Against All Odds - A Story of a Successful Mobile System Acceptance among a Tough Crowd

Jonna Järveläinen, Annukka Vahtera

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Jonna Järveläinen[1] and Annukka Vahtera[2]

[1] Turku School of Economics, University of Turku, Information Systems Science,
Rehtorinpellonkatu 3, 20520 Turku, FINLAND
[2] Turku Centre for Computer Science (TUCS) and
Turku School of Economics , University of Turku, Information Systems Science,
Joukahaisenkatu 3-5, FI-20520 Turku, Finland.
{Jonna.Jarvelainen,Annukka.Vahtera}@utu.fi

Abstract. Two public organizations in early childhood education adopted a simple mobile system with female employees in their 50's to replace an internal paper based data collection system in order to improve information quality and accelerate the billing and payroll process. The workers of this sector emphasize the human-to-human interaction with children and parents, and perceive ICT as time consuming nuisance leaving less time for actual child caring. The objective of this paper is to explore why the mobile system was accepted, although the odds were against it. The system acceptance and incentives seem to have a connection to information timeliness and quality in this context.

Keywords: mobile system, attitude toward technology, technology acceptance

1 Introduction

Governments and municipalities are continuously creating new ways to utilize ICT in their activities. In the recent years, e-government has become everyday reality to many citizens. E-government refers to the use of information and communication technology in the public decision making and in the delivery of public services [1]. The aim of e-government is to improve productivity, effectiveness and citizens' well-being, by rethinking missions, re-engineering processes and implementing information technology solutions [2].

Finland is often been ranked as one of the leading countries in e-government ratings (see e.g. [3], [4]), but it has lost its peak position in the most recent studies (see e.g. [5]). Therefore the Finnish government has launched a new e-government program to regain country's leading position. The Finnish e-government is now being lead by the 'National Knowledge Society Strategy 2007-2015', which emphasizes the use of technology to improve the quality of life. Particular importance in the strategy is given to measures aimed at promoting the reform of the service sector, citizens' well-being and the nation's and companies' competitiveness. The aim of the Finnish e-government is for public administration to provide secure and user-friendly online

services, such as saving trouble and expense for its customers and empowering the citizen [6]. One of the many actors in Finnish public sector is early childhood education (ECE), which has recently also begun to streamline its processes with the use of ICT. Traditionally ECE has not adopted many technologies or information systems for other functions than administration. The workers of this sector emphasize the human-to-human interaction with children and parents, and perceive ICT as time consuming nuisance leaving less time for actual child caring.

In this paper we study the acceptance of a mobile system in early childhood education settings in Finland. Two public organizations adopted a simple mobile system with female employees in their 50's to replace a paper based data collection system in order to improve information quality and accelerate the process. Although the directors of early childhood education were eager to re-engineer the process, the actual users as well as some of their supervisors had their doubts whether the system would actually consume more of their time. With this kind of setting the odds were that the system would not be accepted although the system use was not voluntary. In fact, if a user did not want to use the system, she would have to quit her job (one or two actually did). After a few months of system use, a Unified Theory of Acceptance and Use of Technology and Technology Acceptance Model 3 based questionnaire was sent out to test whether the mobile system was accepted or not. It was discovered that the users used the system and managers of these users indicated that the system was well accepted.

