2007

Students` Acceptance of E-Learning Environments: A Comparative Study in Sweden and Lithuania

Christina Keller
Jönköping International Business School, and Uppsala University, Sweden, kelc@jibs.hj.se

S Hrastinski
hrst@jibs.hj.se

Sven Carlsson
Lund University, sven.carlsson@ics.lu.se

STUDENTS' ACCEPTANCE OF E-LEARNING ENVIRONMENTS: A COMPARATIVE STUDY IN SWEDEN AND LITHUANIA

Keller, Christina, Informatics, Jönköping International Business School, Box 1026, SE-551 11 Jönköping, Sweden, kelc@jibs.hj.se

Hrastinski, Stefan, Informatics, Jönköping International Business School, Box 1026, SE-551 11 Jönköping, Sweden, hrst@jibs.hj.se

Carlsson, Sven A., Informatics and Institute of Economic Research, School of Economics and Management, Lund University, Ole Römers väg 6, SE-223 63 Lund, Sweden, sven.carlsson@ics.lu.se

Abstract

This paper presents findings from an ongoing cross-cultural study exploring the implementation of e-learning environments in higher education in Sweden and Lithuania. The aim of the study was to explore factors affecting students' acceptance and use of e-learning. A questionnaire was developed based on the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Innovation Diffusion Theory (IDT). Data was collected from 67 master students in public health education in Sweden and Lithuania. Lithuanian students were found to experience a substantially higher degree of acceptance of e-learning environments than Nordic students at the Swedish university. Rate of use, time spent on use and confidence in computer use affected acceptance of the e-learning environment positively at the Swedish university. At the Lithuanian university, previous knowledge of computer use affected acceptance in a positive way. Lithuanian male students experienced a lower degree of perceived usefulness of the e-learning environment than Lithuanian female students. The findings of the study suggest that cultural and organisational factors are important to consider in explaining students' acceptance of e-learning environments as well as being important in implementation strategy and tactics.

Keywords: E-learning, E-education, Virtual Learning Environments, Technology acceptance

1 INTRODUCTION

The need for education has changed because of an increased demand for a highly educated workforce who will be expected to learn continuously (Alavi & Leidner 2001). E-learning has become an increasingly important part of higher education. In order to support e-learning, various e-learning environments have been developed, such as WebCT, BlackBoard and ClassFronter (Ngai & Poon & Chan 2007). Alavi and Leidner (2001) argue that there is "a paucity of theoretically grounded and rigorous research to guide the development of [e-learning] environments" (p. 2) but that the reference discipline of information systems is uniquely positioned to contribute to the development of these environments. E-learning environments are used both in distance education, and as a complement to teaching on campus. Yang and Liu (2005) concluded that users of e-learning environments in higher education have different ideas about the use of the technology. They found that teachers and students had disparate views of the environment. Teachers hoped to maintain control of the teaching and learning process just as they do in a traditional classroom, while students valued using tools such as chat-rooms, bulletin boards etc. to control their own learning process and pace.

This study is a part of an ongoing cross-cultural study on implementation of e-learning environments in higher education. The information systems literature suggests that acceptance is a prerequisite of intentions to use, and actual use of information systems (e.g. Davis 1989). In an educational context, acceptance of the e-learning environment is an important prerequisite of learning. The aim of the study was to explore factors affecting students' acceptance and use of e-learning environments. The following research questions guided the study:

- To what extent do students experience acceptance of e-learning environments?
- Is there a relationship between degree of acceptance and rate of use of the e-learning environment?
- To what extent do individual student background factors affect acceptance of e-learning environments?

The remainder of the paper is organized as follows: First, a review and an analysis of technology acceptance research on e-learning environments are presented. Second, the research approach of the study is described and the results of the study are presented. Finally, the results are analysed and discussed.

2 TECHNOLOGY ACCEPTANCE RESEARCH ON E-LEARNING ENVIRONMENTS

User acceptance of information systems and its determinants has been frequently studied in technology acceptance research. The Technology Acceptance Model (TAM) (Davis 1989) was originally developed from the Theory of Reasoned Action (Fishbein & Ajzen 1975). The core constructs of TAM are *perceived usefulness* and *perceived ease of use*. Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p 320). Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989). The model states perceived usefulness and perceived ease of use to be predictors of the behavioural intention to use an information system. The relationships between the model's core constructs are depicted in figure 1.

