Table 3).

	Use	PU	PEOU	Training
PU	Nur: 0.192** Phy: not sig. Off: 0.383***			
PEOU	Nur: 0.163*** Phy: not sig. Off: 0.335**	Nur: 0.503*** Phy: 0.640*** Off: 0.638***		
Training	Nur: not sig. Phy: not sig. Off: not sig.	Nur: 0.244*** Phy: 0.418*** Off: 0.420***	Nur: 0.589*** Phy: 0.549*** Off: 0.641***	
Support	Nur: 0.136** Phy: not sig. Off: not sig.	Nur: 0.190** Phy: 0.298*** Off: 0.337**	Nur: 0.460*** Phy: 0.340*** Off: 0.289**	Nur: 0.481*** Phy: 0.482*** Off: 0.310**

*** = sig. <0.001

** = sig. <0.01

not sig. > 0.05

Table 3 Correlation matrix

The correlation matrix revealed correlations between most of the constructs. The correlations are strongest among relations that are described also in the conceptual model.

Regression analysis results

In order to test the hypotheses, we first employed a regression analysis. Using the conceptual model, we counted regression correlations for each relation in the conceptual model for each of the professional groups. The results of the regression analysis are shown in Figure 2.

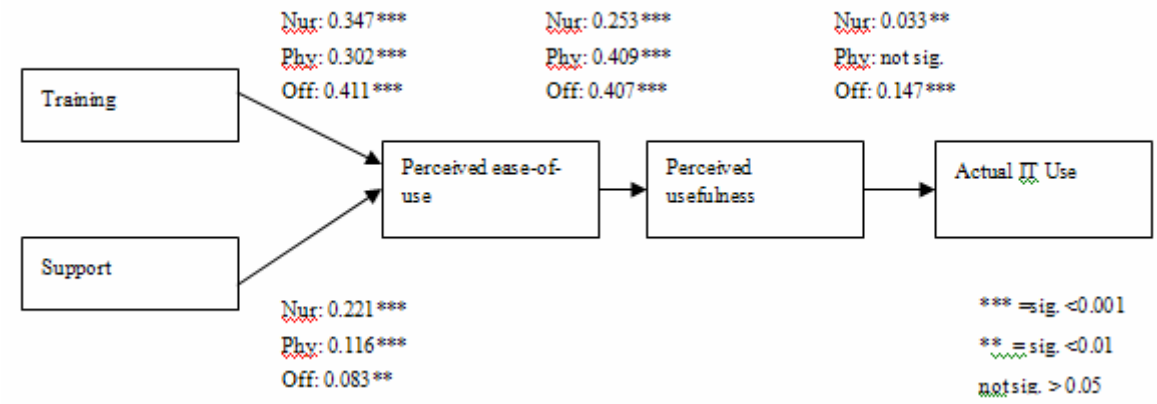


Figure 2 Regression correlations of the relations

The regression analysis reveals that training was a moderately strong explicator of PEOU among all the professional groups. Support was not as strong a factor in explaining PEOU. PEOU was a moderately strong explicator of PU, especially among physicians and office workers. Among the nurses, the regression correlation was not as strong. The explanation power of PU on use was weak among nurses and office workers and not statistically significant among physicians.

In order to explore whether the results of regression analysis differ statistically between the different professional samples, we compared the regression coefficients. To test the null hypothesis Ho:B1=B2, where B1 is the regression coefficient for one professional group, and B2 for another, a dummy variable was created for each professional group, as well as a variable

that was the product of profession and the independent variable in question. Then the dummy variable, independent variable and the produced variable combining these were used in the regression equation. This procedure was employed to analyse the regression coefficients between each variable and each professional group. The significances of the differences are presented in Table 4.

	Nur–Phy	Nur–Off	Off–Phy
Training–PEOU	0.014	0.100	0.017
Support–PEOU	0.835	0.019	0.048
PEOU–PU	0.000	0.048	0.684
PU–Use	0.000	0.137	0.000

Table 4 Significance rates of the regression coefficients differences

Training explained more of the office workers' and nurses' PEOU than the physicians' PEOU. However, support was a less significant factor explaining PEOU for office workers than for other groups. In general, support was not as important a factor explaining PEOU as training, for all of the groups. PEOU explained over 40% of PU in the groups of physicians and office workers. Among nurses, the explanation rate was statistically lower. PU explained quite little of actual IT use. Among nurses it explained around 3% of actual use, and among office workers 15%. Among the physicians, the effect of PU on use was not statistically significant. The acceptance of the hypotheses is presented in Table 5.