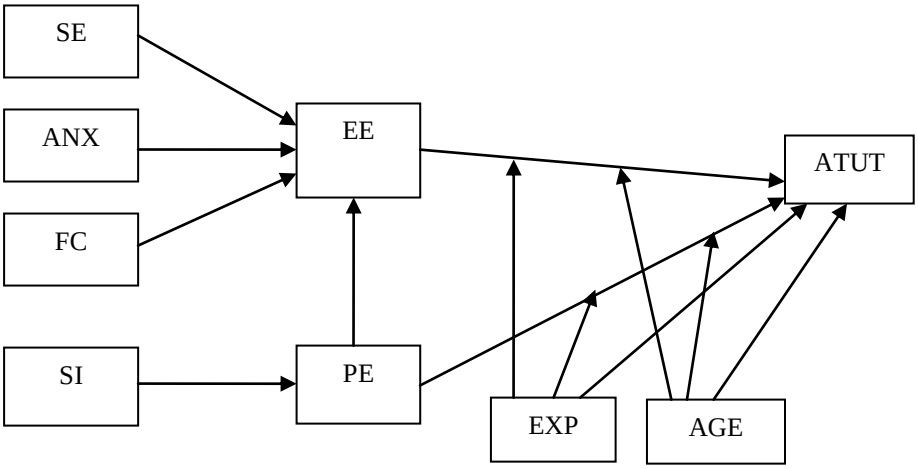
The objective of this paper explore why the mobile system was accepted, although the odds were against it. The system acceptance and incentives seem to have a connection to information timeliness and quality in this context. Furthermore we test whether attitude toward technology use can be used as a dependent variable explaining system acceptance when behavioral intention or actual usage do not have to be explained.

2 Unified Theory of Acceptance and Use of Technology and TAM3

The evaluation of system acceptance is based on Unified Theory of Acceptance and Use of Technology (UTAUT), which was developed by integrating eight theoretical models related to user acceptance [7]. UTAUT argues that user's perception of performance expectancy, effort expectancy, social influence and facilitating conditions affect whether she accepts the technology and uses it. Performance expectancy means that if a user perceives that the technology increases her performance in her work somehow (e.g. is useful, allows her to work faster etc.) then she would use the technology [7]. Effort expectancy means the effortlessness of the technology, which is perception of ease-of-use, ability to use the technology, not fearing the technology [7]. Social influence has also an effect on acceptance, if a user feels that her supervisor and colleagues think that the technology should be used, then user is more likely to use it [7]. The existence of facilitating conditions such as a user manual or a helping colleague also affects system use [7].

Computer self-efficacy, computer anxiety and attitude towards technology use were found to not to have effect on behavioral intention [7]. Computer self-efficacy is defined as "judgment of one's ability to use a technology to accomplish a specific task"[8], where as computer anxiety means that a person is anxious or considers computers intimidating. Attitude (towards technology use) has been used as an independent variable in many studies, especially after Ajzen and Fishbein presented the theory of reasoned action in 1975 [9]. Several studies have found that attitude has a significant effect on behavioral intention (e.g. [10]). UTAUT has also been used in hundreds of academic articles, many of them concentrating on acceptance of mobile services [11], [12] and even of information kiosks [13].

However, a Technology acceptance model 3 was presented in 2009 [14]. It continued reorganizing of independent variables, namely subjective norm (social influence in UTAUT) was a determinant of perceived usefulness (performance expectancy in UTAUT) as well as emphasizing two variables excluded from UTAUT, namely computer self-efficacy and computer anxiety, as determinants of perceived ease-of-use (effort expectancy in UTAUT). TAM3 included also several other variables, which have been studied in connection to technology acceptance. However, there was no place for attitude towards technology use in the theory. Since TAM3 is



such a novel development in the field of user acceptance, it has not been used in published papers.

Fig. 1. The proposed model. PE= Performance expectancy, EE= Effort expectancy, ATUT= Attitude toward using technology, SI= Social Influence; FC=Facilitating conditions, SE= Computer self-Efficacy, ANX=Computer anxiety.

For the purposes of this paper it was decided to combine these two models. The simple UTAUT was the basis of the model, but social influence was expected to affect performance expectancy, as in TAM3, since it was known that representatives of the organization and supervisors of the users had participated in training sessions or even trained part of the users themselves. Furthermore, since the crowd of users was quite tough – females in their 50's, some of them very inexperienced with technology

– it was proposed that computer self-efficacy and computer anxiety affected effort expectancy as in TAM3. Facilitating conditions variable was not included in TAM3, but it was used in UTAUT. Since users used peer support as well as short manuals to gain control over system, it was proposed that facilitating conditions could affect also effort expectancy.