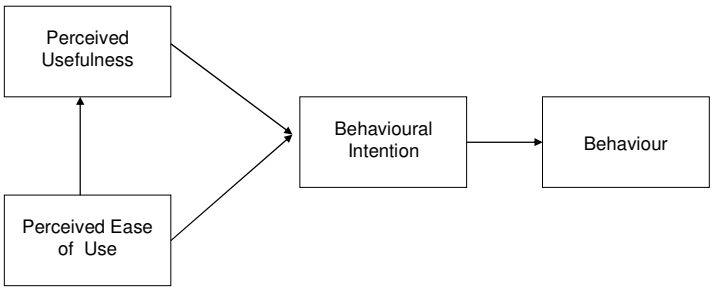

Figure 1. Technology Acceptance Model (TAM) (Davis, 1989).

In technology acceptance research on e-learning, common approaches are quantitative measurements of students' *acceptance*, *perceptions* or *attitude* to e-learning. These measures are frequently correlated to the core constructs of technology acceptance models or to individual background variables to investigate whether there are significant relationships explaining students' reactions (Keller 2005). In table 1, a comprehensive review is presented of twelve studies on e-learning from the perspective of technology acceptance. Six of the reviewed studies used TAM in its original or extended version (Selim 2003, Ong & Lai & Wang 2004, Drennan & Kennedy & Pisarki 2005, Saadé & Bahli, 2005, Ong & Lai 2006, Ngai et al. 2007), two studies built on focus group statements on added value and level of comfort in use of computers in education (Mitra & Lenzmeier & Steffensmeier & Avon & Qu & Hazen 2000, Shuell & Farber 2001), and two studies used models derived from literature on acceptance of computer conferencing (Bures & Amundsen & Abrahmi 2002) and use of hypermedia (Tolhurst & Debus 2002). Furthermore, two studies used the Loyd and Gressards' Computer Attitude Scale (CAS) regarding computer anxiety, computer confidence, computer liking and computer usefulness (Jennings & Onwuegbuzie 2001, Ames 2003).

A meta-analysis of the findings of the reviewed studies were made, describing the relationships between the core constructs of technology acceptance models, individual background factors and students' acceptance of e-learning. We are aware that the term meta-analysis commonly refers to the statistical aggregation of research findings. However, inspired by Pawson (2006), we use the term to describe structured literature reviewing focused on identifying variables that influence acceptance. The meta-analysis is summarised in figure 2.

The main conclusion from the review is that perceived usefulness and perceived ease of use have a substantial impact on students' acceptance of e-learning (Bures et al. 2002, Selim 2003, Ong et al. 2004, Drennan et al. 2005, Saade & Bahli 2005). Moreover, the degree of students' anxiety and confidence in computer use seems to influence the level of acceptance (Jennings & Onwuegbuzie 2001, Shuell & Farber 2001, Ames 2003). Two additional core constructs of technology acceptance are introduced in the reviewed studies: *perceived credibility* and *cognitive absorption*. Perceived credibility is defined as "the degree to which a person believed that using a particular system would be free of privacy and security threats" (Ong et al. 2004, p. 797) and was found to influence acceptance in a positive way. Cognitive absorption is defined as "a state of deep involvement" (Saadé & Bahli 2005, p. 320) in the task being accomplished. Cognitive absorption was found to influence perceived usefulness and perceived ease of use in a positive way, but had no direct relationship to acceptance of online learning. In a study, Ngai et al. (2007) propose that the perception of having access to technical support influences perceived ease of use and perceived usefulness in a positive way.