Hypothesis	Accepted/ Not accepted	Findings concerning the hypotheses
H1 The impact of training on PEOU is stronger among physicians than among nurses.	Not accepted	Training had a stronger influence on PEOU among nurses and office workers than among physicians.
H2 The impact of training on PEOU is stronger among nurses than office workers.	Not accepted	There was not a statistically significant difference in relations between training and PEOU among nurses and office workers.
H3 The impact of support on PEOU is stronger among office workers than among nurses.	Not accepted	Support had a stronger influence on PEOU among nurses and physicians than among office workers.
H4 The impact of support on PEOU is stronger among nurses than physicians.	Not accepted	There was not a statistically significant difference in relations between support and PEOU among nurses and physicians.
H5 The impact of PEOU on PU is stronger among office workers than among nurses.	Accepted	
H6 The impact of PEOU on PU is stronger among nurses than among physicians.	Not accepted	PEOU had a stronger influence on PU among physicians than among nurses.
H7 The impact of PU on IT use is stronger among office workers than among nurses.	Not accepted	There was not a statistically significant difference in relations between PU and use among office workers and nurses.
H8 The impact of PU on IT use is stronger among nurses than among physicians.	Accepted	

Table 5 Table of hypotheses accepted

CONCLUSION

This study has allowed us to compare the IT acceptance process among healthcare professionals. Drawing on TAM, we empirically examined how technology acceptance differs in professional groups. First, although training was found to be a more important factor influencing PEOU than support in each of the professional groups, among physicians PEOU did not profit from training as much as in other groups. Physicians might have had more training in IT use in their education, or, as they are highly educated, have had more experience with IT for longer. Another explanation could be that the physicians have used IT longer in their work than the other professional groups, so that training is not as essential in order to feel that IT is

easy to use. Secondly, support was not a very significant explicator of PEOU in any of the professional groups. IT support as provided had less impact on PEOU among office workers. One of the reasons for that could be the different IT applications the professional groups are using. When using predominantly the same system in one's work, a system that is not especially complex (e.g. word processors, spreadsheets), support might not be as essential in order to feel that the IT use is easy. Thirdly, PEOU was a moderately strong indicator of PU in every professional group. However, its importance was lower among nurses than among physicians and office workers. Nurses may judge PU differently by focusing more on the "caring" aspect of the technology. For instance, nurses may consider IT useful if it also has effects on patient care or gives them more time to spend with patients. Finally, and surprisingly, the PU found to be the most important factor explaining the physicians' IT usage in several studies (Chau, 1996; Chau and Hu, 2002) did not explain actual use to a broad extent. In particular, the result indicating that among the physicians PU does not explain actual use at all was unexpected and noteworthy.

Practical implications

From these results, it appears that organisational actions such as providing training and support could be customised differently among different professionals. It seems that physicians might not need as much training in order to perceive the IT they are using as both easy-to-use and useful. However, among physicians, the amount of use seems not be affected by PU and PEOU. If the target is to get physicians to use more IT, actions other than increasing PU and PEOU should be considered. In fact, it seems that even providing more training and support for physicians does not necessarily result in increased usage. Among nurses, both training and support have a strong impact on PEOU. Nurses should, therefore, be provided with a sufficient level of training and support in order to increase their level of PEOU. As PEOU does not have such an effect on PU as it does for other groups, alternative ways through which to increase PU could be useful. For instance, other benefits accruing from IT usage, such as creating more time for patient contact, could be facts to highlight when introducing new IT to nurses. For office workers, providing support does not increase PEOU as much as in other groups. Office workers could, therefore, profit more from sufficient IT training than from the provision of support services. Among office workers, the impact of PU on actual IT use was the highest compared to the other groups, and so the increasing usefulness of the IT applications should to some extent have a direct effect on the amount of use.

Limitations

This study was conducted in the Finnish healthcare environment and so the results and conclusions may not be repricable in other healthcare environments. However, while the differences in national and global healthcare systems are undeniable, the tasks conducted by each of the professional groups with reference to this study are basically of the same level. When considering whether the results would be repricable in a different setting, the demographics of the sample can serve as a useful tool. It is likely that to some extent the results are due to demographics as well as to professional differences. It is also expected that the respondent might use several applications and that those applications differ. It is, therefore, worth noting that these differences might also have influenced the results. In further studies, the role of demographics on the results as well as the impact of different IT applications should be more carefully examined.

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