The major modification was to include attitude toward using technology as an independent variable, since it was known that the users used the mobile system, and intended to do so also in the future. Moderators in the model are experience (referring to system usage experience) and age of the user. However, we could not test for the moderating effect of gender or voluntariness, since all users were female and the system use was obligatory. The proposed model is shown in Figure 1.

3 Research context

E-government may be understood broadly as the use of information and communication technologies in governmental processes and services, and there are many different actors in governmental level, such as national, state or local [1]; the last one being the context of this paper. If Layne & Lee [15] stage model is considered, the mobile system studied here can be positioned into transactional stage; the system is designed to ease the internal transactions that are required by payroll and billing systems. The system automates the former paper based data gathering system and redesigns the process by excluding a few phases. The current study may also be positioned in eGovRTD2020 framework [16] as an information quality study, focusing on generating incentives to create higher information quality in a timely manner.

The mobile system was adopted in the context of early childhood education (ECE), which refers to the care of children under compulsory school age (ages 0–6). In Finland, every child has a statutory subjective right to receive public day care and municipalities have the obligation to organize day care according to the demand. Public day care is mostly organized in day care centers (approx. 70 % of the children) and family childcare, which offer full day, full year service for children whose parents are either working or studying. The main goal in day care is to promote children's healthy growth, development and learning skills. Day care should also support parents raising their children [17], [18]. Early childhood education in Finland is a well-developed system and much appreciated by parents. Early childhood education is assured by public investments, and quality regulations are clear and strictly enforced. Charges for municipal day care are based on family size and income level. [19] The charge for a municipal day care place cannot exceed 233 € a month (in 2010).

In the focus of this study are the family day care workers. In 2008, there were approximately 160 000 children in day care and 46 000 of them attended family day care [20]. In 2007, family day care employed 16 000 family day care workers [21]. According to the same statistic, in 2007 the Finnish social care employed 177 600 employees of which 34% employed in early childhood education. The average age of family day care workers is relatively high: 47,1 years and it is calculated that 36% of

them will retire during the next ten years; therefore the family day care workers are the oldest occupational group in the Finnish social and health sector [21].

In recent years ICT has found its way also to early childhood education. ICT enables for example new working practices in day care, more effective communication between different early childhood education actors and better quality education. The pressure also comes from parents' side: the use of Internet and different e-services has also increased the demand for ICT solutions and e-services in day care. [22]

In this case a paper-based data collection system for calculating salaries for family day care workers and bills for children was considered to be too laborious, slow and including many possibilities for entry errors which would weaken the information quality. The paper based system was substituted with a mobile system in two small towns in South-West Finland. Earlier every family day care worker filled manually a form with arrival and departure times of each child (usually four children per a worker) she took care of during the day. These forms were signed by parents monthly and sent to administrative clerk who manually transferred the times to the payroll and billing system. The data entry phase took one to two weeks for one clerk's working time each month.

This time-consuming process was identified by directors of early childhood education to be a bottleneck process. Municipality's IT directors decided that the process could be redesigned, although emphasizing that the independent users, most of them having a doubtful or even negative attitude towards any information technology, might not welcome the system. Another obstacle was that not all of the users had a mobile phone, and those who had one, did not have a "smart phone", which was a system requirement.

Purchasing "smart phones" for the users was realized to be an incentive which potentially could have a crucial role in system acceptance. A work mobile phone was perceived as a status symbol, since normally only white collar workers with a managerial position had one, and family day care workers did not identify themselves as part of this group. Therefore in order to accelerate the data gathering and improve the service level and information quality it was decided that a "smart phone" would be purchased to each family day care worker and they would be trained to use the new interface.