No	Authors	Research model of technology acceptance: factors/variables	Factor(s) having statistically significant impact on students' acceptance
1	Mitra et al. 2000	Focus group developed statements: Added value and level of comfort in use of computers in education.	Men were more positively predisposed toward computers and tended to use computers more than women.
2	Jennings & Onwuegbuzie 2001	Loyd and Gressard's Computer Attitude Scale (CAS): Computer anxiety, computer confidence, computer liking, and computer usefulness.	Younger students were not so anxious about using computers and more confident than older students.
3	Shuell & Farber 2001	Focus group developed statements: Added value and level of comfort in use of computers in education.	Women reported benefits of computer use to a lesser extent than men, and felt less comfortable in using computers.
4	Bures et al. 2002	Motivational model derived from literature on acceptance of computer conferencing: Computer attitudes and anxiety, trait-like motivational variables, and state-like motivational variables	A high level of personal relevance of the tasks, task attractiveness, and students' beliefs concerning the relationship of the technology to learning (outcome expectations) influenced acceptance in a positive way.
5	Tolhurst & Debus 2002	Model derived from literature regarding learners' acceptance of control opportunities using hypermedia software: Prior domain knowledge, learning activity structure, ability and attitude.	Epistemological beliefs of students, school culture and gender influenced students' acceptance more than factors of the technology acceptance model.
6	Ames 2003	CAS: Computer anxiety, computer confidence, computer liking, and computer usefulness. Gregorc's learning styles.	Specific learning styles are associated with liking of, confidence in or anxiety about the use of computers.
7	Selim 2003	Technology Acceptance Model (TAM): Perceived usefulness, perceived ease of use	Perceived usefulness and perceived ease of use influences acceptance in a positive way.
8	Ong et al. 2004	TAM: Perceived usefulness, perceived ease of use, computer self-efficiacy, and perceived credibility	Perceived usefulness and perceived credibility influences acceptance in a positive way. Perceived ease of use is an antecedent of perceived usefulness.
9	Drennan et al. 2005	TAM: Perceived usefulness of flexible learning, perceived ease of use of flexible learning, and ease of electronic recovery.	Positive perceptions toward technology (ease of access and use of learning materials), and autonomous learning mode influences acceptance in a positive way.
10	Saadé & Bahli 2005	TAM: Perceived usefulness, perceived ease of use, and cognitive absorption.	Perceived usefulness and perceived ease of use influences acceptance in a positive way. Cognitive absorption influences perceived usefulness and perceived ease of use in a positive way.
11	Ong & Lai 2006	TAM: Perceived ease of use, computer self-efficacy, perceived usefulness, and gender	Men's rating of computer self-efficacy, perceived usefulness and perceived ease of use are higher than women's rating.
12	Ngai et al. 2007	TAM: Perceived usefulness, perceived ease of use and technichal support	Technical support influences perceived usefulness and perceived ease of use in a positive way.

Table 1. Studies focusing on the impact of technology acceptance factors on students' acceptance of e-learning.

Individual background variables found to have an impact on students' acceptance of e-learning are: *gender*, *learning styles*, *age* and *organisational factors* (i.e. school). Gender seems to be the most influential background factor as it affects the level of computer anxiety (Shuell & Farber 2001), perceived usefulness and ease of use (Shuell & Farber 2001, Ong & Lai 2006). Women generally experienced more computer anxiety and a lower degree of perceived usefulness and perceived ease of use than men.

A direct relationship between gender and acceptance is also proposed by Mitra et al. (2000), who concluded that men were more positively predisposed toward computers and tended to use computers more than women. Students' learning styles were found to be linked to liking of, confidence in and anxiety about the use of computers (Ames 2003), but autonomous learning modes also influenced acceptance in a positive way directly (Drennan et al. 2005). Age influenced students' levels of computer confidence, as younger students were not so anxious in using computers (Jennings & Onwuegbuzie 2001). Tolhurst and Debus (2002) are the only authors who reported organisational factors to be an important determinant of students' acceptance of e-learning. The predominant organisational factors influencing acceptance were epistemological beliefs of students, school culture and gender, as the research setting was single gender schools.

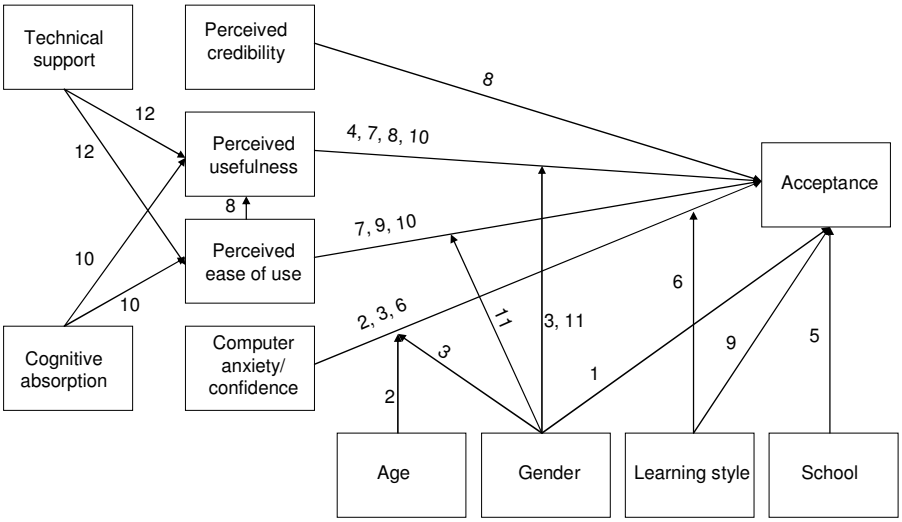

Figure 2. Meta-analysis of technology acceptance core constructs influencing students' acceptance of e-learning. The numbers on the arrows show which research studies listed in table 1 that propose significant relationships between core constructs and acceptance.