The interface of the mobile system was not difficult to use, but it was different from basic SMS and call functionalities which the users were familiar with. First the name of the child had to be sought from the list downloaded to their work mobile phone, and either press "ok" to accept the present time as an arrival or departure time, or enter another time by themselves. The process was to be repeated with each child after their arrival and departure. There were some teething troubles during the first few months of system usage; for instance going into summer (daylight saving) time confused the system and users. The times were directly imported to the payroll and billing system, thus eliminating the data entry phase and allowing the administrative clerk to do other administrative tasks.

4 Data collection

After the mobile system had been implemented and been in use for 4-5 months, a questionnaire to test attitude towards using technology was sent to 74 family day-care workers (29 from Town A, 45 from Town B) - that is the whole population - and 44 were returned, response rate being therefore 59,5%.

The questionnaire used items from [7] with few modifications. Some questions were inappropriate for the context, so they were replaced with more suitable questions which were found or based on items used as root scales for UTAUT. 5-point Likert scale was used for all items.[1]

The descriptives of respondents are presented in table 1. To summarize, the users were mature women, with some or no experience in ICT. The age range of the respondents was from 34 to 64, but only three were under 45 years and 30 respondents were 50 or older. Their experience in family day-care was great, but ICT experience was more limited. At least 4 persons did not have any experience with mobile phones before this project and 14 respondents had no experience with computers or Internet. However, the majority of respondents had 6-10 years of experience with mobile phones, and many over 10 years which is quite normal in Finland.

Table 1. The descriptives of respondents.

	Town A	Town B
Respondents	19	25
Age (mean)	53,75	53,42
Female	100%	100%
Experience with mobile system (mean)	4,4 months	5 months
Experience as family day-care worker (mean)	More than 10 years	More than 10 years
Experience with mobile phone (mean)	6-10 years	6-10 years
Experience with SMS (mean)	3-5 years	3-5 years
Experience with computer (mean)	3-5 years	3-5 years
Experience with the Internet (mean)	1-2 years	3-5 years

5 Results

The analysis was done with partial least squares software, SmartPLS 2.0 [23]. The results indicate that the mobile system adopted was welcomed well. All relationships were discovered to be significant, except for the moderating effects of experience to effort expectancy as well as age to either effort expectancy or performance expectancy. The reason for the insignificancy might be that there were no great differences in respondents' ages and system experience.

[1] The questionnaire may be acquired via e-mail from the first author.