Conclusively, perceived usefulness and perceived ease of use seem to be the most prominent determinants of acceptance of e-learning environments, in spite of the introduction of new factors to extend the original technology acceptance model. Technical support and cognitive absorption only have the ability to affect the degree of acceptance via perceived usefulness and perceived ease of use. Students' computer anxiety or confidence is also an important determinant of acceptance, but seems to be a determinant sensitive to influence by background factors. Perceived credibility does have a direct influence on acceptance, but this influence is only confirmed in one of the studies reviewed.

3 RESEARCH APPROACH

The study was performed as a survey study measuring the degree of technology acceptance of students of master education in public health education in Sweden and Lithuania. The master courses were

conducted in blended learning environments, comprising teaching on campus and distance education delivered by the e-learning environments, WebCT (Lithuania) and ClassFronter (Sweden). The two e-learning environments are comparable in functionality.

The research model of the study was an extension of TAM; the core constructs of the Unified Theory of Acceptance and Use of Technology (UTAUT) and Innovation Diffusion Theory (IDT). This tentative research model has been proposed to explain factors influencing students' acceptance of e-learning environments, as the constructs of TAM have been shown not being able to fully explain students' acceptance of e-learning environments in higher education (Keller & Cernerud 2002, Keller 2005). UTAUT was developed by Venkatesh, Morris, Davis and Davis (2003) and consists of core constructs from eight models of technology acceptance. When tested empirically, UTAUT was found to explain 70% of the variance of intentions to use and actual use of information systems (Venkatesh et al. 2003). The four core constructs of UTAUT are *performance expectancy*, *effort expectancy*, *social influence* and *facilitating conditions*. Two additional core concepts of technology acceptance from IDT were used: *results demonstrability* and *visibility* (Moore & Benbasat, 1991). The core concepts are defined in table 2.

Model	Core construct	Definition
UTAUT	Performance expectancy	The degree to which an individual believes that using the system will help him or her to attain gains in job performance (Venkatesh et al. 2003).
UTAUT	Effort expectancy	The degree of ease associated with the use of the system (Venkatesh et al. 2003).
UTAUT	Social influence	The degree to which an individual perceives that others believe that he or she should use the system (Venkatesh et al. 2003).
UTAUT	Facilitating conditions	The degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system (Venkatesh et al. 2003).
IDT	Results demonstrability	The tangibility of the results of using the innovation, including the observability and communicability (Moore & Benbasat 1991).
IDT	Visibility	The degree to which one can see others using the system in the organisation (Venkatesh et al. 2003, adapted from Moore & Benbasat 1991).

Table 2. Definition of core constructs of UTAUT (Unified Theory of Acceptance and Use of Technology) and IDT (Innovation Diffusion Theory) used in the survey study.

3.1 Data collection

A questionnaire was constructed; measuring the six core constructs of *performance expectancy (PE)*, *effort expectancy (EE)*, *social influence (SI)*, *facilitating conditions (FC)*, *results demonstrability (RD)* and *visibility (VI)*. The constructs were measured by 27 statements. The statements were constructed from the original questionnaire items developed by Venkatesh et al. (2003) and Moore and Benbasat (1991). The statements were adapted to an educational context and tested. The statements measuring the core constructs are described in table 3. The students were asked to rate their level of agreement to each statement on a five-point Likert scale ("I disagree completely" to "I agree completely").

The six core constructs of technology acceptance were hypothesized to influence students' rate of use of e-learning environments in a positive way. Furthermore, the influence of the background factors of university, age (AG), gender (GE), prior knowledge of computers (PK), and confidence in computer use (CO) were explored. To estimate the use of the e-learning environment, students were asked to estimate the rate of use (RU), and duration each time the environment was used (DU).

3.2 Research setting

The survey study was conducted at two university departments offering master education in public health in Sweden and Lithuania. The Swedish research setting was Nordic School of Public Health (NS), situated in Gothenburg. The Nordic School of Public Health receives students from the Nordic countries: Sweden, Norway, Denmark, Finland and Iceland. A majority of the students are from Sweden, Norway and Denmark. ClassFronter was used as an e-learning environment to deliver education online. The questionnaire was distributed in two master courses: Quantitative Methods, and Public Health, Basic Course. Thirty-two students answered the questionnaire; 29 women and three men. Students' ages ranged from 28 to 58 years with a mean age of 49 years.