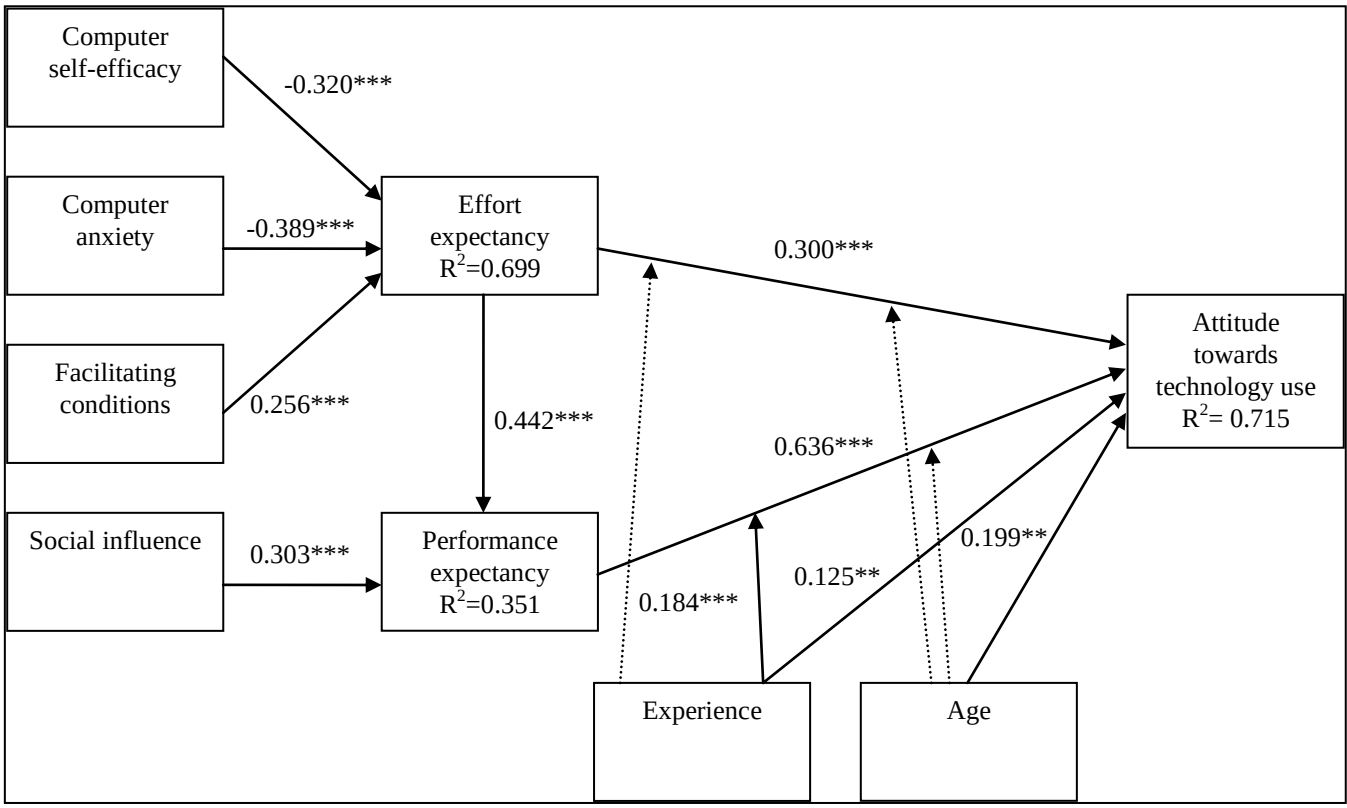


Fig. 2. Tested model. ** t > 1.960, *** t > 2.576

Computer self-efficacy and computer anxiety as well as facilitating conditions were able to explain almost 70% of the variance of effort expectancy, which indicates that user's fears towards the system and their need for assistance in using the system affect the perception of ease-of-use of the system, although these constructs were omitted from the UTAUT [7]. Effort expectancy and social influence had also significant relationships with performance expectancy and explained more than a third of the variance. These results are consistent with TAM3 results [14] confirming that perception of ease-of-use and supporting social environment affect the perception of usefulness. As expected, performance expectancy, effort expectancy, system experience and age had a significant relationship with attitude toward using technology, and explained over 70% of the variables variance. The perception of usefulness had a greater effect on attitude than perception of ease-of-use, which is similar than other acceptance studies, where perceived usefulness has had a bigger effect on behavioral intention than perceived ease-of-use, indicating that the usefulness is more important than the ease-of-use when accepting a technology. Furthermore system experience had a moderating effect to performance expectancy.

Table 2. Composite reliablities (C.R.) average variance extracted (AVE) values, communalities and redundancies for constructs (PE= Performance expectancy, EE= Effort expectancy, ATUT= Attitude toward using technology, SI= Social Influence; FC=Facilitating conditions, SE= Computer self-efficacy, ANX=Computer anxiety).