Core construct	Statement
Performance expectancy	I find the VLE (Virtual Learning Environment) useful in my education. Using the VLE improves my educational performance. Using the VLE increases the possibilities of communication with other students. Using the VLE increases the possibilities of communication with teachers/tutors. Using the VLE fits my style of learning and studying.
Effort expectancy	I find the VLE easy to use. Using the VLE is never frustrating. It was easy to learn and understand the VLE. My interaction with the VLE is clear and understandable. I can without effort get the VLE to do what I want it to do. It is easy to remember how to perform tasks in the VLE. To use the VLE does not require a lot of mental effort.
Social influence	Teachers/tutors encourage my use of the VLE. Other students encourage my use of the VLE. The university in general has supported the use of the VLE. Using the VLE improves my prestige among teachers/tutors. Using the VLE improves my prestige among other students.
Facilitating conditions	I have the knowledge necessary to use the VLE. The VLE is compatible with other application programs that I use. A specific person or group is available for support when problems occur.
Results demonstrability	The VLE enables me to accomplish my educational tasks more quickly. Using the VLE makes it easier for me to plan and control my course work. I would have no difficulty explaining the advantages of the VLE to others.
Visibility	I have seen what teachers/tutors accomplish using the VLE. I have seen what other students accomplish using the VLE. I have had the opportunity to try or learn the VLE before I actually had to use it.

Table 3. Questionnaire items of technology acceptance core constructs.

The Lithuanian research setting was Kaunas University of Medicine, Faculty of Public Health (KMU). WebCT was used as an e-learning environment to deliver education online. The questionnaire was translated by a Lithuanian IS academic and distributed in three master courses: Principles of Epidemiology, Principles of Public Health, and Eye Diseases from a Public Health Perspective. Thirty-five students answered the questionnaire; 22 women, and 13 men. Students' ages ranged from 25 to 56, with a mean age of 41 years.

3.3 Data analysis

A reliability analysis using the measure of Cronbach's α was made to estimate the reliability of the core constructs. According to Hair, Anderson, Tatham and Black (1998), the generally agreed upon lower limit for Cronbach's α is 0.70, although it may decrease to 0.60 in exploratory research. Due to low measures of Cronbach's α, two statements were omitted from the core constructs: 1) I have the knowledge necessary to use the VLE (deleted from the construct of *facilitating conditions*), and 2) I

have had the opportunity to try or learn the VLE before I actually had to use it (deleted from the core construct of *visibility*). With the omission of the two statements, a reliability good enough in exploratory research was reached for each core construct, as all Cronbach's α measures exceeded 0.60. The measures of the core construct ranged from 0.61 to 0.93.

Measures of means and standard distributions were computed for each core construct to compare the responses from the two student populations. A bivariate correlation analysis using Pearson correlation coefficient was conducted to explore relationships between technology acceptance core constructs, and to assess relationships between core constructs and individual student background factors.

4 RESULTS

4.1 Nordic School of Public Health

Means and standard deviations of technology acceptance core constructs and correlation matrix for Nordic School of Public Health are displayed in table 4. The means of each core construct ranged from 2.35 to 2.94 on a scale from 1 to 5. The ranking order of the core constructs are: 1) facilitating conditions, 2) effort expectancy, 3) performance expectancy, 4) social influence, 5) results demonstrability, and 6) visibility. The standard deviations of the constructs ranged from 0.73 (facilitating conditions) to 1.03 (performance expectancy).

A number of significant correlations between the core constructs of technology acceptance and background factors were found. Positive correlations were identified between duration of time spent on use and performance expectancy ($r = 0.40$; $p < 0.05$) and results demonstrability ($r = 0.41$; $p < 0.05$). Students who spend longer sessions working in the e-learning environment experience more advantages and find it easier to explain these advantages to other students. Rate of use was positively correlated to effort expectancy ($r = 0.47$; $p < 0.05$), as was confidence in use of computers ($r = 0.52$; $p < 0.01$). Students who use the e-learning environment often find it easier to use, and are more confident in computer use. Finally, older students seemed to experience a higher degree of visibility than younger students ($r = 0.45$; $p < 0.05$).

Significant correlations were also found between some of the core constructs of technology acceptance. The construct of performance expectancy showed significant correlations to social influence ($r = 0.44$; $p < 0.05$) and results demonstrability ($r = 0.79$; $p < 0.01$). Furthermore, effort expectancy and facilitating conditions were positively correlated ($r = 0.63$; $p < 0.01$), as was social influence and visibility ($r = 0.49$; $p < 0.01$).

4.2 Kaunas University of Medicine, Department of Public Health

Means and standard deviations of the technology acceptance core constructs and correlation matrix for Kaunas University of Medicine are displayed in table 5. The means of each core construct ranges from 3.11 to 4.52 on a scale from 1 to 5. The ranking order of the core constructs are: 1) effort expectancy, 2) results demonstrability, 3) performance expectancy, 4) facilitating conditions, 5) social influence, and 6) visibility. The standard deviations of the constructs ranged from 0.48 (effort expectancy) to 1.31 (visibility).