Variable	C.R.	AVE	Communality	Redundancy
AGE	1.0000	1.0000	1.0000	
ANX	0.9688	0.8860	0.9571	
ATUT	0.9510	0.8292	0.9310	-0.0097
EE	0.9355	0.7841	0.9081	0.3482
EXP	1.0000	1.0000	1.0000	
FC	0.9617	0.9263	0.9225	
PE	0.9324	0.7754	0.9041	0.1944
PE*EXP	0.9444	0.8109	0.9225	
SE	0.8491	0.5850	0.7807	
SI	0.8427	0.5742	0.7564	

Convergent validity of the model is appropriate since all t-values of the significant relationships are over 1.96, most of them actually are over 2.576, as can be seen from Figure 2. In table 2, composite reliabilities are all over 0.8 and AVE of each construct is above 0.5. In table 3, the square root of AVE is greater than any correlation with the construct. In addition the cross loadings were small between items. Therefore the discriminant validity is also good.

Table 3. Latent variable correlations between constructs. Diagonal elements are the square root of AVE of each construct (PE= Performance expectancy, EE= Effort expectancy, ATUT= Attitude toward using technology, SI= Social Influence; FC=Facilitating conditions, SE= Computer self-efficacy, ANX=Computer anxiety).

	AGE	ANX	ATUT	EE	EXP	FC	PE	PE*EXP	SE	SI
ANX	-.239	.941								
ATUT	.071	-.522	.911							
EE	.132	-.767	.603	.885						
EXP	-.184	.438	-.062	-.338	1.000					
FC	.265	-.562	.427	.640	-.233	.962				
PE	-.140	-.351	.768	.516	-.139	.233	.880			
PE * EXP	-.302	.075	.216	-.048	-.212	-.070	.126	.900		
SE	-.142	.732	-.567	-.737	.372	-.516	-.472	.001	.765	
SI	-.251	-.101	.380	.290	-.025	.090	.428	-.011	-.049	.758

6 Discussion

The paper reports the results of a successful mobile system acceptance among a difficult user population in e-government context. The average user was appr. 53 year old female who preferred human-human interaction to ICT, and these facts proposed problems in system acceptance. However, many studies have discovered that this kind of user usually prefers an easy-to-use system rather than useful one (e.g. [24],[7]) and this study supports that finding.

Theoretically we argue that attitude toward using technology could be used as a relevant variable in technology acceptance studies. Some respondents may consider questions such as “I intend to use the system in the next <n> months.”, “I predict I would use the system in the next <n> months.” and “I plan to use the system in the next <n> months.” Humiliating and foolish, and refuse to answer these kinds of questions, especially when they do not have choice but to use the system, and this may affect the response rate. Many studies have found that attitude is in fact relevant variable when explaining intentions and intentions significantly affect actual behavior (e.g. [10]). Therefore, we should not drop out attitude from acceptance studies, but continue investigating its role.

As regards the contributions to practice, this paper provides some insights on the successful implementation of a mobile system to the developers in early childhood education and in social sector more widely. The paper also pursues to inspire directors and developers of social sector to consider implementing ICT into their working environment despite the fact that the field is traditionally seen as “laggard” in ICT usage. When implementing ICT into a crowd who is new to technology and do not consider it necessary in their working practices, much attention is to be paid to the training and usefulness of the applications: when users have incentives to use the system and they are trained well, even the most improbable adopters might accept new technology. In this case, the system acceptance improved the timeliness and

quality of the information, which then improved e-government service quality in billing the parents.

The study has some limitations. All the results cannot be explained by the model used in this study. We recognize several other variables to be significant in the positive outcome of the above described system implementation. For example, the family day care workers attended training sessions where they learned to use the system. Family day care workers also considered receiving a mobile phone from their employee as an indication of a trust and it boosted their work confidence. The municipality was also one of the first municipalities to implement the system, so the software company was easily reached in case of an occurred problem. The successful implementation can perhaps also be explained by some extent by the fact that the old manual system was utterly poor and time consuming, so any enhancement in the process would be accepted with pleasure.

Due to its limitations, this study leaves room for future research. Future research should examine other factors that affect implementation success. The study should contain the above mentioned factors, such as the impact of training, peer support and social environment. In fact, we have already started this sort of study, and the results will be published in the near future.

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