Positive correlations were found between previous knowledge of computers and performance expectancy ($r = 0.45$; $p < 0.01$), and effort expectancy ($r = 0.39$; $p < 0.05$). Students with good previous knowledge of computers tend to think that the e-learning environment brings advantages and that it is easy to use. Gender correlated negatively to performance expectancy ($r = - 0.34$; $p < 0.05$) in the sense that men experienced a lower degree of performance expectancy than women.

	Mean	SD	PE	EE	SI	FC	RD	VI	AG	GE	PK	CO	RU	DU
PE	2.81	1.03	**1.00**											
EE	2.89	0.88	0.03	**1.00**										
SI	2.60	0.65	**0.44***	0.00	**1.00**									
FC	2.94	0.73	0.15	**0.63****	0.19	**1.00**								
RD	2.57	1.01	**0.79****	0.23	0.26	0.27	**1.00**							
VI	2.35	0.98	0.22	0.21	**0.49****	0.24	0.23	**1.00**						
AG	49	5.8	- 0.12	0.03	- 0.02	0.05	0.03	**0.45***	**1.00**					
GE			- 0.22	- 0.18	- 0.33	- 0.27	- 0.19	0.11	0.19	**1.00**				
PK			0.14	- 0.19	0.14	- 0.07	0.11	- 0.05	0.27	0.10	**1.00**			
CO			- 0.12	**0.52****	- 0.15	0.26	0.05	- 0.17	- 0.05	- 0.05	- 0.11	**1.00**		
RU			- 0.04	**0.47****	- 0.15	0.32	0.04	0.07	- 0.16	- 0.12	- 0.31	**0.44***	**1.00**	
DU			**0.40***	0.17	0.12	0.12	**0.41***	0.10	- 0.03	- 0.03	0.06	0.15	0.34	**1.00**

Table 4. Means and standard deviations of technology acceptance core constructs and correlation matrix for Nordic School of Public Health.

	Mean	SD	PE	EE	SI	FC	RD	VI	AG	GE	PK	CO	RU	DU
PE	4.35	0.59	**1.00**											
EE	4.52	0.48	**0.46****	**1.00**										
SI	3.55	0.66	0.17	**0.37***	**1.00**									
FC	4.34	0.81	0.02	**0.46****	0.29	**1.00**								
RD	4.49	0.60	**0.38***	**0.54****	0.14	**0.41***	**1.00**							
VI	3.11	1.31	- 0.01	0.09	**0.38***	0.30	0.18	**1.00**						
AG	41	8.1	0.11	0.04	0.29	- 0.06	0.27	0.07	**1.00**					
GE			**- 0.34***	- 0.26	- 0.03	0.00	- 0.11	- 0.11	0.08	**1.00**				
PK			**0.45****	**0.39***	0.20	0.24	0.19	0.12	- 0.14	**- 0.44****	**1.00**			
CO			0.27	0.22	0.10	0.15	0.11	- 0.06	- 0.10	- 0.01	**0.59****	**1.00**		
RU			0.00	0.33	0.15	0.21	0.07	- 0.21	0.22	0.26	- 0.17	- 0.07	**1.00**	
DU			0.06	- 0.10	0.02	- 0.08	0.05	0.19	0.08	0.07	0.23	0.32	**- 0.37***	**1.00**

Table 5. Means and standard deviations of technology acceptance core constructs and correlation matrix for Kaunas University of Medicine.

Abbreviations used in table 4 and table 5:
PE: Performance Expectancy, EE: Effort Expectancy, SI: Social Influence, FC: Facilitating Conditions, RD: Results demonstrability, VI: Visibility, AG: Age, GE: Gender, PK: Previous knowledge of computer use, CO: Confidence in computer use, RU: Rate of use and DU: Duration of time spent on use.

* Correlation is significant at the 0.05 level ($p < 0.05$).
** Correlation is significant at the 0.01 level ($p < 0.01$).

The significant correlations between core constructs were frequent. The construct of performance expectancy correlated positively with effort expectancy ($r = 0.46$; $p < 0.01$) and results demonstrability ($r = 0.38$; $p < 0.05$). Effort expectancy showed positive correlations to social influence ($r = 0.37$; $p < 0.05$), facilitating conditions ($r = 0.46$; $p < 0.01$) and results demonstrability ($r = 0.54$; $p < 0.01$). Social influence and visibility correlated positively ($r = 0.38$; $p < 0.05$), as did facilitating conditions and results demonstrability ($r = 0.41$; $p < 0.05$).

5 ANALYSIS AND DISCUSSION

The degree of technology acceptance differs considerably between the two universities. Differences between Kaunas University of Medicine and Nordic School of Public Health are displayed in table 6. Lithuanian students display a substantially higher degree of acceptance compared to the Nordic students. Also the rating of the core constructs of technology acceptance is different. Although Nordic students experienced facilitating conditions (rating 1) relatively more than Lithuanian students (rating 4), this did not lead to an increased level of acceptance of the e-learning environment in general. The degree of social influence (rating 5 and 4) and visibility (rating 6 at both universities) seems to be relatively low. This finding indicates that teachers and other students do not encourage use of the e-learning environment and that the possibilities of observing what teachers and other students accomplish in the e-learning environment is low.

Core construct	Mean KMU (rating)	Mean NS (rating)	Difference
Performance expectancy	4.35 (3)	2.81 (3)	1.54
Effort expectancy	4.52 (1)	2.89 (2)	1.63
Social influence	3.55 (5)	2.60 (4)	0.95
Facilitating conditions	4.34 (4)	2.94 (1)	1.40
Results demonstrability	4.49 (2)	2.57 (5)	1.92
Visibility	3.11 (6)	2.35 (6)	0.76

Table 6. Differences in means and rating of core constructs of technology acceptance between Kaunas University of Medicine (KMU) and Nordic School of Public Health (NS).

When analysing significant relationships between the core constructs, different patterns emerge at the two universities. At the Swedish university, performance expectancy was correlated to social influence and results demonstrability. Effort expectancy and facilitating conditions were positively correlated, as were social influence and visibility. At the Lithuanian university, this pattern is more complicated, as the significant relationships between core constructs are more frequent. This finding suggests that acceptance of the e-learning environment is influenced by different organisational and cultural factors at the two universities.

The findings of this study are based on a rather small population, 67 students, in one academic subject. As the research setting is distance master education, the age of the students is higher than in a bachelor education on campus. This circumstance might limit the possibilities of generalisation of the findings to an e-learning context attended by younger students. Furthermore, the statistical correlation analysis performed included simple measures such as means and bivariate correlations. The directions of the causal relationships between core constructs and background factors, and between core constructs are not settled by these measures. As a result, conclusions on how the factors influence each other cannot be drawn.

Based on the research questions, the present study implies the following conclusions:

- The level of students' acceptance of the e-learning environment varied substantially between the two universities. The Lithuanian students displayed a higher degree of acceptance than the

Nordic students, although their experience of facilitating conditions was relatively low, compared to the Nordic students.

- A significant relationship between a high degree of effort expectancy and a high rate of use of the e-learning environment was found at the Swedish university. No other relationships seemed to exist between students' acceptance and the rate of use of the e-learning environment. Other factors, e.g. course content and curriculum, might be stronger determinants of rate of use than level of acceptance.
- Different patterns of influencing background factors emerge at the two universities. At the Swedish university, confidence in use of computers influenced acceptance positively. Moreover, the older the student, the higher was the degree of visibility. This might be due to teachers spending more time instructing older students. At the Lithuanian university, previous knowledge of computer use influenced acceptance in a positive way. Gender was also found to influence acceptance but, contrary to reviewed research, men experienced a lower degree of performance expectancy than women.

These conclusions imply that cultural and organisational factors are important to consider in our understanding of students' acceptance of e-learning environments. This finding is in accordance with earlier studies showing that e-learning implementation are not only a technological solution, but a process with cultural consequences (Cech & Bures 2004) and a negotiation between different organisational cultures (Demetriadis et al. 2003). Keller (2006) found acceptance of e-learning environments among academic staff to be dependent on organisational factors of the educational context. In a comparison between a Lithuanian, a Swedish and a Norwegian university, academic staff from the Lithuanian university experienced performance expectancy and social influence to a high degree, despite a low degree of facilitating conditions. Differences in national cultures could lead to different responses in acceptance of technology (Straub & Weil & Brenner 1997). Hofstede (2001) has developed four widely used constructs to distinguish national cultures on the basis of over 100,000 responses in multinational organizations: *power distance*, *collectivism-individualism*, *masculinity-femininity*, and *uncertainty avoidance*. It is reasonable to believe that these constructs might play a role in adoption of information technology (Leidner & Kayworth, 2006). DeVreede, Jones and Mgaya (1998), as well as Hasan and Ditsa (1999), have found that the level of power distance in organisations influence the rate of acceptance and adoption of information systems. Although Lithuania is not specifically examined by Hofstede, it could be hypothesized that differences in e.g. power distance between the two countries could affect levels of technology acceptance. The influence of cultural and organisational factors on technology acceptance will be further considered in the larger cross-cultural study, of which the survey study is a part.

References

Alavi, M. and Leidner, D.E. (2001). Research commentary: Technology-mediated learning – a call for greater depth and breadth of research. Information Systems Research, 12 (1), 1-10.

Ames, P.C. (2003). Gender and learning style interactions in students' computer attitudes. Journal of Educational Computing Research, 28 (3), 231-244.

Bures, E.M., Amundsen, C.C. and Abrahmi, P.C. (2002). Motivation to learn via computer conferencing: Exploring how task-specific motivation and CC expectations are related to student acceptance of learning via CC. Journal of Educational Computing Research, 27 (3), 249-264.

Cech, P. and Bures, V. (2004). E-learning implementation at university. In Proceedings of the 3rd European Conference on e-Learning, Paris, France.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13 (3), 319-339.

Demetriadis, S., Barbas, A., Molohides, A., Palaigeorgiou, G., Psillos, D., Vlahavas, I., Tsoukalas, I., and Pombortsis, A. (2003). "Cultures in negotiation": teachers' acceptance/resistance attitudes considering the infusion of technology into schools. Computers & Education, 41 (1), 19-37.

DeVreede, G., Jones, N., and Mgaya, R.J. (1998). Exploring the application and acceptance of group support systems in Africa. Journal of Management Information Systems, 15 (3), 197-234.
Drennan, J., Kennedy, J. and Pisarki, A. (2005). Factors affecting student attitudes toward flexible online learning in management education. Journal of Educational Research, 98 (6), 331-338.
Fishbein, M. and Ajzen, I. (1975). Belief, attitude, intention and behaviour: An introduction to theory and research. Addison-Wesley, Reading.
Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1998). Multivariate Data Analysis. Prentice-Hall, Upper Saddle River, New Jersey.
Hasan, H. and Ditsa, G. (1999). The impact of culture on the adoption of IT: An interpretative study. Journal of Global Information Management, 6 (3), 5-15.
Hofstede, G. (2001). Culture's Consequences. Comparing Values, Behaviors, Institutions, and Organizations across Nations. Sage Publications, Thousand Oaks.
Jennings, S.E. and Onwuegbuzie, A.J. (2001). Computer attitudes as a function of age, gender, math attitude, and developmental status. Journal of Educational Computing Research, 25 (4), 367-384.
Keller, C. (2005). Virtual Learning Environments in Higher Education. A Study of Students' Acceptance of Educational Technology. Licentiate Thesis No 1167, Linköping University.
Keller, C. (2006). Technology acceptance in academic organisations: Implementation of virtual learning environments. In Proceedings of the 14th European Conference on Information Systems, Gothenburg, Sweden.
Keller, C. and Cernerud, L. (2002). Students' perceptions of e-learning in university education. Journal of Educational Media, 27 (1-2), 55-67.
Leidner, D.E. and Kayworth, T. (2006). A review of culture in information systems research: Toward a theory of information technology culture conflict. MIS Quarterly, 30 (2), 357-400.
Mitra, A., Lenzmeier, S., Steffensmeier, T., Avon, R., Qu, N. and Hazen M. (2000). Gender and computer use in an academic institution: Report from a longitudinal study. Journal of Educational Computing Research, 23 (1), 67-84.
Moore, G.C. and Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. Information Systems Research, 2 (3), 192-222.
Ngai, E.W.T, Poon, J.K.L and Chan, Y.H.C. (2007). Empirical examination of the adoption of WebCT using TAM. Computers & Education, 48 (2), 250-267.
Ong, C-S., Lai, J-Y. and Wang, Y-S. (2004). Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies. Information & Management, 41 (6), 795-804.
Ong, C-S. and Lai, J-Y. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. Computers in Human Behavior, 22 (5), 816-829.
Pawson, R. (2006). Evidence-based Policy: A Realist Perspective. Sage Publications, London.
Saadé, R. and Bahli, B. (2005). The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: an extension of the technology acceptance model. Information & Management, 42 (2), 317-327.
Selim, H.M. (2003). An empirical investigation of student acceptance of course websites. Computers & Education, 40 (4), 343-360.
Shuell, T.J. and Farber, S.L. (2001). Students' perceptions of technology use in college courses. Journal of Educational Computing Research, 24 (2), 119-138.
Straub, D, Keil, M. and Brenner, W. (1997). Testing the technology acceptance model across cultures: A three country study. Information & Management, 33 (1), 1-11.
Tolhurst, D. and Debus, R.L. (2002). Influence of prior knowledge, attitudes, ability, and activity structure on students' learning and use of software. Journal of Educational Computing Research, 27 (3), 275-313.
Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 2 (3), 425-478.
Yang, Z. and Liu, Q. (2007). Research and development of web-based virtual online classroom. Computers & Education, 48 (2), 171-184.